IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Milwaukee Electric Tool Corporation
Title:	Tape Measure with Tape Blade Profile Increasing Tape Standout
Prior Appl. No.:	PCT/US2018/047759
Prior Appl. Filing Date:	August 23, 2018
Examiner:	To be determined
Art Unit:	To be determined

CONTINUING PATENT APPLICATION TRANSMITTAL LETTER

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Transmitted herewith for filing under 37 C.F.R. § 1.53(b) is a:

[X] Continuation [ ] Division [ ] Continuation-In-Part (CIP)

of the above-identified copending prior application in which no patenting, abandonment, or termination of proceedings has occurred. Priority to the above-identified prior application is hereby claimed under 35 U.S.C. § 120 for this continuing application. The entire disclosure of the above-identified prior application is considered as being part of the disclosure of the accompanying continuing application and is hereby incorporated by reference therein in its entirety.

Enclosed are:

[**X**] Application Data Sheet (37 CFR 1.76)

[**X**] Cover Page, Description, Claims and Abstract

[**X**] Preliminary Amendment

[**X**] Formal drawings

[**X**] Power of Attorney from Assignee/Applicant

The requisite fees are being charged to Deposit Account No. 18-0882.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 18-0882.

Please direct all correspondence to the undersigned attorney or agent at the address indicated below.

Respectfully submitted,

Date August 27, 2018

By /James D. Borchardt/

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Application Data Sheet

Application Information

Application Number:	To Be Determined
Application Type:	Nonprovisional
Subject Matter:	Utility
CD-ROM or CD-R:	None
Computer Readable Form (CRF):	No
Title:	Tape Measure with Tape Blade Profile Increasing Tape Standout
Attorney Docket Number:	066749-1484
Request for Early Publication:	No
Request for Non-Publication:	No
Suggested Drawing Figure:	1
Total Drawing Sheets:	16
Small Entity:	No
Petition included:	No
Secrecy Order in Parent Appl.:	No

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Domestic Priority Information

Application:	Continuity Type:	Prior Application No.:	Parent Filing Date:	Prior Application Status:	Patent No.:
This Application	Is a continuation of	PCT/US2018 /047759	August 23, 2018	Pending	N/A
PCT/US2018 /047759	Claims the benefit under 35 U.S.C. 119(e)	62/702,575	July 24, 2018	Pending	N/A
PCT/US2018 /047759	Claims the benefit under 35 U.S.C. 119(e)	62/549,511	August 24, 2017	Expired	N/A

Foreign Priority Information

Country:	Application number:	Filing Date:	Priority Claimed:

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications

☐ **This application (1) claims priority to or the benefit of an application filed before March 16, 2013 and (2) also contains, or contained at any time, a claim to a claimed invention that has an effective filing date on or after March 16, 2013.**

NOTE: By providing this statement under 37 CFR 1.55 or 1.78, this application, with a filing date on or after March 16, 2013, will be examined under the first inventor to file provisions of the AIA.

Applicant Information

Applicant 1:

[X] Assignee	[ ] Legal Representative under 35 U.S.C. 117	[ ] Person to whom the inventor is obligated to assign	[ ] Person who shows sufficient proprietary interest
If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:			
Name of the Deceased or Legally Incapacitated Inventor:			
If the Assignee is an Organization check here [X]			

Organization Name:	Milwaukee Electric Tool Corporation
13135 West Lisbon Road Brookfield, Wisconsin 53005	

Signature:	/James D. Borchardt/	Date:	August 27, 2018
First Name:	James D.	Last Name:	Borchardt
Registration No.:	62,025		

US PATENT APPLICATION

for

TAPE MEASURE WITH TAPE BLADE PROFILE INCREASING TAPE STANDOUT

Inventors: Jonathan F. Vitas
Abhijeet A. Khangar

TAPE MEASURE WITH TAPE BLADE PROFILE INCREASING TAPE STANDOUT

CROSS-REFERENCE TO RELATED PATENT APPLICATIONS

[0001] The present application is a continuation of International Application No. PCT/US2018/047759, filed August 23, 2018, which claims the benefit of and priority to U.S. Provisional Application No. 62/702,575, filed on July 24, 2018, and U.S. Provisional Application No. 62/549,511, filed on August 24, 2017, all of which are incorporated herein by reference in their entireties.

BACKGROUND OF THE INVENTION

[0002] The present invention relates generally to the field of tools. The present invention relates specifically to a tape measure, measuring tape, retractable rule, etc., that includes a tape measure blade with a profile shape that increases tape standout.

[0003] Tape measures are measurement tools used for a variety of measurement applications, including in the building and construction trades. Some tape measures include a graduated, marked blade wound on a reel and also include a retraction system for automatically retracting the blade onto the reel. In some such tape measure designs, the retraction system is driven by a coil or spiral spring that is tensioned, storing energy as the tape is extended, and that releases energy to spin the reel, winding the blade back onto the reel such that automatic or non-manual tape retraction is provided. In some other tape measure designs, retraction of the tape is controlled via a manual crank, and such tape measure blades tend to have a long length.

SUMMARY OF THE INVENTION

[0004] One embodiment of the invention relates to a tape measure including a tape blade having a profiled cross-sectional shape to increase standout. In a specific embodiment, the tape blade has a flat width less than 27.94 mm and has standout of greater than 115 inches, specifically greater than 120 inches, more specifically greater 125 inches and more specifically greater than 130 inches. In a specific embodiment, the tape blade has a flat width less than 27.94 mm and a curved height greater than 6.3 mm. In a specific embodiment, the tape blade has a flat width less than 27.94 mm and a curved width less than 22.5 mm. In some such embodiments, the tape blade has an angle A (defined below) less than 90 degrees.

[0005] Another embodiment relates to a tape measure including a tape blade having a profiled cross-sectional shape to increase standout along with a low tape blade steel thickness. In a specific embodiment, the tape blade has a metal thickness of less than 0.13 mm, specifically between 0.09 mm and 0.13 mm, and has standout of greater than 115 inches, specifically greater than 120 inches, more specifically greater 125 inches and more specifically greater than 130 inches. In a specific embodiment, the tape blade has a metal thickness of less than 0.13 mm, specifically between 0.09 mm and 0.13 mm, and a curved height greater than 6.3 mm. In a specific embodiment, the tape blade has a metal thickness of less than 0.13 mm, specifically between 0.09 mm and 0.13 mm, and a curved width less than 22.5 mm. In some such embodiments, the tape blade has an angle A (defined below) less than 90 degrees.

[0006] Another embodiment of the invention relates to a tape measure. The tape measure includes a housing, a reel rotatably mounted within the housing and an elongate blade wound around the reel. The elongate blade includes an elongate metal core having an upper surface, a lower surface and a first thickness, T1, measured between the upper surface and the lower surface. The elongate blade includes an upper polymer coating coupled to the upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2, and an upper surface defining the uppermost surface of the elongate blade. The elongate blade includes a lower polymer coating coupled to the lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3, and a lower surface defining the lowermost surface of the elongate blade. The elongate blade includes a curved profile such that the uppermost surface of the elongate blade defines a concave surface, the lowermost surface defines a convex surface, a curved width and a curved height. A flat width of the elongate metal core is less than 32 mm. A ratio of the curved width to a flat width of the elongate metal core is less than 0.74. A ratio of the curved height to the flat width of the elongate metal core is greater than 0.29. A standout distance of the elongate blade from the housing is greater than 150 inches. The tape measure includes a retraction system coupled to the tape reel, and the retraction system drives rewinding of the elongate tape blade on to the tape reel.

[0007] Another embodiment of the invention relates to a tape measure. The tape measure includes a housing, a reel rotatably mounted within the housing and an elongate blade wound around the reel. The elongate blade includes an elongate metal core having an upper surface, a lower surface and a first thickness, T1, measured between the upper surface and the lower surface. The elongate blade includes an upper polymer coating coupled to the upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2, and an upper surface defining the uppermost surface of the elongate blade. The elongate blade includes a lower polymer coating coupled to the lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3, and a lower surface defining the lowermost surface of the elongate blade. The elongate blade includes a curved profile such that the uppermost surface of the elongate blade defines a concave surface, the lowermost surface defines a convex surface, a curved width and a curved height. A flat width of the elongate metal core is 32 mm or greater. A ratio of the curved width to a flat width of the elongate metal core is less than 0.70. A ratio of the curved height to the flat width of the elongate metal core is greater than 0.31. A standout distance of the elongate blade from the housing is greater than 150 inches. The tape measure includes a retraction system coupled to the tape reel, and the retraction system drives rewinding of the elongate tape blade on to the tape reel.

[0008] Another embodiment of the invention relates to a tape measure. The tape measure includes a housing, a reel rotatably mounted within the housing and an elongate blade wound around the reel. The elongate blade includes an upper surface, a lower surface, a curved profile such that the upper surface of the elongate blade defines a concave surface and the lower surface defines a convex surface. The elongate blade includes a flat width of 30 mm or less, a curved width, wherein the curved width is less than the flat width and a standout distance of the elongate blade from the housing of at least 132 inches. The tape measure includes a retraction system coupled to the tape reel, and the retraction system drives rewinding of the elongate tape blade on to the tape reel.

[0009] Another embodiment of the invention relates to a tape measure. The tape measure includes a housing, a reel rotatably mounted within the housing and an elongate blade wound around the reel. The elongate blade includes an upper surface, a lower surface and a curved profile such that the upper surface of the elongate blade defines a concave surface and the lower surface defines a convex surface. The elongate blade includes a flat width greater than or equal to 29 mm and less than 32 mm, a curved width, wherein the curved width is less than the flat width and a standout distance of the elongate blade from the housing of at least 156 inches. The tape measure includes a retraction system coupled to the tape reel, and the retraction system drives rewinding of the elongate tape blade on to the tape reel.

[0010] Another embodiment of the invention relates to a tape measure. The tape measure includes a housing, a reel rotatably mounted within the housing and an elongate blade wound around the reel. The elongate blade includes an upper surface, a lower surface and a curved profile such that the upper surface of the elongate blade defines a concave surface and the lower surface defines a convex surface. The elongate blade includes a flat width greater than 32 mm, a curved width, wherein the curved width is less than the flat width and a standout distance of the elongate blade from the housing of at least 168 inches. The tape measure includes a retraction system coupled to the tape reel, wherein the retraction system drives rewinding of the elongate tape blade on to the tape reel.

[0011] Additional features and advantages will be set forth in the detailed description which follows, and, in part, will be readily apparent to those skilled in the art from the description or recognized by practicing the embodiments as described in the written description and claims hereof, as well as the appended drawings. It is to be understood that both the foregoing general description and the following detailed description are exemplary.

[0012] The accompanying drawings are included to provide further understanding and are incorporated in and constitute a part of this specification. The drawings illustrate one or more embodiments and, together with the description, serve to explain principles and operation of the various embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1 is a left side perspective view of a tape measure, according to an exemplary embodiment.

[0014] FIG. 2 is a left side perspective view of the tape measure of FIG. 1 with a portion of the tape measure housing removed, according to an exemplary embodiment.

[0015] FIG. 3 is a cross-sectional view of a polymer coated tape blade of the tape measure of FIG. 1, according to an exemplary embodiment.

[0016] FIG. 4 is a schematic side view of the tape measure of FIG. 1 with a portion of the tape blade extended from the tape housing, according to another exemplary embodiment.

[0017] FIG. 5 is a cross-sectional view showing the profile of a tape blade, according to an exemplary embodiment.

[0018] FIG. 6 is a cross-sectional view showing the profile of a tape blade, according to an exemplary embodiment.

[0019] FIG. 7 is a plot of four tape blade profiles of the present disclosure plotted relative to the profiles of three prior art tape measures.

[0020] FIG. 8 is a plot of one of the tape blade profiles of the present disclosure plotted relative to the profiles of two prior art tape measures.

[0021] FIG. 9 is a plot of four tape blade profiles of the present disclosure plotted relative to the profile of one prior art tape measures.

[0022] FIG. 10 is a plot of two tape blade profiles of the present disclosure plotted relative to each other.

[0023] FIG. 11 is a plot of four tape blade profiles of the present disclosure plotted relative to the profiles of six prior art tape measures.

[0024] FIG. 12 is a plot of one of the tape blade profiles of the present disclosure plotted relative to the profiles of three prior art tape measures.

[0025] FIG. 13 is a plot of two tape blade profiles of the present disclosure plotted relative to the profiles of two prior art tape measures.

[0026] FIGS. 14-16 show an exemplary tape blade profile labeling the various dimensions listed in Table 3.

[0027] FIG. 17 shows a plot of curved width vs. standout for tape blades having a 33 mm flat width and a 35 mm flat width.

[0028] FIG. 18 is a plot of the tape blade profiles for a 33 mm flat width tape blade and a 35 mm flat width tape blade, according to an exemplary embodiment.

[0029] FIGS. 19 and 20 are photographs showing a droop measurement test, according to an exemplary embodiment.

DETAILED DESCRIPTION

[0030] Referring generally to the figures, various embodiments of a tape measure are shown. Various embodiments of the tape measure discussed herein include an innovative tape blade profile that Applicant believes greatly improves tape standout. In general, Applicant has determined that by shaping the tape blade to a relatively aggressive or steep curved profile shape (as discussed and quantified below), tape standout can be increased and tape droop can be decreased greatly even when utilizing relatively thin and/or relatively narrow pieces of steel for the tape blade. In some embodiments, the steep curved profile shape is formed only along a relatively short lengthwise section of the tape blade that is positioned within a lengthwise zone in which a standard tape tends to buckle during standout. Without being bound by a particular theory, Applicant understands that the steep curved profile shape increases rigidity and buckle resistance, and in particular, tape standout is greatly increased by locating this curved profile shape within the zone where buckling tends to occur.

[0031] Further, Applicant has found that some steep or tight curved shapes may impact readability of markings and numbers on the tape blade due to the relatively steep vertical positioning of the outer widthwise segments of the tape blade. Accordingly, in some embodiments, the tape blade profiles discussed herein may include outer widthwise segments of the tape blade that are somewhat flattened toward horizontal to provide improved readability of markings positioned thereon. In such embodiments, the central widthwise portion of the tape blade includes a highly curved, rigidity increasing profile shape, while outer widthwise segments of the tape blade are slightly flattened back toward horizontal to improve readability of numbers positioned thereon. As discussed below, this readability improving shape is defined by angle A, shown in FIG. 5.

[0032] Surprisingly, Applicant has further determined that standout can be increased by utilizing a compound curved shape, without increasing retraction torque requirements. In such embodiments, the center region of the tape blade profile has a more curved (e.g., smaller radius of curvature) shape than the edge regions. Applicant has found that such a shape may increase standout and improve readability of markings on the tape measure without increasing retraction torque requirement. In contrast to Applicant's understanding of conventional wisdom in the tape measure, the tape blade profiles discussed herein provide a combination of increased standout, lower retraction torque and/or increased readability, while maintaining a relatively low thickness tape blade.

[0033] In some embodiments, the tape blade profile may has a continuous curved shape, such as a parabolic or catenary curved shape. In such embodiments, Applicant has found that continuous curved tape blades may improve durability or tear resistance. For example, Applicant has determined, that at least for some designs, when a tape blade buckles, regions having a sharp change of shape within a compound cross-sectional curve profile are more likely to crack or break when compared to a tape blade with a continuous curve profile.

[0034] Referring to FIG. 1 and FIG. 2, a length measurement device, such as tape measure 10, is shown according to an exemplary embodiment. Tape measure 10 includes a coilable tape blade 14 and a housing 18. In general, tape blade 14 is an elongate strip of material including a plurality of graduated measurement markings, and in specific embodiments, tape blade 14 is an elongate strip of metal material (e.g., steel material) that includes an outer most end coupled to a hook assembly, shown as hook assembly 26. As discussed in more detail below, tape blade 14 may include various coatings (e.g., polymer coating layers) to help protect tape blade 14 from cracking during whip or pinch.

[0035] Further, tape blade 14 may include any combination of tape blade features of the various embodiments discussed herein. Specifically, in various embodiments, tape blade 14 includes a steep curved profile shape as discussed below that improves tape standout performance. As shown in FIG. 1, a variable-length extended segment 22 of the tape blade 14 is retractable and extendable from the housing 18. A hook assembly 26 is fixedly coupled to an outer end portion 30 of tape blade 14.

[0036] As shown in FIG. 2, the non-extended portion of tape blade 14 is wound onto a reel 34, which is surrounded by housing 18. Reel 34 is rotatably disposed about an axis 38 of tape measure 10, and a retraction mechanism 42 is coupled to reel 34 and configured to drive reel 34 about rotation axis 38 which in turn provides powered retraction of tape blade 14. Retraction mechanism 42 may include one or more elongated spiral springs that provide the retraction energy to retraction mechanism 42. A tape lock 46 is provided to selectively engage tape blade 14, which acts to restrain retraction mechanism 42 such that extended segment 22 of tape blade 14 remains at a desired length.

[0037] Referring to FIG. 1, housing 18 includes a first side wall 50, a second side wall 54, and a peripheral wall 58 connecting first side wall 50 and second side wall 54. First side wall 50, second side wall 54, and peripheral wall 58 define an internal cavity 62, shown in FIG. 2, in which reel 34 and retraction mechanism 42 are housed. Referring to FIG. 1, first side wall 50 and second side wall 54 have a substantially circular profile 66. In other embodiments, the side walls may be rectangular, polygonal, or any other desired shape. Portions of the housing 18 may be co-molded or separately formed of a resilient material, such as a natural or synthetic rubber. In the illustrated construction, housing 18 is formed with housing bumpers 70 and a support leg 74 which extends from a lower portion 78 of the peripheral wall 58.

[0038] A slot 82 is defined along a forward portion 86 of peripheral wall 58. Slot 82 provides an opening in the tape measure housing which allows tape lock 46 to extend into housing 18. In addition, slot 82 provides a length sufficient to allow tape lock 46 to be moved relative to housing 18 between locked and unlocked positions.

[0039] Below the slot 82, a tape port 90 is provided in peripheral wall 58. Tape port 90 has an arcuate shape 94, corresponding to an arcuate cross-sectional profile of tape blade 14. The tape port 90 allows for the retraction and extension of tape blade 14 to and from the internal cavity 62 defined within housing 18.

[0040] As shown in FIGS. 1 and 2, tape measure 10 includes a finger guard assembly 98. Finger guard assembly 98 includes a guard 102 and a guard support member 106. As shown in FIG. 1, the portions of guard 102 external to housing 18 are substantially U-shaped and extend downward from housing 18. As shown in FIG. 2, when tape 14 is in the retracted position, a rear surface of hook assembly 26 abuts guard 102.

[0041] Referring to FIG. 3, a cross-sectional view of tape blade 14 is shown. Tape blade 14 includes a core or inner layer 110 formed from a thin, elongate strip of metal material. In a specific embodiment, inner layer 110 is formed from a strip of steel material. In a specific embodiment, inner layer 110 has a thickness, T1, of less than 0.13 mm (with up to a 25% thickness variation), specifically 0.09 mm to less than 0.13 mm (with up to a 25% thickness variation), and more specifically of 0.09 mm to 0.12 mm (with up to a 25% thickness variation). In another specific embodiment, T1 is between 0.12 mm and 0.14 mm and more specifically is between 0.125 mm and 0.135 mm. Inner layer 110 may be formed in a concavo-convex configuration (as shown in FIG. 3), which provides for improved tape standout as discussed herein. Inner layer 110 may be an alloyed spring steel, alloyed high strength steel, etc. In one embodiment, the steel is of a hardness between 50-54 RHC. In another embodiment, the steel is of a hardness between 45-60 RHC.

[0042] In various embodiments, tape blade 14 includes an upper coating layer 112 coupled to (e.g., attached, bonded, glued, etc.) the concave upper surface of inner metal layer 110 and a lower coating layer 114 coupled to (e.g., attached, bonded, glued, etc.) the convex lower surface of inner metal layer 110. In general, coating layers 112 and 114 are formed from a polymer material, and in a specific embodiment, are formed from a nylon material. In specific embodiments, coating layers 112 and 114 are formed from a material that has a modulus of elasticity less than the modulus of elasticity of the metal material of inner layer 110. In specific embodiments, coating layers 112 and 114 are formed from a material that has a hardness less than the hardness of the metal material of inner layer 110. In specific embodiments, the coating layers discussed herein are formed from a nylon 12 material and/or a nylon 6/6 material.

[0043] As shown in FIG. 3, coating layer 112 has a thickness, T2, and coating layer 114 has a thickness, T3. In specific embodiments, the total thickness of the tape blade coating (i.e., the combined thickness of layers 112 and 114, T2+T3) is greater than or less than T1. In other embodiments, the total thickness of the tape blade coating is equal to T1.

[0044] In specific embodiments, the total tape blade thickness (inclusive of all of the coating and the core layer, i.e., T1+T2+T3) is between 0.15 mm and 0.5 mm. In various embodiments, T1+T2+T3 is between 0.15 mm and 0.2 mm, and specifically is 0.18 mm. In various embodiments, T1+T2+T3 is between 0.3 mm and 0.4 mm, and specifically is 0.36 mm.

[0045] In one embodiment, coating layers 112 and 114 may be applied over the entire length of inner layer 110. In one embodiment, coating layers 112 and 114 are applied over at least 6 feet of the length of inner layer 110, specifically over at least 8 feet of the length of inner layer 110, and more specifically over at least 10 feet of the length of inner layer 110. In specific embodiments, these coating lengths are contiguous coating lengths. This may provide increased tear resistance in areas of the tape blade 14 prone to increased wear, while maintaining compactness of the tape relative to a tape blade that has the coating over the entire length. In one embodiment, coating layers 112 and 114 begin at the end of the tape blade 14 proximate the hook. In another embodiment, the coating starts at a location of the blade spaced apart from the end proximate hook assembly 26.

[0046] In some embodiments, coating layers 112 and/or 114 do not have uniform thicknesses along the width and/or length of tape blade 14. In some such embodiments, coating layers 112 and/or 114 may be applied in a pattern (e.g., a honeycomb pattern, a checkered pattern, etc.) where there are portions of thicker and thinner coating distribution across both the length and width of the tape blade 14. In such embodiments, T2 and T3 shown in FIG. 3 represent the thickness measured through the thickest portion of the coating pattern. In some such embodiments, the ranges of T2 and T3 discussed herein represent the maximum thickness of coating layers 112 and 114 at any portion along the length of tape blade 14. In some such embodiments, the combined maximum coating and blade thickness may be .4 mm, but in other areas along the length and width of the tape blade, the coating and blade thickness will be less (e.g., as measured at the thinner coating portions of the coating pattern). In other embodiments, the ranges of T2 and T3 discussed herein represent the average thickness of coating layers 112 and 114 measured at all of the thickest portions of the coating pattern along the length and width of tape blade 14.

[0047] Coating layers 112 and 114 may be applied as a laminate, nylon extrusion, film attached with adhesive, power/spray on coating. In one embodiment, the coating layer(s) are configured such that even if the steel core were to fracture, the coating layer is configured to contain the steel core and to maintain the integrity of the blade (e.g., the coating will tend not to tear).

[0048] In various embodiments, tape blade 14 and the profile shapes discussed herein can be utilized to improve tape standout in tapes having a variety of lengths. In specific embodiments, the length of the tape blade is less than 50 feet or more specifically less than 40 feet. In various embodiments, the length of tape blade 14 is between 15 ft. and 40 ft., and in specific embodiments, the length of the tape blade is 35 ft., 30 ft., 25 ft., or 16 ft.

[0049] Referring to FIG. 4 and FIG. 5, tape blade 14 standout, droop and the cross-sectional profile shape parameters of the tape blade profile of the present disclosure are shown and described. In general, tape standout distance is the maximum length, L1, of tape blade 14 that can be extended from tape housing 18 when the tape housing 18 is positioned such that the tape blade exits the housing in a direction perpendicular to gravity while self-supporting its own weight without buckling and without additional support being provided other than what the tape measure housing itself provides (e.g., without the tape blade being supported by the user's hand). It should be noted that while tape blade standout can be measured using a variety other methods for other purposes (such field testing, marketing, etc.), tape standout distance, as used herein, is determined via preceding test procedure. In one embodiment, droop is measured as shown in FIGS. 19 and 20. Droop distance, shown as DD1, is the vertical distance that the hook end 26 of tape blade 14 moves downward from the opening in tape housing, when a certain length of tape L1 is extended from tape housing 18 and while tape blade 14 is self-supporting. In the test shown in FIGS. 19 and 20, droop is measured with tape blade 14 supported on the support portion of the associated tape measure housing, such as guard assembly 98 of tape measure 10 discussed above. As shown in FIG. 4, L1 is the tape length extending from housing 18.

[0050] Referring to FIG. 5, the curvature profile 120 of tape blade 14 is shown according to an exemplary embodiment. In general the curvature profiles, such as profile 120, discussed herein are measured via a laser profilometer along the upper surface of coating layer 112. However, because in at least some embodiments, coating layer 112 is of a consistent thickness the profile of coating layer 112 discussed herein also generally reflects the shape of the steel core 110 of tape blade 14.

[0051] As discussed in detail herein, Applicant has found that a curvature profile 120 having one or more of the curvature shape features discussed and quantified below is effective at increasing standout and/or decreasing droop. This is particularly true given a tape blade 14 having a relatively low flat tape width and relatively low steel thickness, but is also true for wider tape blades having conventional thicknesses. While curvature profile 120 can be described and classified in a wide variety of ways, Applicant has determined that curved profile height, H1, curved profile width, W1, and a cross-sectional angle A, can be used to classify and quantify the profile shape parameters that improve standout performance. In addition, Applicant has determined that H1, W1 and angle A when evaluated in relation to flat tape blade width and steel thickness define relative parameters that quantify the standout improving profile shapes discussed herein. Various embodiments of curvature profile 120 and tape blade 14 are shown in Table 1, Table 2, Table 3 and Table 4 and FIGS. 7-13 and 18 below.

[0052] In various embodiments, the flat width of tape blade 14 is between 20 mm and 40 mm. In specific embodiments, the flat width of tape blade 14 is 25 mm to 32 mm. In specific embodiments, the flat width of tape blade 14 is 25 mm, 27 mm, 30 mm, 32 mm, 33 mm or 35 mm. The thickness of the metal inner core 110 (T1 discussed above) and of the coated tape blade 14 are as discussed above regarding FIG. 3.

[0053] W1, particularly when compared to the flat width of tape blade 14, provides an indication of the extent to which tape blade 14 is formed into a curved shape. In various embodiments, W1 is less than 23.5 mm, specifically is between 15 mm and 23.5 mm, and more specifically is between 20 mm and 23 mm. In even more specific embodiments, W1 is between 21 mm and 22 mm.

[0054] In various embodiments, because profile 120 is substantially more curved than the typical tape blade, the ratio of W1 to flat tape width is substantially less than is typical, and this is particularly true for tape blades of a relatively low steel thickness. In specific embodiments, the ratio of W1 to flat tape width is less than 0.8, specifically is less than 0.745 and more specifically is less than 0.73. In specific embodiments, the ratio of W1 to flat tape width is between 0.6 and 0.8 and more specifically is between 0.7 and 0.73.

[0055] In addition, H1 particularly when compared to the flat width of tape blade 14, provides an indication of the extent to which tape blade 14 is formed into a curved shape. In various embodiments, H1 is greater than 7 mm, specifically is between 7 mm and 10 mm, and more specifically is between 8.5 mm and 9.5 mm. In even more specific embodiments, H1 is between 8.8 mm and 9.4 mm.

[0056] In various embodiments, because profile 120 is substantially more curved than the typical tape blade, the ratio of H1 to flat tape width is substantially larger than is typical, and this is particularly true for tape blades of a relatively low steel thickness. In specific embodiments, the ratio of H1 to flat tape width is greater than 0.285, specifically is greater than 0.29 and more specifically is greater than 0.295. In specific embodiments, the ratio of H1 to flat tape width is between 0.29 and 0.32 and more specifically is between 0.295 and 0.317.

[0057] Applicant has determined that as steel thickness T1 of tape blade 14 decreases, the degree of curvature of tape blade 14 increases to achieve a certain level of standout to account for the lower rigidity of the thin steel. Accordingly, Applicant has determined that in order to both decrease tape blade steel thickness while improving standout, a suitable ratio of height to steel thickness, T1 should be selected. Accordingly, given the steep curvature of profile 120, the ratio of H1 to steel thickness is substantially larger than is typical. In specific embodiments, the ratio of H1 to T1 is greater than 65, specifically is greater than 75 and more specifically is greater than 80. In specific embodiments, the ratio of H1 to T1 is between 75 and 85 and more specifically is between 80 and 85.

[0058] In various embodiments, angle A also provides an indication of the extent to which tape blade 14 is formed into a curved shape. As shown in FIG. 5, angle A is the angle measured between lines tangential to the laterally outermost sections of tape blade 14 when viewed in longitudinal cross-section, and a smaller angle A represents a steeper curve formed in tape blade 14. In other embodiments, angle A is the interior angle measured between the widthwise midpoint of tape blade 14 and any two points along the tape blade within 5 mm of the left and right widthwise ends of the tape blade. In various embodiments, angle A is less than 90 degrees. In various embodiments, angle A is less than 75 degrees, specifically is less than 65 degrees and more specifically is less than 58 degrees. In a specific embodiment, angle A is between 45 and 58 degrees. In any of these embodiments, angle A may also be greater than 45 degrees. Additional embodiments of tape blades with different angles A and the relation to readability are shown in Appendix B.

[0059] In various embodiments, because profile 120 is substantially more curved than the typical tape blade, the ratio of angle A to flat tape width is substantially less than is typical, and this is particularly true for tape blades of a relatively low steel thickness. In specific embodiments, the ratio of angle A to flat tape width is less than 3 degrees/mm, specifically is less than 2.7 degrees/mm, and more specifically is less than 2.1 degrees/mm. In specific embodiments, the ratio of angle A to flat tape width is between 1.85 degrees/mm and 3 degrees/mm, specifically is between 1.85 degrees/mm and 2.7 degrees/mm and more specifically is between 1.85 degrees/mm and 2.1 degrees/mm.

[0060] In various embodiments, tape blade 14 may have one or more of the profile dimensions or relative dimensions discussed above, and in specific embodiments, tape blade 14 may have one or more of the profile dimensions or relative dimensions discussed above in combination with any of the other tape blade features or dimensions discussed herein. In particular, in various embodiments, any of the profile dimensions discussed above are provided with a tape blade 14 having a thickness T1 that is less than 0.13 mm, specifically between 0.09 mm and 0.13 mm, specifically less than 0.125 mm, more specifically between 0.09 mm and 0.12 mm, and even more specifically between 0.105 mm and 0.115 mm. In such embodiments, tape thickness is decreased while providing high levels of standout via the profile shapes discussed herein. Applicant believes that conventional tape blades in these thickness ranges do not have the profile shape parameters as discussed herein and therefore do not achieve the high levels of standout and low levels of droop discussed herein. However, in other embodiments, tape blade

14 may have a steel thickness typically in conventional tape blades (e.g., 0.13 mm), and by utilizing the various tape blade profiles discussed herein, very high levels of standout can be achieved compared to tape blades having a conventional profile.

[0061] In a specific embodiment, tape blade 14 has a flat width less than 27.94 mm and has standout of greater than 115 inches, specifically greater than 120 inches, more specifically greater 125 inches and more specifically greater than 130 inches. In a specific embodiment, tape blade 14 has a flat width less than 27.94 mm and a curved height, H1, greater than 6.3 mm. In a specific embodiment, tape blade 14 has a flat width less than 27.94 mm and a curved width, W1, less than 22.5 mm. In a specific embodiment, tape blade 14 has a flat width less than 27.94 mm, a curved width, W1, less than 22.5 mm and a curved height, H1, greater than 6.3 mm. In some such embodiments, tape blade 14 has an angle A (defined below) less than 90 degrees. Applicant believes that a tape blade having a flat width less than 27.94 mm has not been achieved previously with this high level of standout, and that Applicant's curved profile having H1 and/or W1 described above are the shape parameters that allow such standout despite the relatively narrow tape blade.

[0062] In other specific embodiments, tape blade 14 has a tape blade 14 that has a metal thickness, T1, of less 0.13 mm, specifically between 0.09 mm and 0.13 mm, and has standout of greater than 115 inches, specifically greater than 120 inches, more specifically greater 125 inches and more specifically greater than 130 inches. In some embodiments, the tape blade 14 has standout of greater than 144 inches, greater than 156 inches, greater than 159 inches, greater than 162 inches, greater than 165 inches, or greater than 168 inches. In a specific embodiment, tape blade 14 has a metal thickness, T1, as discussed herein and a curved height, H1, and H1 is greater than 6.3 mm. In a specific embodiment, tape blade 14 has a metal thickness, T1, of less 0.13 mm and W1, less than 22.5 mm. In a specific embodiment, tape blade 14 has a metal thickness, T1, of less 0.13 mm, and a curved width, W1, less than 22.5 mm and a curved height, H1, greater than 6.3 mm. In some such embodiments, the flat width of the tape blade is between 22 mm and 33 mm, and specifically is between 29 mm and 32 mm. In alternative embodiments, the flat width of the tape blade 14 is greater than 33 mm. For example, the flat width of the tape blade 14 is between 35 mm and 38 mm. In yet other embodiments, the flat width of tape blade

14 may be greater than 38 mm. In some such embodiments, the tape blade has an angle A (defined below) less than 90 degrees. Applicant believes that a tape blade having a thickness of less than 0.13 mm has not been achieved previously with this high level of standout, and that Applicant's curved profile having H1 and/or W1 described above are the shape parameters that allow such standout despite the relatively thin tape blade.

[0063] Referring to FIG. 6, profile 120 is shown according to an exemplary embodiment. In FIG. 6 the relative position between the central section 122 of profile 120 and the widthwise outer sections 124 of profile 120 is exaggerated to better demonstrate the shape of profile 120. As shown in the embodiment of FIG. 6, profile 120 is not a continuous curve. In this embodiment, the upper surfaces of outer sections 124 have a greater radius of curvature than central section 122. This results in outer sections 124 being less curved which improves visibility of markings and numbers located along tape blade 14 within profile 120. In addition, outer sections 124 are more horizontally positioned than they would be in a profile in which the curvature of central section 122 continues outward to both lateral edges of tape blade 14.

[0064] Referring back to FIG. 4, in various embodiments, profile 120 is formed in a lengthwise subsection 130 of the total length of tape blade 14. In a specific embodiment, profile 120 is formed in the portion of tape blade 14 that tends to buckle during standout, and thus the increased rigidity provided by profile 120 in this region increases standout distance and/or decreases droop. Specifically, profile 120 is formed in a lengthwise sub-section 130 of tape blade 14 that is located adjacent to housing 18 when the amount of tape extended is approaching the maximum standout. Thus, while the positioning of profile 120 will vary somewhat depending on the standout length of a particular tape blade design, in general, lengthwise sub-section 130 extends from 5 feet to 15 feet from the hook end of tape blade 14. In a specific embodiment, lengthwise sub-section 130 extends from 6.5 feet to 13 feet from the hook end of tape blade 14. In an even more specific embodiment, when tape blade 14 is at its maximum standout length, subsection 130 extends 5 feet from housing 18 along the length of tape blade 14 toward hook end 26.

[0065] In various embodiments, by forming tape blade 14 having profile 120 characterized via one or more of the profile dimensions discussed above, Applicant believes that significantly improved standout and droop decrease are achieved. In various embodiments, standout of tape blade 14 provided at least in part by profile 120 is greater than 115 inches, specifically greater than 120 inches, more specifically greater than 125 inches and more specifically greater than 130 inches. In various embodiments, standout of tape blade 14 provided at least in part by profile 120 is greater than 144 inches, specifically is greater than 150 inches, and more specifically is greater than 155 inches. In various embodiments, droop of a 10 foot section of tape blade 14 is less than 33 inches, specifically is less than 30 inches, and more specifically is less than 28 inches. In a specific embodiment, standout of tape blade 14 provided at least in part by profile 120 is 156-160 inches and droop of a 10 foot section of tape blade 14 is between 22-25 inches.

[0066] In various embodiments, tape blade 14 has a curved profile 120 defined by the following parameters: a flat width of the elongate metal core of less than 32 mm, a ratio of the curved width to a flat width of the elongate metal core of less than 0.74 and a ratio of the curved height to the flat width of the elongate metal core of greater than 0.29, and in such embodiments, tape blade 14 has a standout distance of the elongate blade from the housing that is greater than 150 inches. In other embodiments, tape blade 14 has a curved profile 120 defined by the following parameters: wherein a flat width of the elongate metal core of 32 mm or greater, a ratio of the curved width to a flat width of the elongate metal core of less than 0.70, a ratio of the curved height to the flat width of the elongate metal core of greater than 0.31, and in such embodiments, tape blade 14 has a standout distance of the elongate blade from the housing of greater than 150 inches.

[0067] In various embodiments, tape blade 14 has a curved profile 120 that provides for improved standout for a given tape blade flat width. In various embodiments, tape blade 14 has a flat width of 30 mm or less, a curved width that is less than the flat width and a standout distance of at least 132 inches, specifically greater than 138 inches, and more specifically greater than 144 inches. In various embodiments, tape blade 14 has a flat width greater than or equal to 29 mm and less than 32 mm, a curved width that is less than the flat width and a standout distance of at least 156 inches and more specifically greater than 160 inches. In various embodiments, tape blade 14 has a flat width greater than 32 mm, a curved width less than the flat width and a standout distance of the elongate blade from the housing of at least 168 inches. In various embodiments, the tape blade standout distance is greater than the various lengths disclosed herein and is also less than 400 inches, specifically less than 300 inches, more specifically is less than 250 inches or even less than 200 inches.

[0068] In addition to the tape blade profile geometry, Applicant believes that other properties of the tape blade may influence or improve standout. For example, Applicant's investigation into tape blade standout has shown that the standout performance of a tape blade is also related to the tape blade material (e.g., steel in the tape blades investigated by Applicant) having sufficient elasticity so that it does not experience plastic deformation during its typical stress states (standout buckling, winding onto spool, etc.). In some instances, the standout performance of a tape blade depends, at least in part, on the steel of the blade having sufficient elasticity such that the blade does not experience plastic deformation during typical stress states (e.g., standout buckling, winding onto a spool, etc.). The elasticity can be increased, decreased, controlled, adjusted, etc. via any suitable method. In some instances, increasing the elasticity of the steel may also decrease the standout of the blade but allow for the blade to have less degradation in standout over time (e.g., after being extended and retracted from the housing, after being stored on the spool, etc.). Similarly, decreasing elasticity of the blade may allow greater initial standout of the blade, but may decrease the standout over time. In some instances, residual stresses may be added to increase the elastic range of the steel in bending. Further, in some instances, increasing the hardness of the steel may increase the standout of the blade. For example, the blade steel may have a hardness of up to 70 HRC.

Test Examples

[0069] The droop and standout ranges for four specific inventive tape profiles with different tape widths, blade thicknesses and coating thickness are shown below along with the profile dimensions (e.g., curve height, angle) for each profile design. The standout and droop data shown in Table 1 was determined via testing of the identified tape measures, and the profile measurements were measured using a laser profilometer measurement along the upper most surface of the tape blade of each tape measure. For this testing, droop was measured as shown in FIGS. 19 and 20. These are compared against three conventional tape measure designs. As shown below, the profile designs discussed herein provide for significantly decreased droop and increased standout as compared to the conventional tape measures. In Table 1 below, tape designs A-D represent specific designs having the rigidity increasing curvature as discussed herein, and the next three rows show corresponding data for three tape blade designs of three tape measures available from Milwaukee Electric Tool Corporation currently on the market. The last three rows show corresponding data from three prior art competitor tape measures. As can be seen from Table 1, the designs having the rigidity increasing profile discussed herein greatly increase standout and decrease droop, particularly for a given flat width and/or steel thickness.

Table 1

Tape Design	Flat Width (mm)	Steel Thickness (mm)	Total Thickness (mm)	Angle - Laser (deg)	Curved Height - Laser (mm)	Curved Width - Laser (mm)	Droop @ 10ft (in)	Standout (in)
A	30	0.11	0.18	57.39	8.8515	21.85	22-25	156-160
B	30	0.11	0.18	62.71	9.074	21.5	20-23	160-162
C	30	0.11	0.36	49.68	9.348	21.15	23-25	159-164
D	27	0.11	0.36	72.42	7.5385	21.151	25-27	133-135
Milwaukee Electric Tool Prod. No. 48-22-7116	27	0.13	0.19	96.26	5.904	23.4	N/A	108-112
Milwaukee Electric Tool Prod. No. 48-22-7135	27	0.12	0.19	91.12	6.281	22.8	N/A	110-114
Milwaukee Electric Tool Prod. No. 48-22-7526	32	0.13	0.18	58.48	8.986	23.9	34-36	142-146
Prior Art Tape No. 1	31.75	0.13	0.18	62	9.1835	23.651	31-32	145 avg
Prior Art Tape No. 2	31.75	0.13	0.22	64	9.166	23.601	28-29	149 avg
Prior Art Tape No. 3	31.75	0.13	0.18	88	7.9675	26.05	32-33	138 avg

[0070] Table 2 below calculates various ratios related to the tape profiles dimensions shown in Table 1 that Applicant believes further quantifies the high level of rigidity provided by the tape blade curvature profiles as discussed herein.

Table 2

Tape Design	Ratio - Height/Flat Width	Ratio - Height/Steel Thickness	Ratio - Curved Width/Flat Width	Ratio - Angle/Flat Width
A	0.29505	80.46818182	0.728333333	1.913
B	0.302466667	82.49090909	0.716666667	2.0903333
C	0.3116	84.98181818	0.705	1.656
D	0.279203704	68.53181818	0.78337037	2.6822222
Milwaukee Electric Tool Prod. No. 48-22-7116	0.218666667	45.41538462	0.866666667	3.5651852
Milwaukee Electric Tool Prod. No. 48-22-7135	0.23262963	52.34166667	0.844444444	3.3748148
Milwaukee Electric Tool Prod. No. 48-22-7526	0.2808125	69.12307692	0.746875	1.8275
Prior Art Tape No. 1 @ 12 ft.	0.289244094	70.64230769	0.744913386	1.9625197
Prior Art Tape No. 2 @ 12 ft.	0.288692913	70.50769231	0.743338583	2.0179528
Prior Art Tape No. 3 @ 12 ft.	0.250944882	61.28846154	0.820472441	2.7672441

[0071] As shown in Table 1 and Table 2, in various embodiments, tape standout of greater than 130 inches, specifically greater than 150 inches, and more specifically greater than 155 inches is achieved utilizing the various tape profiles as discussed herein.

[0072] FIG. 7 shows cross-sectional profiles of tapes A-D from Table 1 and Table 2 plotted relative to the three Milwaukee Tool prior art tape measures. FIG. 8 shows the profile of tape D plotted relative to the profile of the Milwaukee Electric Tool Prod. No. 48-22-7116 and of Milwaukee Electric Tool Prod. No. 48-22-7135. FIG. 8 shows the more steep profile of tape D relative to the two other currently available tape measures that also have a 27 mm flat width tape blade.

[0073] FIG. 9 shows the profile of tapes A, B and C plotted relative to the 32 mm flat width 8m CAWB tape that is currently available. This figure shows the more steep profiles of tapes A, B and C relative to the profile of the Milwaukee Electric Tool Prod. No. 48-22-7526 tape.

[0074] FIG. 10 shows the profile of tape B compared to tape C. As shown in Table 1, tape B and tape C both have the same flat tape width and the same steel thickness. However, tape C has a thicker polymer coating layer as shown in the total tape thickness column. Thus, FIG. 10 demonstrates that a more steep curved profile of tape C is needed to maintain standout as coating layer thickness (and hence weight of tape blade) increases. FIG. 11 shows the plotted profile of all tapes in Table 1, and FIG. 12 shows tape B of the present disclosure plotted relative to three prior art tape blades.

<u>Additional Tape Blade Profile Designs</u>

[0075] Referring to FIGS. 13-16 and Table 3 below, Applicant has developed a variety of additional new tape blade profile designs that, based on Applicant's modeling, allow for a variety of tape measure design/performance parameters to be strategically selected or optimized to achieve a combination of performance parameters not believed achievable with previous designs. In particular, Applicant has determined that by selecting the tape blade width and the tape blade profile shape, the amount of tape blade standout and the amount of torque needed to retract the tape blade can be selected to achieve blade standout and retraction torque requirements not previously achievable.

[0076] For example, Applicant has determined that, for a given tape blade thickness, standout can be increased by making the profile of the tape blade more curved and/or making the tape blade wider. Further, Applicant understands conventional tape blade design wisdom indicates that both methods of increasing standout (e.g., increasing width or increasing curved shape) also requires an increase in retraction torque (e.g., a stronger retraction spring) in order to fully retract the wider and/or more curved tape blade. However, in contrast to this conventional wisdom, Applicant's tape blade design and modeling work has unexpectedly discovered a variety of tape blade widths and curvatures that provide for increased standout (for a tape blade of a given thickness) without substantially altering the increasing torque that needs to be delivered by the retraction system to rewind the spring.

Table 3

Design Parameter	**Prior Art 1 (CAWB 78deg)**	**Prior Art 2 (CAWB 55deg)**	**Prototype 1 (35 FW Deep)**	**Prototype 2 (38 FW Deep)**	**Prototype 3 (35 FW)**	**Prototype 4 (38 FW)**	**Prototype 5 (35 Super Deep)**	**Prototype 6 (38 Super Deep)**
Thickness (mm)	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Flat Width (mm)	32	32	35	38	35	38	35	38
arc angle center (deg)	102.23	108.916	110	112.5	102	104	108.916	108.916
Radius at center	11.57	10.37	10.8	11.4	13	16.1	10.37	10.37
Radius at edges	76.33	22.77	23.35	23.35	30	50	22.77	22.77
Center arc length	20.644	19.713	20.735	22.384	23.143	29.224	19.713	19.713
Leg arc length	5.68	6.14	7.13	7.81	5.93	4.39	7.64	9.14
Curved Height Total	8.86	*9.76*	*10.98*	*12.16*	*9.76*	*9.76*	11.18	12.64
Curbed Width Total	24.81	*22.59*	*23.98*	*25.32*	*26.71*	*30.47*	23.53	24.28
Ratio Curved Width to Flat Width	0.7753125	0.7059375	0.685142857	0.666315789	0.763142857	0.801842105	0.672285714	0.638947368
Ratio Height Width to Flat Width	0.276875	0.305	0.313714286	0.32	0.278857143	0.256842105	0.319428571	0.332631579
Total Energy per 1mm Length	**3.7112**	**4.7072**	**4.7080**	**4.7094**	**3.6539**	**3.0517**	**4.8817**	**5.0562**

(N*mm) @ r31 (approx 10ft mark)								

[0077] Table 3 shows modeling data for two conventional tape measure blade designs and for six potential new tape blade designs. In Table 3, thickness is the thickness of the metal (e.g., steel) material of the tape blade, and flat width is the width of the tape blade prior to forming to a curved shape. The other blade curvature profile parameters listed in the Design Parameter column of Table 3 are labeled in FIGS. 14-16. The energy amounts shown in Table 3 are calculated for one half of the tape blade (e.g., the left or right side of the tape blade). The total energy for the entire width of the tape blade is actually double the amounts shown in Table 3.

[0078] Referring to FIG. 13, the profiles of Prototype 1 and Prototype 2 are overlaid relative to Prior Art 1 and Prior Art 2 shown in Table 3. Further FIG. 13 identifies the calculated standout distance for Prior Art 2 and Prototypes 1 and 2. As shown in FIG. 13, the standout distance of both Prototypes 1 and 2 are calculated to be greater than the standout of Prior Art 2. This increase in standout has been achieved even though Prototypes 1 and 2 are less curved than Prior Art 2 which is contrary to conventional wisdom in the field of tape blade design. Further, as can be seen by comparing the values in the "Total Energy" row in Table 3, Prototypes 1 and 2 utilize approximately the same spring energy for retraction as Prior Art 2 despite having significantly greater standout.

[0079] Thus, surprisingly, Applicant determined that by designing the tape blade to have a width and profile shape as shown in Table 3 and FIG. 13, standout can be increased without requiring more torque/retraction energy to be provided by the retractions system. Thus, this allows a tape measure with a tape blade such as that of Prototype 1 and 2 to have increased standout without the need to greatly increase tape measure housing size to accommodate a larger spring (or other retraction system). Further, Applicant has further found that the greater width and/or less steep curve of the blades of Prototypes 1 and 2 also provide for increased readability of the measurement markings located on the tape blade as compared to tape blades with a lower width and/or more steeply curved blade profiles. Thus, Applicant believes that the tape blade profiles discussed herein provide a unique combination of readability, high level of standout and low retraction torque requirements not achieved with prior tape blade designs or previously understood to be achievable based on conventional understanding in the field of tape measure design.

[0080] Further, referring to Table 3, Prototypes 3 and 4 utilize less torque for retraction than either Prior Art 2 or Prototypes 1 and 2, but Applicant's modeling also indicates that Prototypes 3 and 4 will have lower standout than Prior Art 2 or Prototypes 1 and 2. Prototypes 5 and 6 utilize more torque for retraction than either Prior Art 2 or Prototypes 1 and 2, but Applicant's modeling also indicates that Prototypes 5 and 6 will have greater standout than Prior Art 2 or Prototypes 1 and 2. In at least some embodiments, Applicant has determined that some such tape blade profiles (e.g., Prototypes 5 and 6) have greater than 15 feet of standout. For at least some of the tape profiles discussed herein, Applicant believes that a cold-forming process may be a particularly suitable manufacturing technique to reliably form the profiles discussed herein.

[0081] Referring to FIGS. 13-16, Applicant believes that the balance between a high level of tape blade standout, width/readability and retraction torque is achieved at least in part by utilizing a tape blade profile with a compound curvature. In particular, as shown in FIG. 15, the tape blade profile includes a first curved shape having a first radius of curvature, shown as radius (center), that defines the curved shape of the widthwise central region of the tape blade. In addition, as shown in FIG. 16, the tape blade profile includes a second curved shape having a second radius of curvature, shown as radius (edge), that defines the curved shape of the edge regions of the tape blade. As shown in FIG. 16, the edge regions are the regions of the tape blade on either widthwise side of the central region that extend to the outer lateral edges of the tape blade.

[0082] In various designs, radius (edge) is greater than radius (center). In specific embodiments, radius (edge) is at least 1.5 times radius (center) and more specifically is at least 2 times radius (center).

[0083] Referring to FIG. 17 and FIG. 18, details of various 33 mm flat width and 35 mm flat width curved tape blades are provided. FIG. 17 shows the curved width plotted against standout for both 33 mm flat width and 35 mm flat width tape blades. Table 4 below shows the flat width, curved width, curved height and ratio of curved width to curved height for a variety of 33 mm flat width and 35 mm flat width tape blades.

[0084] Table 4

Flat Width (mm)	Curved Width (mm)	Curved Height (mm)	Ratio of Curved Width to Flat Width	Ratio of Curved Height to Flat Width
33	21.50	10.70	0.651522	0.324179
	22.00	10.53	0.666684	0.319026
	22.50	10.35	0.681826	0.313604
	23.00	10.16	0.696969	0.307893
	23.50	9.96	0.712134	0.301867
	24.00	9.75	0.727247	0.295538
	24.50	9.53	0.742424	0.288838
	25.00	9.30	0.757569	0.281781
	25.50	9.05	0.772727	0.274321
35	22.00	11.66	0.6286	0.353465
	22.50	11.51	0.642814	0.348661
	23.00	11.34	0.657071	0.323967
	23.50	11.16	0.671544	0.318882
	24.00	10.98	0.685603	0.313697
	24.50	10.79	0.699919	0.308157

[0085] As shown in FIG. 17, Applicant has determined that a highly linear relationship exists between curved width and standout for 33 mm and 35 mm flat width tape blades. As shown in FIG. 17, as curved width decreases (representing a more highly curved profile) standout increases. For the 33 mm flat width tape blade, even at a curved width of 25.5 mm, standout was still greater than 150 inches, and standout increases as the curved width decreases. For the 35 mm flat width tape blade with a curved width of 23.5 mm, standout was greater than 150 inches, and standout increases as the curved width decreases. FIG. 18 shows the profile plots of exemplary profiles of a curved 33 mm flat width tape blade and a 35 mm flat width tape.

[0086] It should be understood that the figures illustrate the exemplary embodiments in detail, and it should be understood that the present application is not limited to the details or methodology set forth in the description or illustrated in the figures. It should also be understood that the terminology is for description purposes only and should not be regarded as limiting.

[0087] Further modifications and alternative embodiments of various aspects of the invention will be apparent to those skilled in the art in view of this description. Accordingly, this description is to be construed as illustrative only. The construction and arrangements, shown in the various exemplary embodiments, are illustrative only. Some elements shown as integrally formed may be constructed of multiple parts or elements, the position of elements may be reversed or otherwise varied, and the nature or number of discrete elements or positions may be altered or varied. The order or sequence of any process, logical algorithm, or method steps may be varied or re-sequenced according to alternative embodiments. Other substitutions, modifications, changes and omissions may also be made in the design, operating conditions and arrangement of the various exemplary embodiments without departing from the scope of the present invention.

[0088] Unless otherwise expressly stated, it is in no way intended that any method set forth herein be construed as requiring that its steps be performed in a specific order. Accordingly, where a method claim does not actually recite an order to be followed by its steps or it is not otherwise specifically stated in the claims or descriptions that the steps are to be limited to a specific order, it is in no way intended that any particular order be inferred. In addition, as used herein, the article "a" is intended to include one or more component or element, and is not intended to be construed as meaning only one.

[0089] Various embodiments of the invention relate to any combination of any of the features, and any such combination of features may be claimed in this or future applications. Any of the features, elements or components of any of the exemplary embodiments discussed above may be utilized alone or in combination with any of the features, elements or components of any of the other embodiments discussed above.

What is claimed is:

1. A tape measure comprising:

a housing;

a reel rotatably mounted within the housing;

an elongate blade wound around the reel, the elongate blade comprising:

an elongate metal core having an upper surface, a lower surface and a first thickness, T1, measured between the upper surface and the lower surface,

an upper polymer coating coupled to the upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2, and an upper surface defining the uppermost surface of the elongate blade;

a lower polymer coating coupled to the lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3, and a lower surface defining the lowermost surface of the elongate blade; and

a curved profile such that the uppermost surface of the elongate blade defines a concave surface, the lowermost surface defines a convex surface, a curved width and a curved height;

wherein a flat width of the elongate metal core is less than 32 mm;

wherein a ratio of the curved width to a flat width of the elongate metal core is less than 0.74;

wherein a ratio of the curved height to the flat width of the elongate metal core is greater than 0.29;

wherein a standout distance of the elongate blade from the housing is greater than 150 inches; and

a retraction system coupled to the tape reel, wherein the retraction system drives rewinding of the elongate tape blade on to the tape reel.

2. The tape measure of claim 1, wherein the curved profile is located along a lengthwise portion of the elongate blade having a length less than a total length of the elongate blade.

3. The tape measure of claim 1, wherein $T1 \geq T2 + T3$

4. The tape measure of claim 1, wherein the retraction system is a spring-based retraction system comprising a spring coupled to the tape reel, wherein, as the elongate tape blade is unwound from the tape reel to extend from the housing, the spring stores energy and the spring releases energy driving rewinding of the elongate tape blade on to the tape reel.

5. A tape measure comprising:

a housing;

a reel rotatably mounted within the housing;

an elongate blade wound around the reel, the elongate blade comprising:

an elongate metal core having an upper surface, a lower surface and a first thickness, T1, measured between the upper surface and the lower surface;

an upper polymer coating coupled to the upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2, and an upper surface defining the uppermost surface of the elongate blade;

a lower polymer coating coupled to the lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3, and a lower surface defining the lowermost surface of the elongate blade; and

a curved profile such that the uppermost surface of the elongate blade defines a concave surface, the lowermost surface defines a convex surface, a curved width and a curved height;

wherein a flat width of the elongate metal core is 32 mm or greater;

wherein a ratio of the curved width to the flat width of the elongate metal core is less than 0.70;

wherein a ratio of the curved height to the flat width of the elongate metal core is greater than 0.31;

wherein a standout distance of the elongate blade from the housing is greater than 150 inches; and

a retraction system coupled to the tape reel, wherein the retraction system drives rewinding of the elongate tape blade on to the tape reel.

6. The tape measure of claim 5, wherein the curved profile is located along a lengthwise portion of the elongate blade having a length less than a total length of the elongate blade.

7. The tape measure of claim 5, wherein $T1 \geq T2 + T3$

8. The tape measure of claim 5, wherein the retraction system is a spring-based retraction system comprising a spring coupled to the tape reel, wherein, as the elongate tape blade is unwound from the tape reel to extend from the housing, the spring stores energy and the spring releases energy driving rewinding of the elongate tape blade on to the tape reel.

9. A tape measure comprising:

a housing;

a reel rotatably mounted within the housing;

an elongate blade wound around the reel, the elongate blade comprising:

an upper surface;

a lower surface;

a curved profile such that the upper surface of the elongate blade defines a concave surface and the lower surface defines a convex surface;

a flat width of 30 mm or less; and

a curved width, wherein the curved width is less than the flat width;

a standout distance of the elongate blade from the housing of at least 132 inches; and

a retraction system coupled to the tape reel, wherein the retraction system drives rewinding of the elongate tape blade on to the tape reel.

10. The tape measure of claim 9, wherein a ratio of the curved width to the flat width is less than 0.8.

11. The tape measure of claim 9, wherein the curved width is less than 22 mm.

12. The tape measure of claim 9, wherein a ratio of curved height to flat width is greater than 0.24.

13. The tape measure of claim 9, wherein the elongate blade includes a metal core and the metal core has an average thickness along its length that is less than 0.13 mm.

14. The tape measure of claim 9, wherein the standout distance of the elongate blade from the housing is greater than 138 inches.

15. The tape measure of claim 9, wherein the standout distance of the elongate blade from the housing is greater than 144 inches.

16. The tape measure of claim 9, wherein the curved profile is located along a lengthwise portion of the elongate blade having a length less than a total length of the elongate blade.

17. The tape measure of claim 9, wherein the curved profile is located along at least the first 132 inches of a length of the elongate blade.

18. The tape measure of claim 9, wherein the elongate blade comprises:

an elongate metal core having a first thickness, T1;

an upper polymer coating coupled to an upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2;

a lower polymer coating coupled to a lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3.

19. The tape measure of claim 18, wherein $T1 \geq T2 + T3$

20. The tape measure of claim 9, wherein the retraction system is a spring-based retraction system comprising a spring coupled to the tape reel, wherein, as the elongate tape blade is unwound from the tape reel to extend from the housing, the spring stores energy and the spring releases energy driving rewinding of the elongate tape blade on to the tape reel.

21. A tape measure comprising:

a housing;

a reel rotatably mounted within the housing;

an elongate blade wound around the reel, the elongate blade comprising:

an upper surface;

a lower surface;

a curved profile such that the upper surface of the elongate blade defines a concave surface and the lower surface defines a convex surface;

a flat width greater than or equal to 29 mm and less than 32 mm; and

a curved width, wherein the curved width is less than the flat width;

a standout distance of the elongate blade from the housing of at least 156 inches; and

a retraction system coupled to the tape reel, wherein the retraction system drives rewinding of the elongate tape blade on to the tape reel.

22. The tape measure of claim 21, wherein a ratio of the curved width to the flat width is less than 0.74.

23. The tape measure of claim 21, wherein the curved width is less than 23.5 mm.

24. The tape measure of claim 21, wherein a ratio of curved height to flat width is greater than 0.29.

25. The tape measure of claim 21, wherein the elongate blade includes a metal core and the metal core has an average thickness along its length that is less than 0.13 mm.

26. The tape measure of claim 21, wherein the standout distance of the elongate blade from the housing is greater than 160 inches.

27. The tape measure of claim 21, wherein the curved profile is located along a lengthwise portion of the elongate blade having a length less than a total length of the elongate blade.

28. The tape measure of claim 21, wherein the curved profile is located along at least the first 132 inches of a length of the elongate blade.

29. The tape measure of claim 21, wherein the elongate blade comprises:

an elongate metal core having a first thickness, T1;

an upper polymer coating coupled to an upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2;

a lower polymer coating coupled to a lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3.

30. The tape measure of claim 29, wherein $T1 \geq T2 + T3$

31. The tape measure of claim 21, wherein the retraction system is a spring-based retraction system comprising a spring coupled to the tape reel, wherein, as the elongate tape blade is unwound from the tape reel to extend from the housing, the spring stores energy and the spring releases energy driving rewinding of the elongate tape blade on to the tape reel.

32. A tape measure comprising:

a housing;

a reel rotatably mounted within the housing;

an elongate blade wound around the reel, the elongate blade comprising:

an upper surface;

a lower surface;

a curved profile such that the upper surface of the elongate blade defines a concave surface and the lower surface defines a convex surface;

a flat width greater than 32 mm; and

a curved width, wherein the curved width is less than the flat width;

a standout distance of the elongate blade from the housing of at least 168 inches; and

a retraction system coupled to the tape reel, wherein the retraction system drives rewinding of the elongate tape blade on to the tape reel.

33. The tape measure of claim 32, wherein a ratio of the curved width to the flat width is less than 0.8.

34. The tape measure of claim 32, wherein the curved width is less than 26 mm.

35. The tape measure of claim 32, wherein a ratio of curved height to flat width is greater than 0.27.

36. The tape measure of claim 32, wherein the elongate blade includes a metal core and the metal core has an average thickness along its length that is less than 0.14 mm.

37. The tape measure of claim 32, wherein the curved profile is located along a lengthwise portion of the elongate blade having a length less than a total length of the elongate blade.

38. The tape measure of claim 32, wherein the curved profile is located along at least the first 132 inches of a length of the elongate blade.

39. The tape measure of claim 32, wherein the elongate blade comprises:

an elongate metal core having a first thickness, T1;

an upper polymer coating coupled to an upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2;

a lower polymer coating coupled to a lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3.

40. The tape measure of claim 39, wherein $T1 \geq T2 + T3$

41. The tape measure of claim 32, wherein the retraction system is a spring-based retraction system comprising a spring coupled to the tape reel, wherein, as the elongate tape blade is unwound from the tape reel to extend from the housing, the spring stores energy and the spring releases energy driving rewinding of the elongate tape blade on to the tape reel.

ABSTRACT

A tape measure, including a tape measure blade having a cross-sectional profile to increase standout is provided. The profile has a curved shape that increases standout. The tape blade may have a flat width of 30 mm or less and a standout of at least 132 inches. The tape blade may have a flat width greater than or equal to 29 mm and less than 32 mm and a standout of at least 156 inches. The tape blade may have a flat width greater than 32 mm and a standout of at least 168 inches.

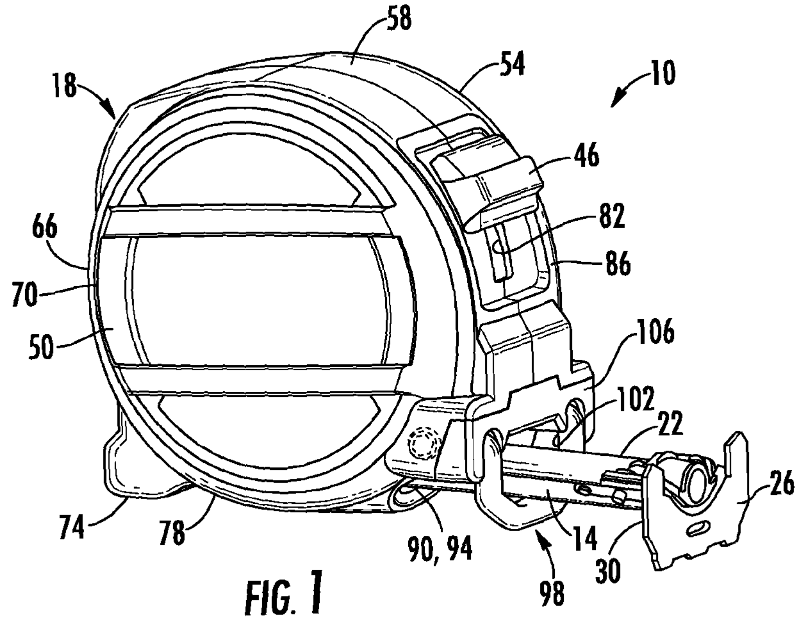

58
54
10
18
46
82
66
86
70
50
106
102
22
26
74
78
90, 94
14
30
98

FIG. 1

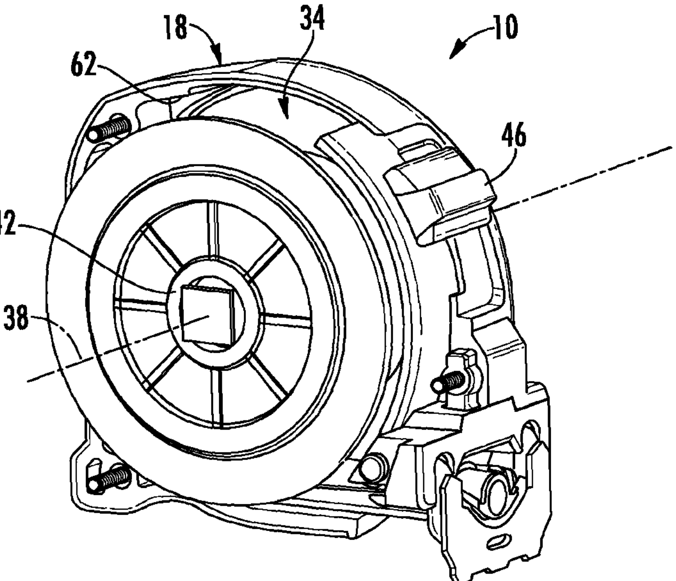

18
34
10
62
46
42
38

FIG. 2

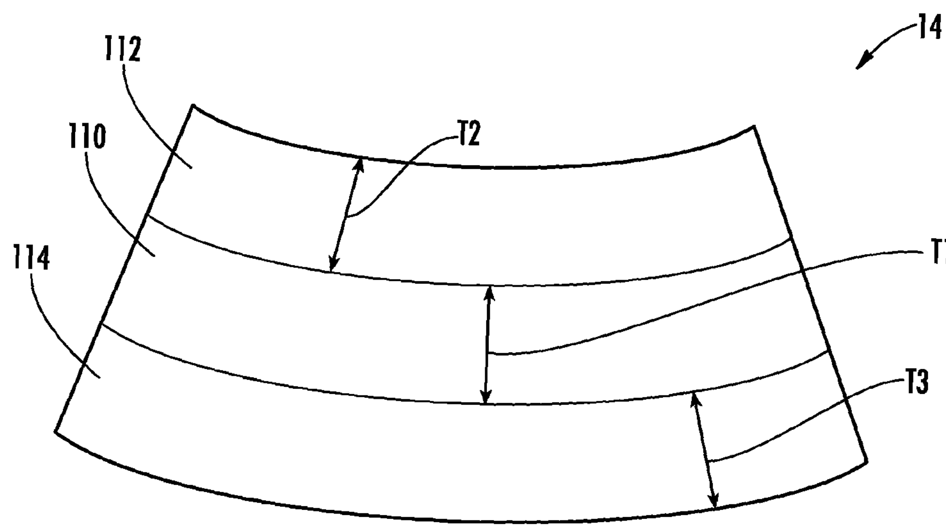


FIG. 3

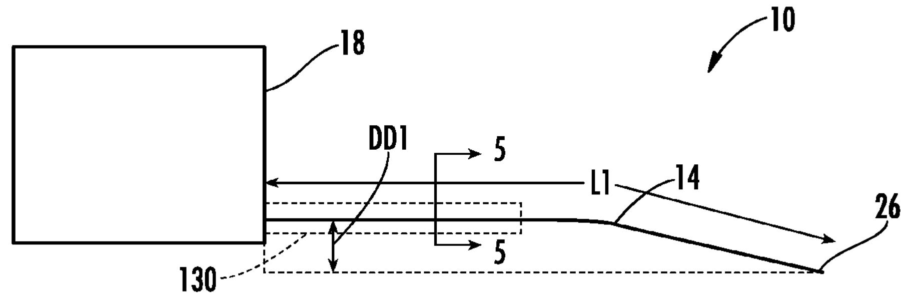


FIG. 4

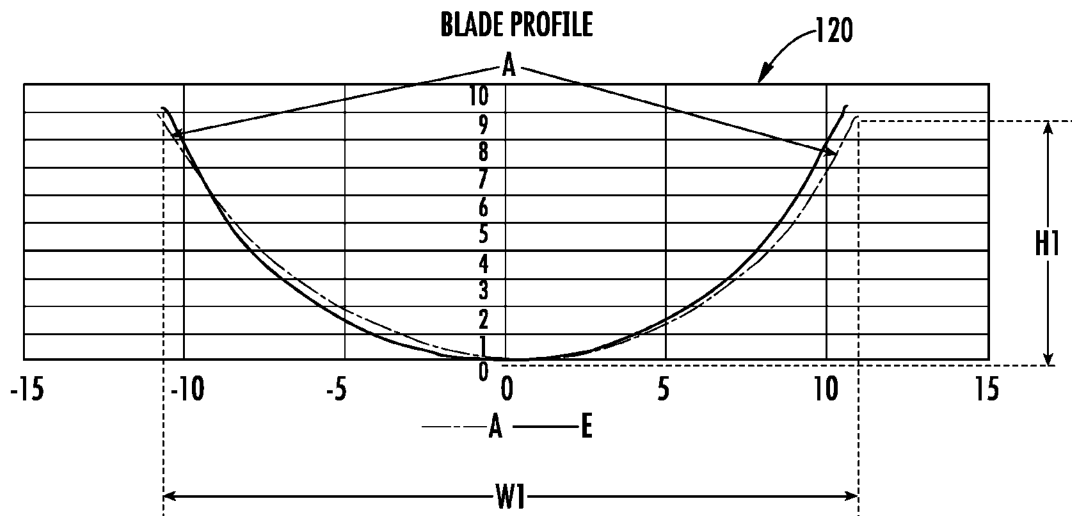


FIG. 5

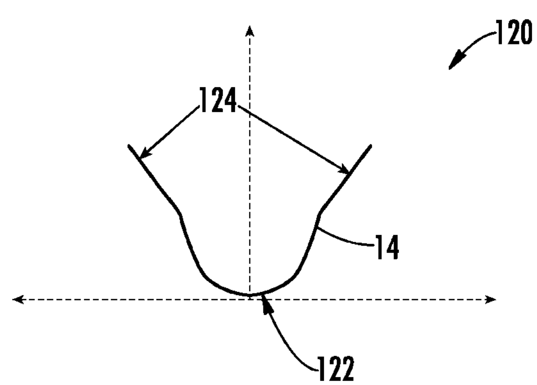
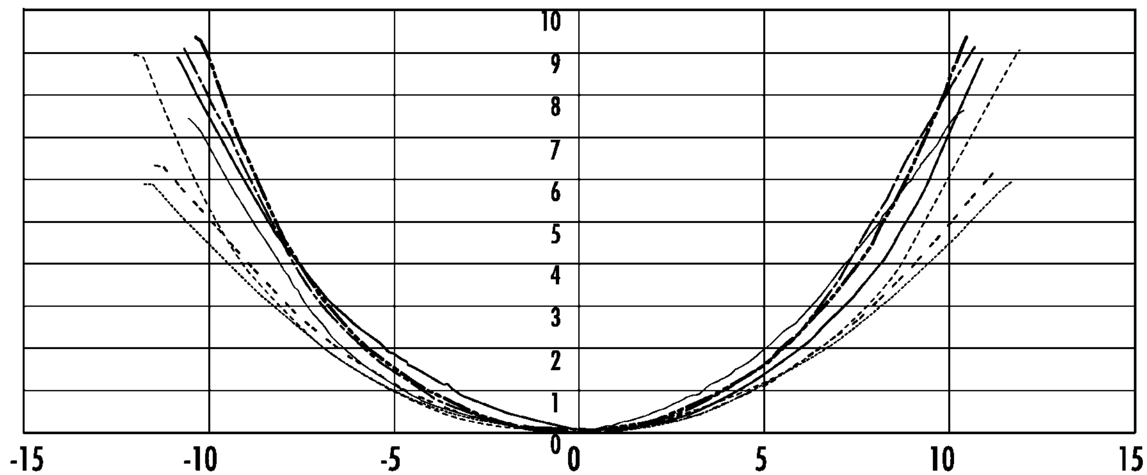


FIG. 6

MILWAUKEE TOOLS BLADES - CURRENT AND FUTURE



PROTOTYPE BLADE A
PROTOTYPE BLADE B
PROTOTYPE BLADE C
PROTOTYPE BLADE D
MILWAUKEE TOOL 48-22-7116
MILWAUKEE TOOL 48-22-7135
MILWAUKEE TOOL 48-22-7526

FIG. 7

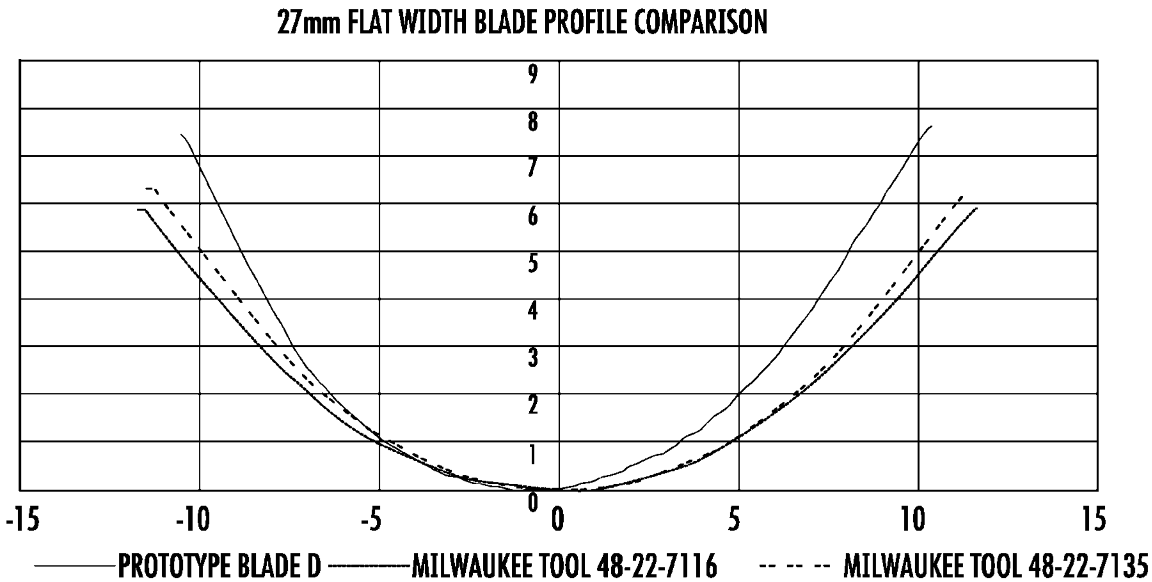

27mm FLAT WIDTH BLADE PROFILE COMPARISON
9
8
7
6
5
4
3
2
1
0
-15
-10
-5
0
5
10
15
PROTOTYPE BLADE D
MILWAUKEE TOOL 48-22-7116
MILWAUKEE TOOL 48-22-7135

FIG. 8

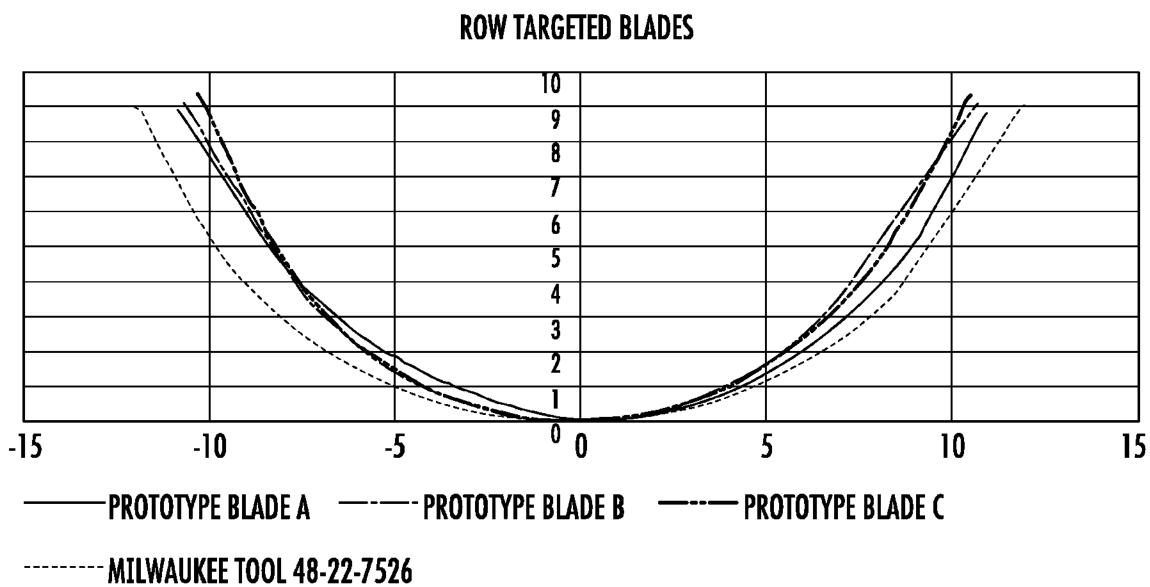

ROW TARGETED BLADES
10
9
8
7
6
5
4
3
2
1
0
-15
-10
-5
0
5
10
15
PROTOTYPE BLADE A
PROTOTYPE BLADE B
PROTOTYPE BLADE C
MILWAUKEE TOOL 48-22-7526

FIG. 9

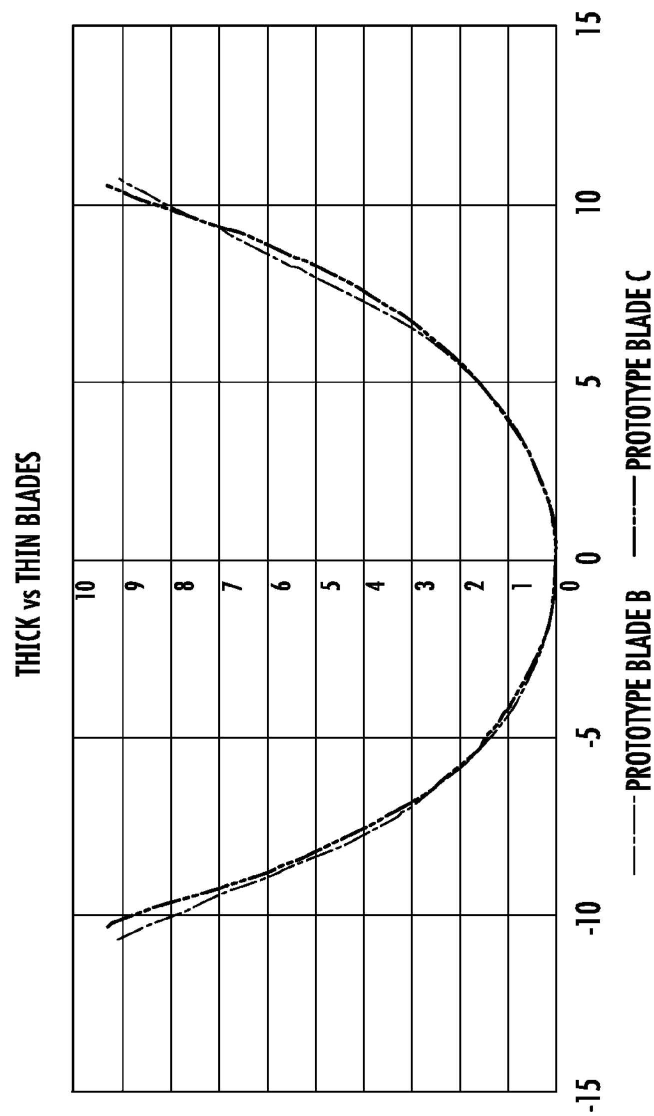

THICK vs THIN BLADES
10
9
8
7
6
5
4
3
2
1
0
-15
-10
-5
0
5
10
15
PROTOTYPE BLADE B
PROTOTYPE BLADE C

FIG. 10

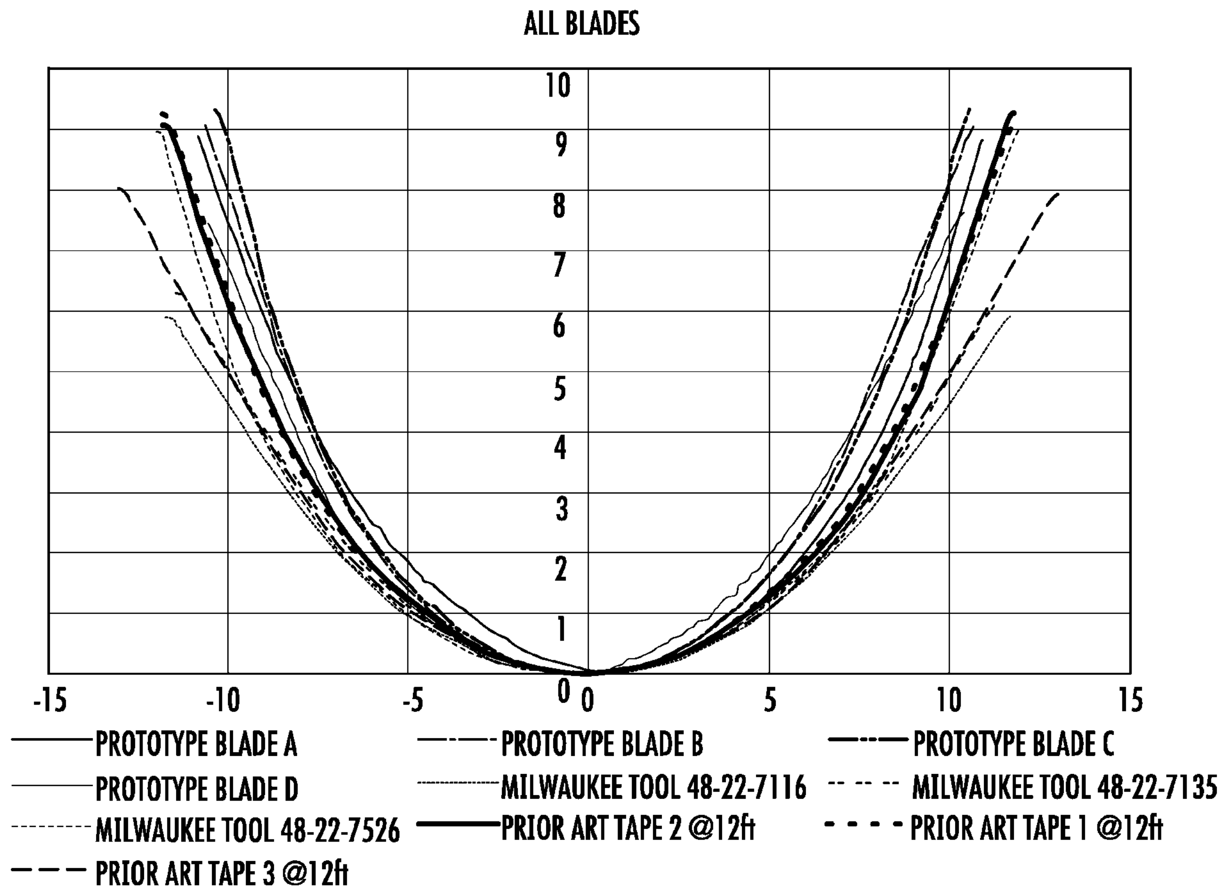

ALL BLADES
10
9
8
7
6
5
4
3
2
1
0
-15
-10
-5
0
5
10
15
PROTOTYPE BLADE A
PROTOTYPE BLADE B
PROTOTYPE BLADE C
PROTOTYPE BLADE D
MILWAUKEE TOOL 48-22-7116
MILWAUKEE TOOL 48-22-7135
MILWAUKEE TOOL 48-22-7526
PRIOR ART TAPE 2 @12ft
PRIOR ART TAPE 1 @12ft
PRIOR ART TAPE 3 @12ft

FIG. 11

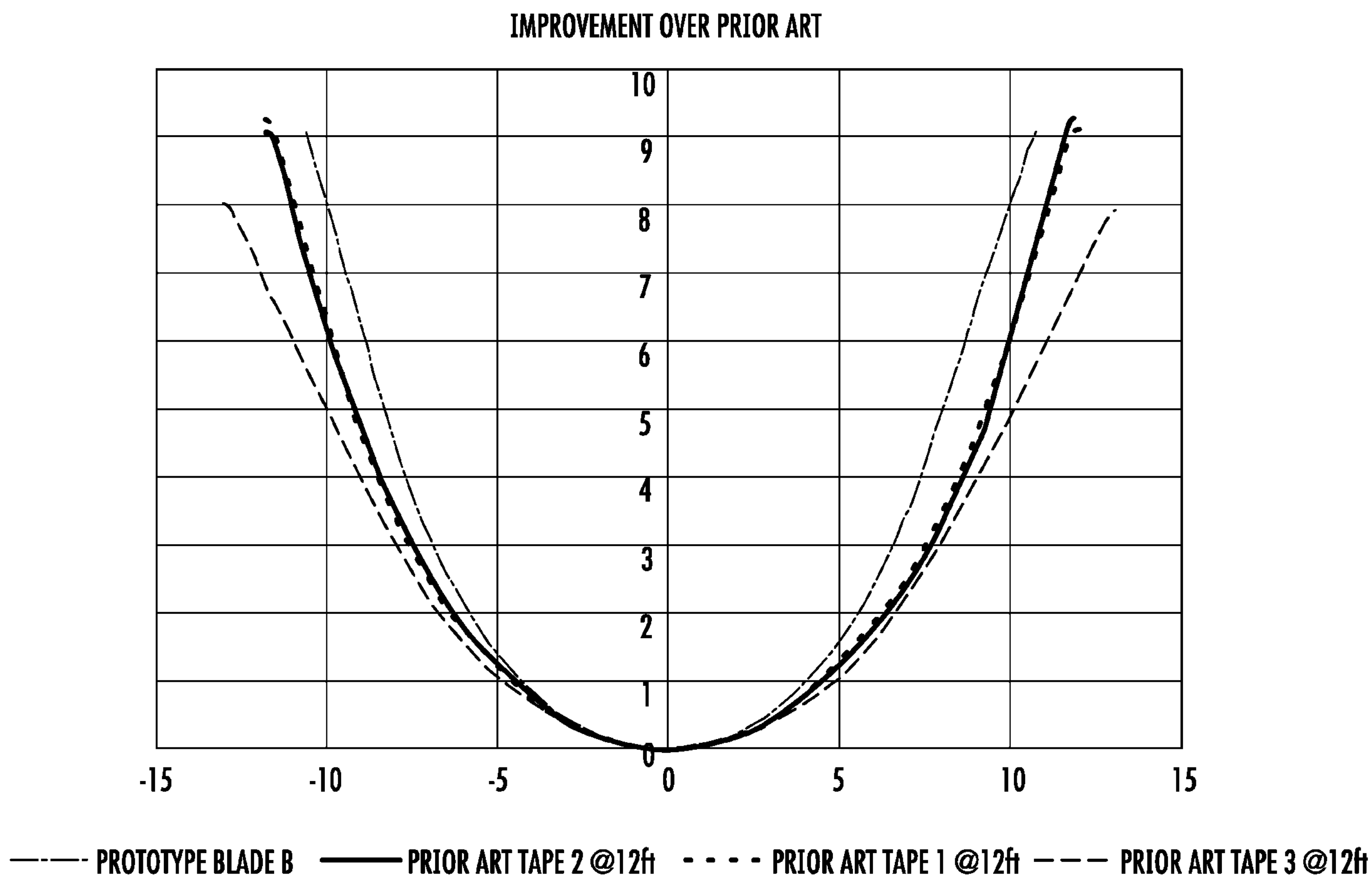

IMPROVEMENT OVER PRIOR ART
10
9
8
7
6
5
4
3
2
1
0
-15
-10
-5
0
5
10
15
PROTOTYPE BLADE B
PRIOR ART TAPE 2 @12ft
PRIOR ART TAPE 1 @12ft
PRIOR ART TAPE 3 @12ft

FIG. 12

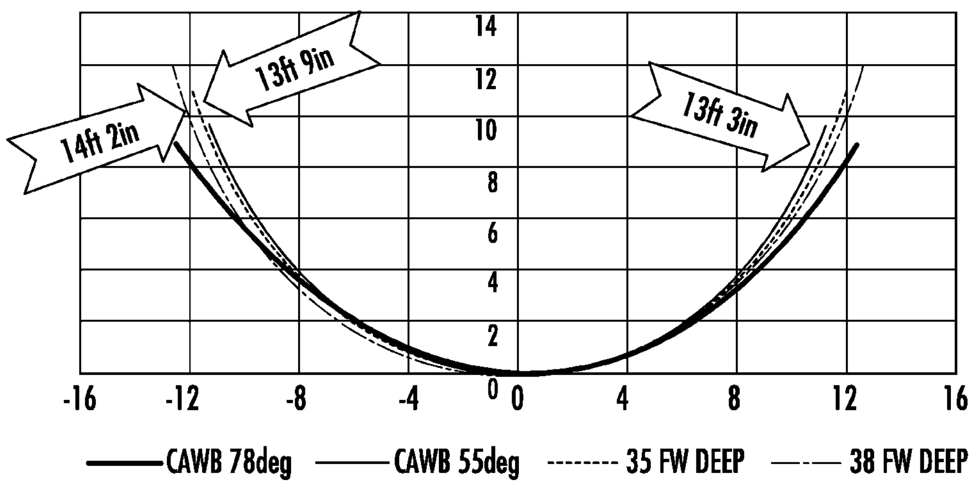

14
12
10
8
6
4
2
0
-16
-12
-8
-4
0
4
8
12
16
14ft 2in
13ft 9in
13ft 3in
CAWB 78deg
CAWB 55deg
35 FW DEEP
38 FW DEEP

FIG. 13

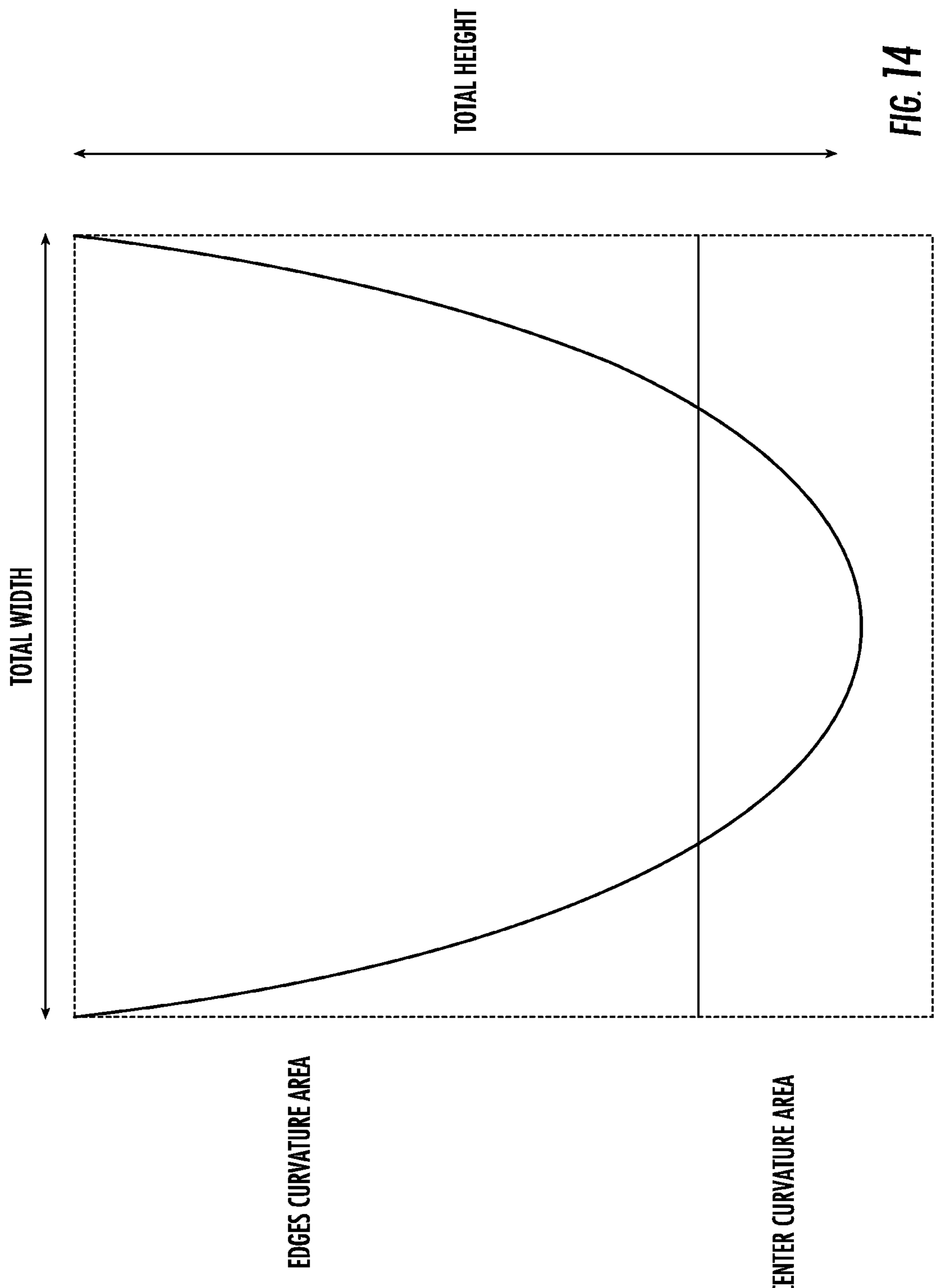

TOTAL HEIGHT
TOTAL WIDTH
EDGES CURVATURE AREA
CENTER CURVATURE AREA

FIG. 14

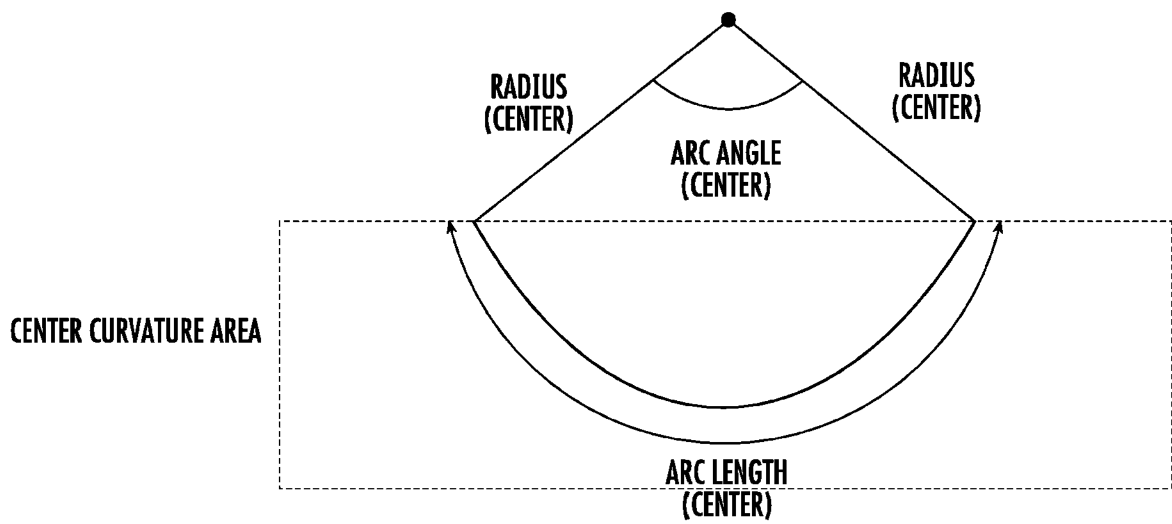
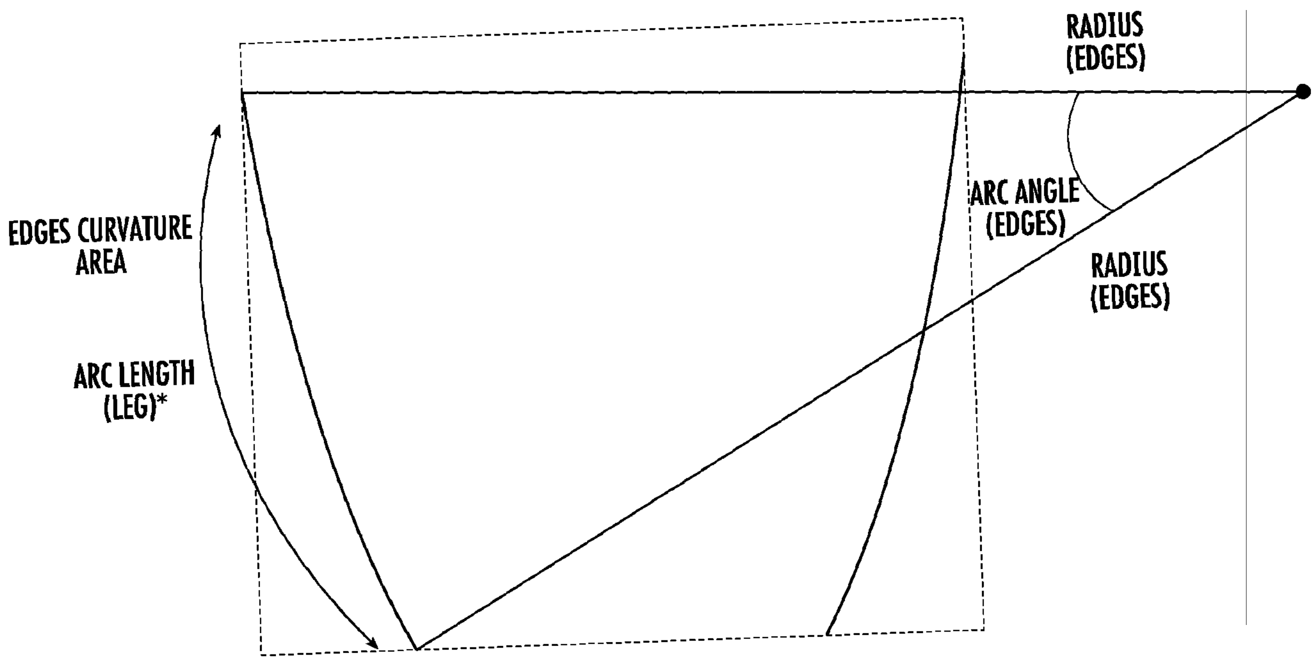

RADIUS
(CENTER)
RADIUS
(CENTER)
ARC ANGLE
(CENTER)
CENTER CURVATURE AREA
ARC LENGTH
(CENTER)

FIG. 15



*A "LEG" IS ONE SIDE OF THE EDGES PORTION

FIG. 16

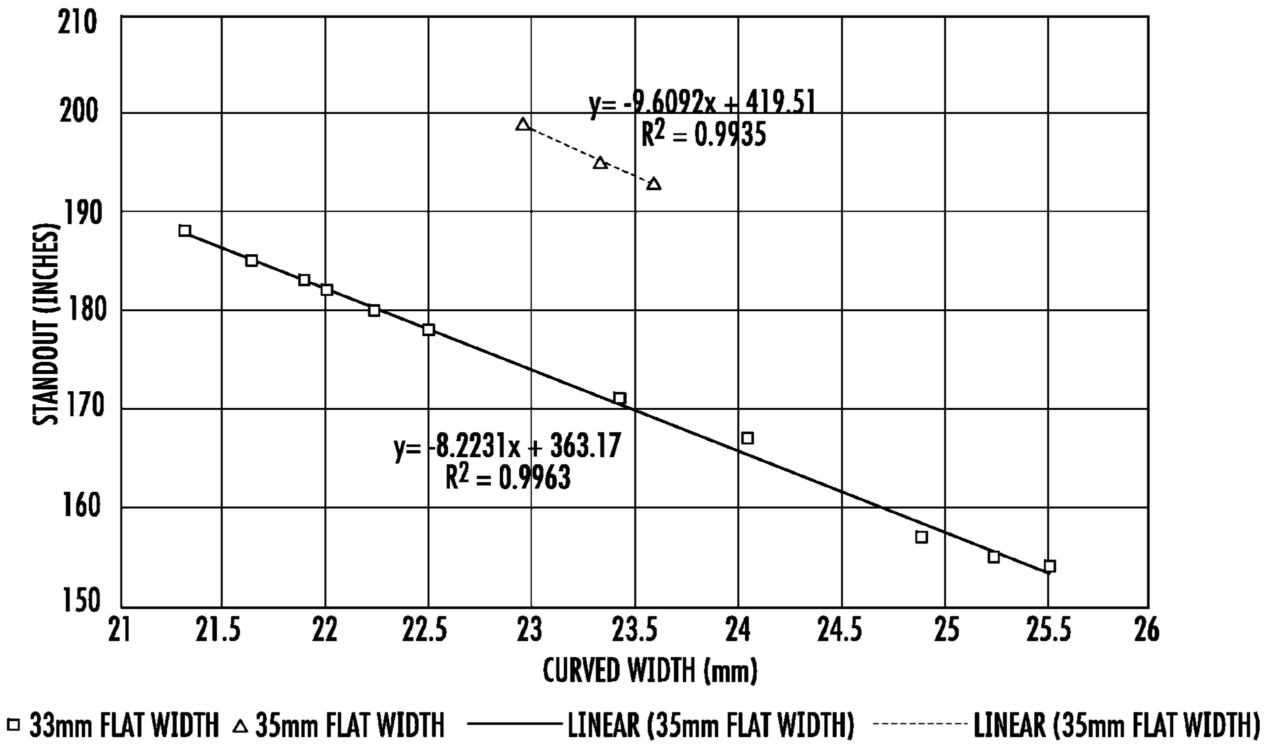

210
200
190
180
170
160
150
STANDOUT (INCHES)
21
21.5
22
22.5
23
23.5
24
24.5
25
25.5
26
CURVED WIDTH (mm)
y= -9.6092x + 419.51
R2 = 0.9935
y= -8.2231x + 363.17
R2 = 0.9963
33mm FLAT WIDTH
35mm FLAT WIDTH
LINEAR (35mm FLAT WIDTH)
LINEAR (35mm FLAT WIDTH)

FIG. 17

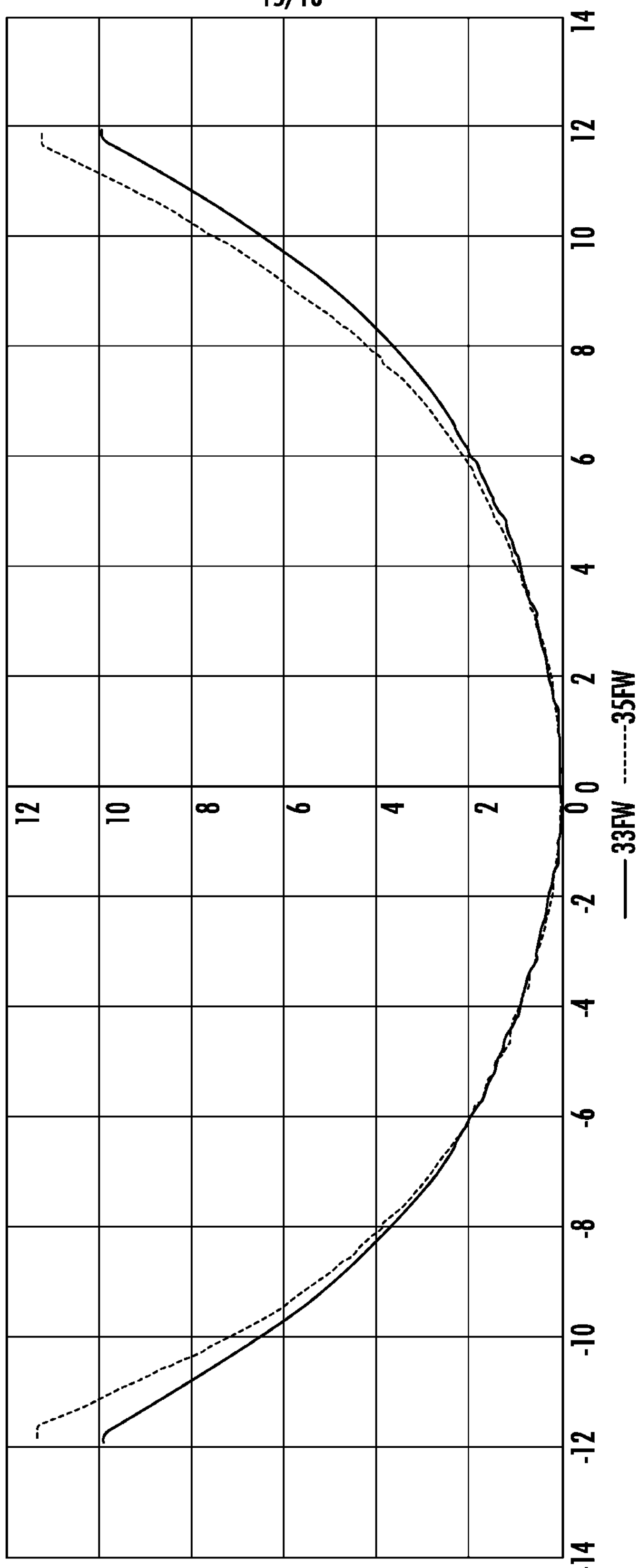


FIG. 18

14

98

FIG. 19

DD1

98

FIG. 20

14

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
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TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	To be determined
Filing Date	August 27, 2018
First Named Inventor	Jonathan F. Vitas
Title	Tape Measure with Tape Blade Profile Increasing Tape Standout
Art Unit	To be determined
Examiner Name	To be determined
Attorney Docket Number	066749-1484

SIGNATURE of Applicant or Patent Practitioner

Signature	/James D. Borchardt/	Date (Optional)	August 27, 2018
Name	James D. Borchardt	Registration Number	62,025
Title (if Applicant is a juristic entity)	Attorney for Applicant		
Applicant Name (if Applicant is a juristic entity)	Milwaukee Electric Tool Corporation		

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

☒ Practitioners associated with Customer Number: 142078

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

☒ The address associated with Customer Number: 142078

OR

☐

Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

Assignee Name and Address: Milwaukee Electric Tool Corporation
13135 West Lisbon Road
Brookfield, Wisconsin 53002

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be Filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature	Ty S	Date	7-6-16
Name	Ty Staviski	Telephone	262-781-3600
Title	Vice-President, Secretary and Treasurere		

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Milwaukee Electric Tool Corporation
Title:	Tape Measure with Tape Blade Profile Increasing Tape Standout
Appl. No.:	To be determined
Filing Date:	August 27, 2018
Examiner:	To be determined
Art Unit:	To be determined
Confirmation No:	To be determined

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

PRELIMINARY AMENDMENT UNDER 37 CFR 1.115

Prior to examination of the present application, Applicants respectfully request that the application be amended as follows:

Amendments to the Claims begin on page 2 of this document.

Remarks begin on page 7 of this document.

Please amend the application as follows:

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Original) A tape measure comprising:

a housing;

a reel rotatably mounted within the housing;

an elongate blade wound around the reel, the elongate blade comprising:

an elongate metal core having an upper surface, a lower surface and a first thickness, T1, measured between the upper surface and the lower surface,

an upper polymer coating coupled to the upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2, and an upper surface defining the uppermost surface of the elongate blade;

a lower polymer coating coupled to the lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3, and a lower surface defining the lowermost surface of the elongate blade; and

a curved profile such that the uppermost surface of the elongate blade defines a concave surface, the lowermost surface defines a convex surface, a curved width and a curved height;

wherein a flat width of the elongate metal core is less than 32 mm;

wherein a ratio of the curved width to a flat width of the elongate metal core is less than 0.74;

wherein a ratio of the curved height to the flat width of the elongate metal core is greater than 0.29;

wherein a standout distance of the elongate blade from the housing is greater than 150 inches; and

a retraction system coupled to the tape reel, wherein the retraction system drives rewinding of the elongate tape blade on to the tape reel.

2. (Original) The tape measure of claim 1, wherein the curved profile is located along a lengthwise portion of the elongate blade having a length less than a total length of the elongate blade.

3. (Original) The tape measure of claim 1, wherein $T1 \geq T2 + T3$

4. (Original) The tape measure of claim 1, wherein the retraction system is a spring-based retraction system comprising a spring coupled to the tape reel, wherein, as the elongate tape blade is unwound from the tape reel to extend from the housing, the spring stores energy and the spring releases energy driving rewinding of the elongate tape blade on to the tape reel.

5. (Original) A tape measure comprising:

a housing;

a reel rotatably mounted within the housing;

an elongate blade wound around the reel, the elongate blade comprising:

an elongate metal core having an upper surface, a lower surface and a first thickness, T1, measured between the upper surface and the lower surface;

an upper polymer coating coupled to the upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2, and an upper surface defining the uppermost surface of the elongate blade;

a lower polymer coating coupled to the lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3, and a lower surface defining the lowermost surface of the elongate blade; and

a curved profile such that the uppermost surface of the elongate blade defines a concave surface, the lowermost surface defines a convex surface, a curved width and a curved height;

wherein a flat width of the elongate metal core is 32 mm or greater;

wherein a ratio of the curved width to the flat width of the elongate metal core is less than 0.70;

wherein a ratio of the curved height to the flat width of the elongate metal core is greater than 0.31;

wherein a standout distance of the elongate blade from the housing is greater than 150 inches; and

a retraction system coupled to the tape reel, wherein the retraction system drives rewinding of the elongate tape blade on to the tape reel.

6. (Original) The tape measure of claim 5, wherein the curved profile is located along a lengthwise portion of the elongate blade having a length less than a total length of the elongate blade.

7. (Original) The tape measure of claim 5, wherein $T1 \geq T2 + T3$

8. (Original) The tape measure of claim 5, wherein the retraction system is a spring-based retraction system comprising a spring coupled to the tape reel, wherein, as the elongate tape blade is unwound from the tape reel to extend from the housing, the spring stores energy and the spring releases energy driving rewinding of the elongate tape blade on to the tape reel.

9. (Original) A tape measure comprising:

a housing;

a reel rotatably mounted within the housing;

an elongate blade wound around the reel, the elongate blade comprising:

an upper surface;

a lower surface;

a curved profile such that the upper surface of the elongate blade defines a concave surface and the lower surface defines a convex surface;

a flat width of 30 mm or less; and

a curved width, wherein the curved width is less than the flat width;

a standout distance of the elongate blade from the housing of at least 132 inches; and

a retraction system coupled to the tape reel, wherein the retraction system drives rewinding of the elongate tape blade on to the tape reel.

10. (Original) The tape measure of claim 9, wherein a ratio of the curved width to the flat width is less than 0.8.

11. (Original) The tape measure of claim 9, wherein the curved width is less than 22 mm.

12. (Original) The tape measure of claim 9, wherein a ratio of curved height to flat width is greater than 0.24.

13. (Original) The tape measure of claim 9, wherein the elongate blade includes a metal core and the metal core has an average thickness along its length that is less than 0.13 mm.

14. (Original) The tape measure of claim 9, wherein the standout distance of the elongate blade from the housing is greater than 138 inches.

15. (Original) The tape measure of claim 9, wherein the standout distance of the elongate blade from the housing is greater than 144 inches.

16. (Original) The tape measure of claim 9, wherein the curved profile is located along a lengthwise portion of the elongate blade having a length less than a total length of the elongate blade.

17. (Original) The tape measure of claim 9, wherein the curved profile is located along at least the first 132 inches of a length of the elongate blade.

18. (Original) The tape measure of claim 9, wherein the elongate blade comprises:

an elongate metal core having a first thickness, T1;

an upper polymer coating coupled to an upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2;

a lower polymer coating coupled to a lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3.

19. (Original) The tape measure of claim 18, wherein $T1 \geq T2 + T3$

20. (Original) The tape measure of claim 9, wherein the retraction system is a spring-based retraction system comprising a spring coupled to the tape reel, wherein, as the elongate tape blade is unwound from the tape reel to extend from the housing, the spring stores energy and the spring releases energy driving rewinding of the elongate tape blade on to the tape reel.

21-41. (Cancelled)

REMARKS

Applicant respectfully requests that the foregoing amendments to the claims be made prior to examination of the present application. No new matter has been added with this amendment.

Applicant believes that the present application is in condition for allowance. Favorable consideration of the application as amended is respectfully requested. The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

Although Applicant believes that no additional fee is required for this Request, the Commissioner is hereby authorized to charge any additional fees which may be required for this Request to Deposit Account No. 18-0882.

Respectfully submitted,

Date August 27, 2018

By /James D. Borchardt/

James D. Borchardt
Attorney for Applicant
Registration No. 62,025

Reinhart Boerner Van Deuren s.c.
Customer Number: 142078
Telephone: (414) 298-8160
Facsimile: (414) 298-8097

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	Tape Measure with Tape Blade Profile Increasing Tape Standout
First Named Inventor/Applicant Name:	Jonathan F. Vitas
Filer:	James D. Borchardt/Andrea Dietzel
Attorney Docket Number:	066749-1484

Filed as Large Entity

Filing Fees for **Utility under 35 USC 111(a)**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
UTILITY APPLICATION FILING	1011	1	300	300
UTILITY SEARCH FEE	1111	1	660	660
UTILITY EXAMINATION FEE	1311	1	760	760
Pages:				
Claims:				
Miscellaneous-Filing:				
LATE FILING FEE FOR OATH OR DECLARATION	1051	1	160	160
Petition:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1880**

Electronic Acknowledgement Receipt

EFS ID:	33548369
Application Number:	16113695
International Application Number:	
Confirmation Number:	3697
Title of Invention:	Tape Measure with Tape Blade Profile Increasing Tape Standout
First Named Inventor/Applicant Name:	Jonathan F. Vitas
Customer Number:	142078
Filer:	James D. Borchardt/Andrea Dietzel
Filer Authorized By:	James D. Borchardt
Attorney Docket Number:	066749-1484
Receipt Date:	27-AUG-2018
Filing Date:	
Time Stamp:	16:56:07
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	DA
Payment was successfully received in RAM	$1880
RAM confirmation Number	082818INTEFSW00004086180882
Deposit Account	180882
Authorized User	Andrea Dietzel

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

37 CFR 1.16 (National application filing, search, and examination fees)

37 CFR 1.17 (Patent application and reexamination processing fees)

37 CFR 1.19 (Document supply fees)

37 CFR 1.20 (Post Issuance fees)

37 CFR 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	066749-1484_Application_Transmittal.pdf	60944 656024f69185b44c1eb813f1bfd42fb53c25e55e	no	2

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Application Data Sheet	066749-1484_ADS.pdf	64715 0c5a0204f03b0297d8c084faeca86950c2c126f6	no	4

Warnings:

Information:

This is not an USPTO supplied ADS fillable form

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
3		066749-1484_Application.pdf	249809 a59197b1f18e3a65459cd1161a57ffd7f3d49bd3	yes	37

Multipart Description/PDF files in .zip description

Document Description	Start	End
Specification	1	27
Claims	28	36
Abstract	37	37

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
4	Drawings-only black and white line drawings	066749-1484_Drawings.pdf	439089 e0503083ef1bed632a07cc822abf5c675519ae61	no	16

Warnings:

Information:

5	Power of Attorney	066749-1484_PoA.pdf	199958 3c1ff50f5f745fc85815404620383f0cb1a1dad8	no	2
Warnings:					
Information:					
6		066749-1484_Preliminary_Amendment.pdf	91242 4e1bd7fe04202a3bd03596615ef1293477876ad2	yes	7

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Preliminary Amendment	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	7

Warnings:					
Information:					
7	Fee Worksheet (SB06)	fee-info.pdf	37203 982afcf057813288270bc4f174ae2043fd21af0a	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1142960		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

DocCode – SCORE

SCORE Placeholder Sheet for IFW Content

Application Number: 16113695 Document Date: 08/27/2018

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Since this was an electronic submission, there is no physical artifact folder, no artifact folder is recorded in PALM, and no paper documents or physical media exist. The TIFF images in the IFW record were created from the original documents that are stored in SCORE.

- Drawing

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Form Revision Date: August 26, 2013

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 16/113,695	Filing Date 08/27/2018	☐ To be Mailed

ENTITY: ☑ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A		N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A		N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*		x $100 =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*		x $460 =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).				
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))					
* If the difference in column 1 is less than zero, enter "0" in column 2.				TOTAL	

APPLICATION AS AMENDED - PART II

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT	08/27/2018	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0		x $100 =	0
AMENDMENT	Independent (37 CFR 1.16(h))	* 3	Minus	*** 3	= 0		x $460 =	0
AMENDMENT	☐ Application Size Fee (37 CFR 1.16(s))							
AMENDMENT	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	0

		(Column 1)		(Column 2)	(Column 3)			
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA		RATE ($)	ADDITIONAL FEE ($)
AMENDMENT	Total (37 CFR 1.16(i))	*	Minus	**	=		x $0 =	
AMENDMENT	Independent (37 CFR 1.16(h))	*	Minus	***	=		x $0 =	
AMENDMENT	☐ Application Size Fee (37 CFR 1.16(s))							
AMENDMENT	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							
							TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.	LDRC
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".	/eva gillis/
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".	
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.	

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/113,695	08/27/2018	Jonathan F. Vitas	066749-1484

CONFIRMATION NO. 3697

INFORMAL NOTICE

OC000000102299335

142078
Reinhart (Milwaukee Tool)
ATTN: TRAVIS MCDONNELL, PARALEGAL
1000 NORTH WATER STREET
SUITE 2100
MILWAUKEE, WI 53202

Date Mailed: 09/14/2018

INFORMATIONAL NOTICE TO APPLICANT

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file an oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

- A properly executed inventor's oath or declaration has not been received for the following inventor(s):
  Jonathan F. Vitas
  Abhijeet A. Khangar

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/elbanaybanay/

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number
16/113,695

APPLICATION AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	300
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	660
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	760
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 100 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*				x 460 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
			TOTAL			TOTAL	1720

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

AMENDMENT A

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

AMENDMENT B

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
Application Size Fee (37 CFR 1.16(s))									
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
16/113,695	08/27/2018	2855	1880	066749-1484	20	3

CONFIRMATION NO. 3697

FILING RECEIPT

OC000000102299334

142078
Reinhart (Milwaukee Tool)
ATTN: TRAVIS MCDONNELL, PARALEGAL
1000 NORTH WATER STREET
SUITE 2100
MILWAUKEE, WI 53202

Date Mailed: 09/14/2018

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Jonathan F. Vitas, Muskego, WI;
Abhijeet A. Khangar, Pewaukee, WI;

Applicant(s)

Milwaukee Electric Tool Corporation, Brookfield, WI;

Power of Attorney: The patent practitioners associated with Customer Number 142078

Domestic Priority data as claimed by applicant

This application is a CON of PCT/US2018/047759 08/23/2018
which claims benefit of 62/702,575 07/24/2018
and claims benefit of 62/549,511 08/24/2017

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

Permission to Access Application via Priority Document Exchange: No

Permission to Access Search Results: No

Applicant may provide or rescind an authorization for access using Form PTO/SB/39 or Form PTO/SB/69 as appropriate.

If Required, Foreign Filing License Granted: 09/13/2018

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 16/113,695**

Projected Publication Date: 02/28/2019

Non-Publication Request: No

Early Publication Request: No
Title

Tape Measure with Tape Blade Profile Increasing Tape Standout

Preliminary Class

033

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

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Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

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Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

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Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	16/113,695
				Filing Date	August 27, 2018
Date Submitted: November 27, 2018				**First Named Inventor**	Jonathan F. Vitas
				Art Unit	2855
(use as many sheets as necessary)				Examiner Name	To be determined
Sheet	1	of	4	Attorney Docket Number	066749-1484

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	A1	2,089,209	08-10-1937	KEUFFEL AND ESSER CO	
	A2	2,303,368	12-01-1942	KEUFFEL AND ESSER CO	
	A3	2,471,395	05-24-1949	Adolf Keuffel	
	A4	RE23,133	07-12-1949	Kueffel et al.	
	A5	2,814,881	12-03-1957	ANDERS LJUNGBERG TURE	
	A6	3,121,957	02-25-1964	STANLEY WORKS	
	A7	3,214,836	11-02-1965	STANLEY WORKS	
	A8	3,330,709	07-11-1967	LUFKIN RULE CO	
	A9	3,409,988	11-12-1968	COOPER IND INC	
	A10	3,439,428	04-22-1969	COOPER IND INC	
	A11	3,450,367	06-17-1969	PORTER CO INC H K	
	A12	3,889,897	06-17-1975	STANLEY WORKS	
	A13	3,942,738	03-09-1976	STANLEY WORKS	
	A14	4,198,458	04-15-1980	TEIJIN LTD	
	A15	4,286,387	09-01-1981	STANLEY WORKS	
	A16	4,531,688	07-30-1985	SEARS ROEBUCK AND CO	
	A17	4,835,870	06-06-1989	BOSCH GMBH ROBERT	
	A18	4,926,566	05-22-1990	RENISHAW PLC	
	A19	5,471,761	12-05-1995	H.T. CHENG	
	A20	5,738,743	04-14-1998	SHIH TUNG LEE	
	A21	5,820,057	10-13-1998	STANLEY WORKS	
	A22	5,895,539	04-20-1999	CHENG-HUI HSU	
	A23	5,979,238	11-09-1999	ZEISS CARL JENA GMBH	
	A24	6,115,933	09-12-2000	SHIH-LIN LI	
	A25	6,148,534	11-21-2000	SHIH LIN LI	
	A26	6,243,964	06-12-2001	STANLEY WORKS	
	A27	6,249,986	06-26-2001	STANLEY WORKS	
	A28	6,282,808	09-04-2001	STANLEY WORKS	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. 3 Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4 For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5 Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. 6 Applicant is to place a check mark here if English language Translation is attached.

Substitute for form 1449/PTO				*Complete if Known*	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	16/113,695
				Filing Date	August 27, 2018
Date Submitted: November 27, 2018				**First Named Inventor**	Jonathan F. Vitas
				Art Unit	2855
(use as many sheets as necessary)				Examiner Name	To be determined
Sheet	2	of	4	Attorney Docket Number	066749-1484

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No [1]	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant
	A29	6,324,769	12-04-2001	STANLEY WORKS	
	A30	6,440,502	08-27-2002	SHIN-LIN LEE	
	A31	6,449,866	09-17-2002	STANLEY WORKS	
	A32	6,499,226	12-31-2002	Joe Reda	
	A33	6,637,124	10-28-2003	3M INNOVATIVE PROPERTIES CO	
	A34	6,643,947	11-11-2003	STANLEY WORKS	
	A35	6,804,899	10-19-2004	STANLEY WORKS	
	A36	6,907,676	06-21-2005	HUEI-YEN LIAO	
	A37	7,398,604	07-15-2008	STANLEY WORKS	
	A38	7,565,751	07-28-2009	STANLEY WORKS	
	A39	7,856,735	12-28-2010	THALES SA ; CENTRE NAT RECH SCIENT ; UNIV PROVENCE	
	A40	8,117,762	02-21-2012	COOK VINCENT ; DELNEO JOHN ; MURRAY JOHN ; STANLEY BLACK AND DECKER INC	
	A41	8,117,763	02-21-2012	COOK VINCENT ; DELNEO JOHN ; MURRAY JOHN ; STANLEY BLACK AND DECKER INC	
	A42	8,356,418	01-22-2013	HALL BRUCE	
	A43	8,584,373	11-19-2013	STANLEY BLACK AND DECKER INC ; DELNEO JOHN ; MURRAY JOHN C	
	A44	2001/0053436	12-20-2001	SHIH LIN LI	
	A45	2002/0073570	06-20-2002	COREY P. CONDER	
	A46	2002/0129509	09-19-2002	STARRETT L S CO	
	A47	2004/0071869	04-15-2004	GILLIAM ET AL.	
	A48	2006/0053649	03-16-2006	GREALLY, SEAMUS	
	A49	2006/0059703	03-23-2006	Hernandez	
	A50	2006/0130352	06-22-2006	INDEX MEASURING TAPE CO LTD	
	A51	2007/0074417	04-05-2007	Fu-Cheng Sun	
	A52	2007/0079520	04-12-2007	WHITNEY HAMILTON S M; LEVINE STEVEN R; WEIR JAMES A	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. 3 Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4 For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5 Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. 6 Applicant is to place a check mark here if English language Translation is attached.

Substitute for form 1449/PTO				*Complete if Known*	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	16/113,695
				Filing Date	August 27, 2018
Date Submitted: November 27, 2018				**First Named Inventor**	Jonathan F. Vitas
				Art Unit	2855
(use as many sheets as necessary)				Examiner Name	To be determined
Sheet	3	of	4	Attorney Docket Number	066749-1484

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant
	A53	2009/0090016	04-09-2009	Brian Roach	
	A54	2011/0232119	09-29-2011	SMALLS ANDRE N	
	A55	2012/0036727	02-16-2012	Ronald J. McCarthy	
	A56	2013/0067759	03-21-2013	MURRAY ET AL.	

UNPUBLISHED U.S. PATENT APPLICATION DOCUMENTS

Examiner Initials*	Cite No.[1]	U.S. Patent Application Document Serial Number-Kind Code[2] *(if known)*	Filing Date of Cited Document MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	A57	62/639,743	03-07-2018	KHANGAR ET AL.	

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	A58	CN202066436	12-07-2011	XIANJIA SHI		
	A59	CN202432942	09-12-2012	UNIV NINGBO		
	A60	CN202757538	02-27-2013	JIANGSU POSTS AND TELECOMM PLANNING AND DESIGNING INST CO LTD		
	A61	CN204612629	09-02-2015	UNIV HUAINAN NORMAL		
	A62	CN205482653	08-17-2016	ZHEJIANG GUOXIANG ELECTRICAL AND MECH ENG CO LTD		
	A63	CN2705772	06-22-2005	MEDID INTERNAT CORP		
	A64	DE19628318	03-26-1998	BEIERSDORF AG		
	A65	EP0100138	02-08-1984	FISCO PRODUCTS LTD		
	A66	EP1411319	04-21-2004	LI SHIN LIN		
	A67	EP1444479	08-11-2004	STANLEY WORKS		
	A68	EP1647797	06-20-2012	STANLEY BLACK AND DECKER INC		
	A69	EP2400258	11-26-2014	STANLEY BLACK AND DECKER INC		

Examiner Signature		Date Considered	

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Substitute for form 1449/PTO				*Complete if Known*	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	16/113,695
				Filing Date	August 27, 2018
Date Submitted: November 27, 2018				**First Named Inventor**	Jonathan F. Vitas
				Art Unit	2855
(use as many sheets as necessary)				Examiner Name	To be determined
Sheet	4	of	4	Attorney Docket Number	066749-1484

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	A70	WO02057710	07-25-2002	3M INNOVATIVE PROPERTIES CO		
	A71	WO03031903	04-17-2003	STANLEY WORKS		
	A72	WO2004063659	07-29-2004	FISCO TOOLS LIMITED ET AL.		
	A73	WO17172683	10-05-2017	APEX BRANDS INC		

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[6]
	A74	Comparative prior art tape measures identified in FIGS. 7-9 and 11-13 and Tables 1, 2 and 3 and discussed in the related paragraphs of Applicant's specification.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. 3 Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4 For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5 Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. 6 Applicant is to place a check mark here if English language Translation is attached.

Electronic Acknowledgement Receipt

EFS ID:	34410326
Application Number:	16113695
International Application Number:	
Confirmation Number:	3697
Title of Invention:	Tape Measure with Tape Blade Profile Increasing Tape Standout
First Named Inventor/Applicant Name:	Jonathan F. Vitas
Customer Number:	142078
Filer:	James D. Borchardt/Andrea Dietzel
Filer Authorized By:	James D. Borchardt
Attorney Docket Number:	066749-1484
Receipt Date:	27-NOV-2018
Filing Date:	27-AUG-2018
Time Stamp:	17:09:39
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	066749-1484_Transmittal.pdf	81652 b95e1829324af5247ef9ea6f0567cf05b7944f0e	no	2

Warnings:

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	066749-1484_SB08.pdf	126278 16708fe4eeb281c2167f78458b29142752bbff3a	no	4
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
		Total Files Size (in bytes):	207930		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Milwaukee Electric Tool Corporation
Title:	Tape Measure with Tape Blade Profile Increasing Tape Standout
Appl. No.:	16/113,965
Filing Date:	August 27, 2018
Examiner:	To Be Determined
Art Unit:	2855
Confirmation Number:	3697

INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR §1.56

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Submitted herewith on Form PTO/SB/08 is a listing of the documents known to Applicants in order to comply with Applicants' duty of disclosure pursuant to 37 CFR § 1.56.

The submission of any document herewith, which is not a statutory bar, is not intended as an admission that such document constitutes prior art against the claims of the present application or that such document is considered material to patentability as defined in 37 CFR §1.56(b). Applicants do not waive any rights to take any action which would be appropriate to antedate or otherwise remove as a competent reference any document which is determined to be a *prima facie* art reference against the claims of the present application.

TIMING OF THE DISCLOSURE

The listed documents are being submitted in compliance with 37 CFR §1.97(b)(1), within three (3) months of the filing date of the application.

RELEVANCE OF EACH DOCUMENT

All of the documents are in English.

Applicants respectfully request that each listed document be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08 be returned in accordance with MPEP §609.

Although Applicant believes that no fee is required for this Request, the Commissioner is hereby authorized to charge any additional fees which may be required for this Request to Deposit Account No. 18-0882.

Respectfully submitted,

Date November 27, 2018

By /James D. Borchardt/

Reinhart Boerner Van Deuren s.c.
Customer Number: 142078
Telephone: (414) 298-8160
Facsimile: (414) 298-8097

James D. Borchardt
Attorney for Applicant
Registration No. 62,025

DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I HEREBY DECLARE:

THAT my residence, post office address, and citizenship are as stated below next to my name;

THAT I believe I am the original inventor or an original joint inventor of a claimed invention in the application identified below

TAPE MEASURE WITH TAPE BLADE PROFILE INCREASING TAPE STANDOUT

(Attorney Docket No. 066749-1484)

the specification of which (check one)

___ is attached hereto.

_X_ was filed on August 27, 2018 as United States Application Number 16/113,695.

THAT the above-identified application was made or authorized by me;

THAT I do not know and do not believe that the same invention was invented by another and was patented, described in any printed publication, in public use, on sale or otherwise available to the public in any country, prior to the effective filing date of this United States application or before I (we) had publicly disclosed the invention (if applicable);

THAT I do not know and do not believe that the same invention was patented, described in any printed publication, in public use, on sale or otherwise available to the public in any country, for more than one year prior to the effective filing date of this United States application;

THAT I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment specifically referred to above;

THAT I believe that the above-identified specification contains a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention, and sets forth the best mode contemplated by me of carrying out the invention; and

THAT I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I HEREBY CLAIM foreign priority benefits under Title 35, United States Code §119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number	Country	Foreign Filing Date	Priority Claimed?	Certified Copy Attached?

I HEREBY CLAIM the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

U.S. Provisional Application Number	Filing Date
62/702,575	July 24, 2018
62/549,511	August 24, 2017

I HEREBY CLAIM the benefit under Title 35, United States Code, §120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Application Number	Parent Filing Date	Parent Patent Number
N/A	PCT/US2018/047759	August 23, 2018	N/A

I HEREBY APPOINT the registered attorneys and agents at Customer Number

142078

to have full power to prosecute this application and any continuations, divisions, reissues, and reexaminations thereof, to receive the patent, and to transact all business in the United States Patent and Trademark Office connected therewith.

I request that all correspondence be directed to:

James D. Borchardt
Reinhart Boerner Van Deuren s.c.
Customer Number: 142078

Telephone: (414) 298-8160
Facsimile: (414) 298-8097

I UNDERSTAND AND AGREE THAT the foregoing attorneys and agents appointed by me to prosecute this application do not personally represent me or my legal interests, but instead represent the interests of the legal owner(s) of the invention described in this application.

I HEREBY ACKNOWLEDGE THAT any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

Name of first inventor	Jonathan F. Vitas
Residence	Muskego, Wisconsin
Citizenship Country	U.S.
Post Office Address	S96W12969 Claude Harmon Circle, Muskego, Wisconsin 53150
Inventor's signature	
Date	9-17-18

Name of second inventor	Abhijeet A. Khangar
Residence	Pewaukee, Wisconsin
Citizenship Country	U.S.
Post Office Address	N43 W22755 Victoria Street, Pewaukee, Wisconsin 53072
Inventor's signature	Abhijit
Date	09/19/2018

Electronic Acknowledgement Receipt

EFS ID:	34576740
Application Number:	16113695
International Application Number:	
Confirmation Number:	3697
Title of Invention:	Tape Measure with Tape Blade Profile Increasing Tape Standout
First Named Inventor/Applicant Name:	Jonathan F. Vitas
Customer Number:	142078
Filer:	James D. Borchardt/Andrea Dietzel
Filer Authorized By:	James D. Borchardt
Attorney Docket Number:	066749-1484
Receipt Date:	13-DEC-2018
Filing Date:	27-AUG-2018
Time Stamp:	18:01:57
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Oath or Declaration filed	066749-1484_Declaration.pdf	397474 5d29f53ec07bd672b92d1e18b13eb9a7f89ecd95	no	4

Warnings:

Information:	
Total Files Size (in bytes):	397474

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
New International Application Filed with the USPTO as a Receiving Office
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Substitute for form 1449/PTO				*Complete if Known*	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	16/113,695
				Filing Date	August 27, 2018
Date Submitted: December 20, 2018				**First Named Inventor**	Jonathan F. Vitas
				Art Unit	2855
(use as many sheets as necessary)				Examiner Name	To be determined
Sheet	1	of	1	Attorney Docket Number	066749-1484

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	A1	2008/0010847	01-17-2008	LIAO, HUEI-YEN	

UNPUBLISHED U.S. PATENT APPLICATION DOCUMENTS

Examiner Initials*	Cite No.[1]	U.S. Patent Application Document Serial Number-Kind Code[2] *(if known)*	Filing Date of Cited Document MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[6]
	A2	International Search Report and Written Opinion for PCT/US2018/047759, dated December 7, 2018, 24 pages.	

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. 3 Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4 For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5 Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. 6 Applicant is to place a check mark here if English language Translation is attached.

6848980

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

To:
BORCHARDT, James D.

1000 North Water Street Suite 1700 Milwaukee, Wisconsin 53202 USA

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

	Date of mailing *(day/month/year)* 07 December 2018 (07.12.2018)
Applicant's or agent's file reference 066749-1483	**FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. **PCT/US2018/047759**	International filing date *(day/month/year)* **23 August 2018 (23.08.2018)**
Applicant **MILWAUKEE ELECTRIC TOOL CORPORATION**	

1. [X] The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.
   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the international application (see Rule 46):
   When? The time limit for filing such amendments is normally two months from the date of transmittal of the international search report.
   How? Directly to the International Bureau of WIPO preferably through ePCT or on paper to, 34 chemin des Colombettes 1211 Geneva 20, Switzerland, Facsimile No.: +41 22 338 82 70
   For more detailed instructions, see *PCT Applicant's Guide*, International Phase, paragraphs 9.004 - 9.011.

2. [ ] The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. [ ] **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:
   [ ] the protest together with the decision thereon has been transmitted to the International Bureau together with any request to forward the texts of both the protest and the decision thereon to the designated Offices.
   [ ] no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. These comments will be made available to the public after international publication. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established.

Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before the completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices. In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months. For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

Within **22 months** from the priority date, the applicant may request that a supplementary international search be carried out by a different International Searching Authority, that offers this service (Rule 45*bis*.1). The procedure for requesting supplementary international search is described in the *PCT Applicant's Guide*, International Phase, paragraphs 8.006-8.032.

Name and mailing address of the ISA/KR International Application Division Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea	Authorized officer COMMISSIONER
Facsimile No. 82-42-481-8578	Telephone No. 82-42-481-8751

* Attention

Copies of the documents cited in the international search report can be searched in the following Korean Intellectual Property Office English website for six months(expire date : **2019.06.07**) from the date of mailing of the international search report.

http://www.kipo.go.kr/en/ => PCT Service => PCT Services

ID : PCT international application number
PW : **U6S7Y3U3**

Inquiries related to PCT International Search Report or Written Opinion prepared by KIPO as an International Searching Authority can be answered not only by KIPO but also through IPKC (Intellectual Property Korea Center), located in Vienna, VA, which functions as a PCT Help Desk for PCT applicants.

Homepage: http://www.ipkcenter.com

Email: ipkc@ipkcenter.com

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference 066749-1483	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. **PCT/US2018/047759**	International filing date *(day/month/year)* **23 August 2018 (23.08.2018)**	(Earliest) Priority Date *(day/month/year)* 24 August 2017 (24.08.2017)
Applicant **MILWAUKEE ELECTRIC TOOL CORPORATION**		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 3 sheets

☐ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language**, the international search was carried out on the basis of:
      ☒ the international application in the language in which it was filed
      ☐ a translation of the international application into ____________, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.
2. ☐ **Certain claims were found unsearchable** (See Box No. II)
3. ☐ **Unity of invention is lacking** (See Box No. III)
4. With regard to the **title**,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established by this Authority to read as follows:
5. With regard to the **abstract**,
   ☒ the text is approved as submitted by the applicant.
   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.
6. With regard to the **drawings**,
   a. the figure of the **drawings** to be published with the abstract is Figure No. 1
      ☒ as suggested by the applicant.
      ☐ as selected by this Authority, because the applicant failed to suggest a figure.
      ☐ as selected by this Authority, because this figure better characterizes the invention.
   b. ☐ none of the figures is to be published with the abstract.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2018/047759

A. CLASSIFICATION OF SUBJECT MATTER

G01B 3/10(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G01B 3/10

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean utility models and applications for utility models
Japanese utility models and applications for utility models

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
eKOMPASS(KIPO internal) & keywords: tape measure, standout, profile, flat width, curved width, curved height

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 2008-0010847 A1 (LIAO, HUEI-YEN) 17 January 2008 See paragraphs [0025]-[0039], table 2 and figures 1, 2, 4.	9-17,20-28,31-38,41 1-8,18,19,29,30,39,40
Y	US 2007-0079520 A1 (LEVINE et al.) 12 April 2007 See paragraphs [0020]-[0024] and figure 6.	1-8,18,19,29,30,39,40
A	US 6282808 B1 (MURRAY, JOHN C.) 04 September 2001 See column 3, lines 1-12, column 6, lines 10-52, column 7, lines 21-34 and figure 9.	1-41
A	US 2013-0067759 A1 (MURRAY et al.) 21 March 2013 See figures 7A-10.	1-41
A	US 2006-0053649 A1 (GREALLY, SEAMUS) 16 March 2006 See figures 1-3c.	1-41

☐ Further documents are listed in the continuation of Box C.   ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
07 December 2018 (07.12.2018)	**07 December 2018 (07.12.2018)**

Name and mailing address of the ISA/KR
International Application Division
Korean Intellectual Property Office
189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea
Facsimile No. +82-42-481-8578

Authorized officer
LEE, Chang Ho
Telephone No. +82-42-481-8288

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/US2018/047759

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2008-0010847 A1	17/01/2008	US 7395608 B2	08/07/2008
US 2007-0079520 A1	12/04/2007	WO 2007-044739 A1	19/04/2007
US 6282808 B1	04/09/2001	None	
US 2013-0067759 A1	21/03/2013	AU 2012-216614 A1	04/04/2013
		AU 2012-216614 B2	26/05/2016
		BR 202012023804 U2	13/10/2015
		CA 2790319 A1	21/03/2013
		EP 2573506 A1	27/03/2013
		EP 2573506 B1	18/09/2013
		ES 2431305 T3	25/11/2013
		MX 2012010946 A	21/03/2013
		US 8584373 B2	19/11/2013
US 2006-0053649 A1	16/03/2006	AU 2003-273507 A1	30/04/2004
		CN 1310010 C	11/04/2007
		CN 1682361 A	26/10/2005
		EP 1540266 A1	15/06/2005
		US 7281340 B2	16/10/2007
		WO 2004-025213 A1	25/03/2004

Form PCT/ISA/210 (patent family annex) (January 2015)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
BORCHARDT, James D.

1000 North Water Street Suite 1700 Milwaukee, Wisconsin
53202 USA

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing *(day/month/year)*	**07 December 2018 (07.12.2018)**
Applicant's or agent's file reference: 066749-1483	FOR FURTHER ACTION: See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2018/047759	**23 August 2018 (23.08.2018)**	24 August 2017 (24.08.2017)

International Patent Classification (IPC) or both national classification and IPC
G01B 3/10(2006.01)i

Applicant
MILWAUKEE ELECTRIC TOOL CORPORATION

1. This opinion contains indications relating to the following items:

- [x] Box No. I Basis of the opinion
- [ ] Box No. II Priority
- [ ] Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- [ ] Box No. IV Lack of unity of invention
- [x] Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step and industrial applicability; citations and explanations supporting such statement
- [ ] Box No. VI Certain documents cited
- [x] Box No. VII Certain defects in the international application
- [x] Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR	Date of completion of this opinion	Authorized officer
International Application Division Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon, 35208, Republic of Korea Facsimile No. +82-42-481-8578	07 December 2018 (07.12.2018)	LEE, Chang Ho Telephone No. +82-42-481-8288

Form PCT/ISA/237 (cover sheet) (January 2015)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY	International application No. PCT/US2018/047759

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of :

☒ the international application in the language in which it was filed

☐ a translation of the international application into ____________ which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of a sequence listing:

   a. ☐ forming part of the international application as filed:
      ☐ in the form of an Annex C/ST.25 text file.
      ☐ on paper or in the form of an image file.

   b. ☐ furnished together with the international application under PCT Rule 13*ter*.1(a) for the purposes of international search only in the form of an Annex C/ST.25 text file.

   c. ☐ furnished subsequent to the international filing date for the purposes of international search only:
      ☐ in the form of an Annex C/ST.25 text file (Rule 13*ter*.1(a)).
      ☐ on paper or in the form of an image file (Rule 13*ter*.1(b) and Administrative Instructions, Section 713).

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that forming part of the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2018/047759

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-20,25,27-30,34,36-40	YES
	Claims	21-24,26,31-33,35,41	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-41	NO
Industrial applicability (IA)	Claims	1-41	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following documents:

D1: US 2008-0010847 A1 (LIAO, HUEI-YEN) 17 January 2008
D2: US 2007-0079520 A1 (LEVINE et al.) 12 April 2007

1. Novelty and Inventive Step

1.1 Independent Claim 1

D1, which is considered to be the closest prior art to the subject matter of claim 1, discloses a tape measure (see figures 1, 2) comprising: a housing (a shell 10) (see figures 1, 2); a reel (a reel 21) rotatably mounted within the housing (10) (see figures 1, 2); an elongate blade (a tape 30) wound around the reel (21), the elongate blade (30) (see figures 1, 2) comprising: an elongate metal core (the tape 30 made of metal) having an upper surface, a lower surface and a first thickness, T1 (a thickness T), measured between the upper surface and the lower surface (see paragraphs [0026], [0039] and figure 4), and a curved profile (a concave-convex shape 33) such that the uppermost surface of the elongate blade (30) defines a concave surface, the lowermost surface defines a convex surface, a curved width (a width W) and a curved height (a height H) (see paragraph [0029] and figure 4); wherein a flat width (a flattened width L) of the elongate metal core (the tape 30 made of metal) is less than 32 mm (L= 1.250 inches in test No.6) (see table 2); wherein a ratio of the curved width (W= 0.8228 inches) to a flat width (L= 1.250 inches) of the elongate metal core (30) is less than 0.74 (W/L= 0.658) (see table 2); wherein a ratio of the curved height (H= 0.4016 inches) to the flat width (L= 1.250 inches) of the elongate metal core (30) is greater than 0.29 (H/L= 0.32) (see table 2); wherein a standout distance (a standout length Smax) of the elongate blade (30) from the housing is greater than 150 inches (Smax= 195 inches) (see table 2); and a retraction

Continued on Supplemental Box

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/US2018/047759

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

The unit of measure (inch) employed in claims 1, 5, 9, 14, 15, 17, 21, 26, 28, 32 and 38 is not additionally expressed in terms of the units stipulated by PCT Rule 10.1(a).

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY	International application No. PCT/US2018/047759

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

The term "the first 132 inches" in claims 17, 28 and 38 has not been previously defined (PCT Article 6).

Form PCT/ISA/237 (Box No. VIII) (January 2015)

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
Continuation of : Box No. V

system (a coil spring 22) coupled to the tape reel (21), wherein the retraction system (22) drives rewinding of the elongate tape blade (30) on to the tape reel (21) (see paragraph [0025] and figure 2).

Claim 1 differs from D1 in that the elongate blade comprises: an upper polymer coating coupled to the upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2, and an upper surface defining the uppermost surface of the elongate blade; and a lower polymer coating coupled to the lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3, and a lower surface defining the lowermost surface of the elongate blade.

However, said feature would be easily conceived from D2 considering that a film (38), which is flexible material such as polyester, has a top portion (38a) that extends over and is attached to an upper surface (14a) of a blade (14) and a bottom portion (38b) that extends over and is attached to a bottom surface (14b) of the blade (14) (see paragraphs [0020], [0024] and figure 6). And D1 and D2 are concerned with mutually related technical fields and there is no need for fundamental changes in the key features or for a new technical idea in combining the subject matters of D1 and D2. Accordingly, claim 1 would have been obvious over D1 in view of D2. Therefore, claim 1 does not involve an inventive step under PCT Article 33(3).

1.2 Dependent Claims 2-4

1.2.1 Claim 2

The additional feature of claim 2 is characterized in that the curved profile is located along a lengthwise portion of the elongate blade having a length less than a total length of the elongate blade. However, this feature would be easily conceived from D1 considering that the tape (30) includes the concave-convex shape (33) when it is reeled out, however the tape (30) is flattened when it is reeled in (see paragraph [0026]). Accordingly, claim 2 would have been obvious over D1 in view of D2. Therefore, claim 2 does not involve an inventive step under PCT Article 33(3).

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1.2.2 Claim 3

The additional feature of claim 3 is characterized in that T1 ≥ T2 + T3. However, this feature is merely a matter of design option to a person skilled in the art, considering the film (30) having a thickness of 0.001 to 0.015 inches in D2 (see paragraph [0020]). Accordingly, claim 3 would have been obvious over D1 in view of D2. Therefore, claim 3 does not involve an inventive step under PCT Article 33(3).

1.2.3 Claim 4

The additional feature of claim 4 is identical to the feature of D1 in that the retraction system (22) is a spring-based retraction system comprising a spring (the coil spring) coupled to the tape reel (21), wherein, as the elongate tape blade is unwound from the tape reel to extend from the housing, the spring stores energy and the spring releases energy driving rewinding of the elongate tape blade on to the tape reel (the coil spring 22 causes the reel 21 to reel in the tape 30) (see paragraph [0025] and figure 2). Accordingly, claim 4 would have been obvious over D1 in view of D2. Therefore, claim 4 does not involve an inventive step under PCT Article 33(3).

1.3 Independent Claim 5

D1, which is considered to be the closest prior art to the subject matter of claim 5, discloses a tape measure (see figures 1, 2) comprising: a housing (a shell 10) (see figures 1, 2); a reel (a reel 21) rotatably mounted within the housing (10) (see figures 1, 2); an elongate blade (a tape 30) wound around the reel (21), the elongate blade (30) (see figures 1, 2) comprising: an elongate metal core (the tape 30 made of metal) having an upper surface, a lower surface and a first thickness, T1 (a thickness T), measured between the upper surface and the lower surface (see paragraphs [0026], [0039] and figure 4), and a curved profile (a concave-convex shape 33) such that the uppermost surface of the elongate blade (30) defines a concave surface, the lowermost surface defines a convex surface, a curved width (a width W) and a curved height (a height H) (see paragraph [0029] and figure 4); wherein a flat width (a flattened width L) of the elongate metal core (the tape 30 made of metal) is less than 32 mm (L= 1.625 inches in test No.7) (see table 2); wherein a ratio of the curved width (W= 1.0591 inches) to a flat width (L= 1.625 inches) of the elongate metal core (30) is less than 0.74

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Supplemental Box

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(W/L= 0.652) (see table 2); wherein a ratio of the curved height (H= 0.5079 inches) to the flat width (L= 1.625 inches) of the elongate metal core (30) is greater than 0.29 (H/L= 0.31) (see table 2); wherein a standout distance (a standout length Smax) of the elongate blade (30) from the housing is greater than 150 inches (Smax= 193 inches) (see table 2); and a retraction system (a coil spring 22) coupled to the tape reel (21), wherein the retraction system (22) drives rewinding of the elongate tape blade (30) on to the tape reel (21) (see paragraph [0025] and figure 2).

Claim 5 differs from D1 in that the elongate blade comprises: an upper polymer coating coupled to the upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2, and an upper surface defining the uppermost surface of the elongate blade; and a lower polymer coating coupled to the lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3, and a lower surface defining the lowermost surface of the elongate blade.

However, said feature would be easily conceived from D2 considering that a film (38), which is flexible material such as polyester, has a top portion (38a) that extends over and is attached to an upper surface (14a) of a blade (14) and a bottom portion (38b) that extends over and is attached to a bottom surface (14b) of the blade (14) (see paragraphs [0020], [0024] and figure 6). And D1 and D2 are concerned with mutually related technical fields and there is no need for fundamental changes in the key features or for a new technical idea in combining the subject matters of D1 and D2. Accordingly, claim 5 would have been obvious over D1 in view of D2. Therefore, claim 5 does not involve an inventive step under PCT Article 33(3).

1.4 Dependent Claims 6-8

1.4.1 Claim 6

The additional feature of claim 6 is characterized in that the curved profile is located along a lengthwise portion of the elongate blade having a length less than a total length of the elongate blade. However, this feature would be easily conceived from D1 considering that the tape (30) includes the concave-convex shape (33) when it is reeled out, however the tape (30) is flattened when it is reeled in (see paragraph [0026]). Accordingly, claim 6 would have been

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Supplemental Box

In case the space in any of the preceding boxes is not sufficient.
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obvious over D1 in view of D2. Therefore, claim 6 does not involve an inventive step under PCT Article 33(3).

1.4.2 Claim 7

The additional feature of claim 7 is characterized in that T1 ≥ T2 + T3. However, this feature is merely a matter of design option to a person skilled in the art, considering the film (30) having a thickness of 0.001 to 0.015 inches in D2 (see paragraph [0020]). Accordingly, claim 7 would have been obvious over D1 in view of D2. Therefore, claim 7 does not involve an inventive step under PCT Article 33(3).

1.4.3 Claim 8

The additional feature of claim 8 is identical to the feature of D1 in that the retraction system (22) is a spring-based retraction system comprising a spring (the coil spring) coupled to the tape reel (21), wherein, as the elongate tape blade is unwound from the tape reel to extend from the housing, the spring stores energy and the spring releases energy driving rewinding of the elongate tape blade on to the tape reel (the coil spring 22 causes the reel 21 to reel in the tape 30) (see paragraph [0025] and figure 2). Accordingly, claim 8 would have been obvious over D1 in view of D2. Therefore, claim 8 does not involve an inventive step under PCT Article 33(3).

1.5 Independent Claim 9

D1, which is considered to be the closest prior art to the subject matter of claim 9, discloses a tape measure (see figures 1, 2) comprising: a housing (a shell 10) (see figures 1, 2); a reel (a reel 21) rotatably mounted within the housing (10) (see figures 1, 2); an elongate blade (a tape 30) wound around the reel (21), the elongate blade (30) (see figures 1, 2) comprising: an upper surface; a lower surface; a curved profile (a concave-convex shape 33) such that the upper surface of the elongate blade (30) defines a concave surface and the lower surface defines a convex surface (see figure 4); a flat width (a flattened width L) (see table 2); a curved width (a width W), wherein the curved width (W) is less than the flat width (L) (see table 2); a standout distance (a standout length Smax) of the elongate blade (30) from the housing (10) (see table 2); and a retraction system (a coil spring 22) coupled to the tape reel

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In case the space in any of the preceding boxes is not sufficient.
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(21), wherein the retraction system (22) drives rewinding of the elongate tape blade (30) on to the tape reel (21) (see paragraph [0025] and figure 2).

Claim 9 differs from D1 in that the elongate blade comprises: a flat width of 30 mm or less; and a standout distance of the elongate blade from the housing of at least 132 inches. However, said feature is merely a matter of design option to a person skilled in the art, considering the flattened width L being 1.250 inches in test No. 6 and the standout distance (Smax) being 195 inches in D1 (see table 2). Accordingly, claim 9 would have been obvious over D1. Therefore, claim 9 does not involve an inventive step under PCT Article 33(3).

1.6 Dependent Claims 10-20

1.6.1 Claim 10

The additional feature of claim 10 is characterized in that a ratio of the curved width to the flat width is less than 0.8. However, this feature is merely a matter of design option to a person skilled in the art, considering the width (W) being 0.8228 inches and the flattened width (L) being 1.250 inches in D1 (see table 2). Accordingly, claim 10 would have been obvious over D1. Therefore, claim 10 does not involve an inventive step under PCT Article 33(3).

1.6.2 Claim 11

The additional feature of claim 11 is characterized in that the curved width is less than 22 mm. However, this feature is merely a matter of design option to a person skilled in the art, considering the width (W) being 0.8228 inches in D1 (see table 2). Accordingly, claim 11 would have been obvious over D1. Therefore, claim 11 does not involve an inventive step under PCT Article 33(3).

1.6.3 Claim 12

The additional feature of claim 12 is characterized in that a ratio of curved height to flat width is greater than 0.24. However, this feature is merely a matter of design option to a person skilled in the art, considering a height (H) being 0.4016 inches and the flattened width

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In case the space in any of the preceding boxes is not sufficient.
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(L) being 1.250 inches in D1 (see table 2). Accordingly, claim 12 would have been obvious over D1. Therefore, claim 12 does not involve an inventive step under PCT Article 33(3).

1.6.4 Claim 13

The additional feature of claim 13 is characterized in that the elongate blade includes a metal core and the metal core has an average thickness along its length that is less than 0.13 mm. However, this feature is merely a matter of design option to a person skilled in the art, considering the tape (30) made of metal and having various thickness (T) in D1 (see paragraphs [0026], [0039]) Accordingly, claim 13 would have been obvious over D1. Therefore, claim 13 does not involve an inventive step under PCT Article 33(3).

1.6.5 Claims 14 and 15

The additional features of claims 14 and 15 are characterized in that the standout distance of the elongate blade from the housing is greater than 138 inches, and the standout distance of the elongate blade from the housing is greater than 144 inches. However, these features are merely matters of design option to a person skilled in the art, considering the standout length (Smax) being 195 inches in D1 (see table 2). Accordingly, claims 14 and 15 would have been obvious over D1. Therefore, claims 14 and 15 do not involve an inventive step under PCT Article 33(3).

1.6.6 Claim 16

The additional feature of claim 16 is characterized in that the curved profile is located along a lengthwise portion of the elongate blade having a length less than a total length of the elongate blade. However, this feature would be easily conceived from D1 considering that the tape (30) includes the concave-convex shape (33) when it is reeled out, however the tape (30) is flattened when it is reeled in (see paragraph [0026]). Accordingly, claim 16 would have been obvious over D1. Therefore, claim 16 does not involve an inventive step under PCT Article 33(3).

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In case the space in any of the preceding boxes is not sufficient.
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1.6.7 Claim 17

The additional feature of claim 17 is characterized in that the curved profile is located along at least the first 132 inches of a length of the elongate blade. However, this feature would be easily conceived from D1 considering that the tape (30) includes the concave-convex shape (33) when it is reeled out, and the standout length (Smax) is 195 inches (see paragraph [0026] and table 2). Accordingly, claim 17 would have been obvious over D1. Therefore, claim 17 does not involve an inventive step under PCT Article 33(3).

1.6.8 Claim 18

The additional feature of claim 18 is characterized in that the elongate blade comprises: an elongate metal core having a first thickness, Tl; an upper polymer coating coupled to an upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2; a lower polymer coating coupled to a lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3. However, this feature would be easily conceived from D1 and D2 considering: the elongate blade (30) comprising an elongate metal core (the tape 30 made of metal) having a first thickness, Tl (a thickness T) in D1 (see paragraphs [0026], [0039] and figure 4); and a film (38), which is flexible material such as polyester, having a top portion (38a) that extends over and is attached to an upper surface (14a) of a blade (14) and a bottom portion (38b) that extends over and is attached to a bottom surface (14b) of the blade (14) in D2 (see paragraphs [0020], [0024] and figure 6). And D1 and D2 are concerned with mutually related technical fields and there is no need for fundamental changes in the key features or for a new technical idea in combining the subject matters of D1 and D2. Accordingly, claim 18 would have been obvious over D1 in view of D2. Therefore, claim 18 does not involve an inventive step under PCT Article 33(3).

1.6.9 Claim 19

The additional feature of claim 19 is characterized in that T1 ≥ T2 + T3. However, this feature is merely a matter of design option to a person skilled in the art, considering the film (30) having a thickness of 0.001 to 0.015 inches in D2 (see paragraph [0020]). Accordingly, claim 19 would have been obvious over D1 in view of D2. Therefore, claim 19 does not involve an inventive step under PCT Article 33(3).

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1.6.10 Claim 20

The additional feature of claim 20 is identical to the feature of D1 in that the retraction system (22) is a spring-based retraction system comprising a spring (the coil spring) coupled to the tape reel (21), wherein, as the elongate tape blade is unwound from the tape reel to extend from the housing, the spring stores energy and the spring releases energy driving rewinding of the elongate tape blade on to the tape reel (the coil spring 22 causes the reel 21 to reel in the tape 30) (see paragraph [0025] and figure 2). Accordingly, claim 20 would have been obvious over D1. Therefore, claim 20 does not involve an inventive step under PCT Article 33(3).

1.7 Independent Claim 21

D1, which is considered to represent the closest prior art, discloses a tape measure (see figures 1, 2) comprising: a housing (a shell 10) (see figures 1, 2); a reel (a reel 21) rotatably mounted within the housing (10) (see figures 1, 2); an elongate blade (a tape 30) wound around the reel (21), the elongate blade (30) (see figures 1, 2) comprising: an upper surface; a lower surface; a curved profile (a concave-convex shape 33) such that the upper surface of the elongate blade (30) defines a concave surface and the lower surface defines a convex surface (see figure 4); a flat width (a flattened width L) greater than or equal to 29 mm and less than 32 mm (L= 1.250 inches in test No. 6); and a curved width (a width W), wherein the curved width (W= 0.8228 inches) is less than the flat width (L= 1.250 inches) (see table 2); a standout distance (a standout length Smax) of the elongate blade (30) from the housing (10) of at least 156 inches (Smax= 195 inches) (see table 2); and a retraction system (a coil spring 22) coupled to the tape reel (21), wherein the retraction system (22) drives rewinding of the elongate tape blade (30) on to the tape reel (21) (see paragraph [0025] and figure 2). As all of the features of claim 21 are disclosed in D1, this claim is anticipated by D1. Therefore, claim 21 lacks novelty under PCT Article 33(2).

1.8 Dependent Claims 22-31

1.8.1 Claim 22

The additional feature of claim 22 is identical to the feature of D1 in that a ratio of the curved width (W= 0.8228 inches) to the flat width (L= 1.250 inches) is less than 0.74 (W/L=

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0.658) (see table 2). Accordingly, claim 22 is anticipated by D1. Therefore, claim 22 lacks novelty under PCT Article 33(2).

1.8.2 Claim 23

The additional feature of claim 23 is identical to the feature of D1 in that the curved width (W) is less than 23.5 mm (W= 0.8228 inches) (see table 2). Accordingly, claim 23 is anticipated by D1. Therefore, claim 23 lacks novelty under PCT Article 33(2).

1.8.3 Claim 24

The additional feature of claim 24 is identical to the feature of D1 in that a ratio of curved height (a height H= 0.4016 inches) to flat width (L= 1.250 inches) is greater than 0.29 (H/L= 0.321) (see table 2). Accordingly, claim 24 is anticipated by D1. Therefore, claim 24 lacks novelty under PCT Article 33(2).

1.8.4 Claim 25

The additional feature of claim 25 is characterized in that the elongate blade includes a metal core and the metal core has an average thickness along its length that is less than 0.13 mm. However, this feature is merely a matter of design option to a person skilled in the art, considering the tape (30) made of metal and having various thickness (T) in D1 (see paragraphs [0026], [0039]). Accordingly, claim 25 would have been obvious over D1. Therefore, claim 25 does not involve an inventive step under PCT Article 33(3).

1.8.5 Claim 26

The additional feature of claim 26 is identical to the feature of D1 in that the standout distance (Smax) of the elongate blade (30) from the housing (10) is greater than 160 inches (Smax= 195 inches) (see table 2). Accordingly, claim 26 is anticipated by D1. Therefore, claim 26 lacks novelty under PCT Article 33(2).

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1.8.6 Claim 27

The additional feature of claim 27 is characterized in that the curved profile is located along a lengthwise portion of the elongate blade having a length less than a total length of the elongate blade. However, this feature would be easily conceived from D1 considering that the tape (30) includes the concave-convex shape (33) when it is reeled out, however the tape (30) is flattened when it is reeled in (see paragraph [0026]). Accordingly, claim 27 would have been obvious over D1. Therefore, claim 27 does not involve an inventive step under PCT Article 33(3).

1.8.7 Claim 28

The additional feature of claim 28 is characterized in that the curved profile is located along at least the first 132 inches of a length of the elongate blade. However, this feature would be easily conceived from D1 considering that the tape (30) includes the concave-convex shape (33) when it is reeled out, and the standout length (Smax) is 195 inches (see paragraph [0026] and table 2). Accordingly, claim 28 would have been obvious over D1. Therefore, claim 28 does not involve an inventive step under PCT Article 33(3).

1.8.8 Claim 29

The additional feature of claim 29 is characterized in that the elongate blade comprises: an elongate metal core having a first thickness, Tl; an upper polymer coating coupled to an upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2, a lower polymer coating coupled to a lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3. However, this feature would be easily conceived from D1 and D2 considering: the elongate blade (30) comprising an elongate metal core (the tape 30 made of metal) having a first thickness, Tl (a thickness T) in D1 (see paragraphs [0026], [0039] and figure 4); and a film (38), which is flexible material such as polyester, having a top portion (38a) that extends over and is attached to an upper surface (14a) of a blade (14) and a bottom portion (38b) that extends over and is attached to a bottom surface (14b) of the blade (14) in D2 (see paragraphs [0020], [0024] and figure 6). And D1 and D2 are concerned with mutually related technical fields and there is no need for fundamental changes in the key features or for a new technical idea in combining the subject matters of D1

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and D2. Accordingly, claim 29 would have been obvious over D1 in view of D2. Therefore, claim 29 does not involve an inventive step under PCT Article 33(3).

1.8.9 Claim 30

The additional feature of claim 30 is characterized in that $T1 \geq T2 + T3$. However, this feature is merely a matter of design option to a person skilled in the art, considering the film (30) having a thickness of 0.001 to 0.015 inches in D2 (see paragraph [0020]). Accordingly, claim 30 would have been obvious over D1 in view of D2. Therefore, claim 30 does not involve an inventive step under PCT Article 33(3).

1.8.10 Claim 31

The additional feature of claim 31 is identical to the feature of D1 in that the retraction system (22) is a spring-based retraction system comprising a spring (the coil spring) coupled to the tape reel (21), wherein, as the elongate tape blade is unwound from the tape reel to extend from the housing, the spring stores energy and the spring releases energy driving rewinding of the elongate tape blade on to the tape reel (the coil spring 22 causes the reel 21 to reel in the tape 30) (see paragraph [0025] and figure 2). Accordingly, claim 31 is anticipated by D1. Therefore, claim 31 lacks novelty under PCT Article 33(2).

1.9 Independent Claim 32

D1, which is considered to represent the closest prior art, discloses a tape measure (see figures 1, 2) comprising: a housing (a shell 10) (see figures 1, 2); a reel (a reel 21) rotatably mounted within the housing (10) (see figures 1, 2); an elongate blade (a tape 30) wound around the reel (21), the elongate blade (30) (see figures 1, 2) comprising: an upper surface; a lower surface; a curved profile (a concave-convex shape 33) such that the upper surface of the elongate blade (30) defines a concave surface and the lower surface defines a convex surface (see figure 4); a flat width (a flattened width L) greater than 32 mm (L= 1.625 inches in test No. 7); and a curved width (a width W), wherein the curved width (W= 1.0591 inches) is less than the flat width (L= 1.625 inches) (see table 2); a standout distance (a standout length Smax) of the elongate blade (30) from the housing (10) of at least 156 inches (Smax= 193 inches) (see table 2); and a retraction system (a coil spring 22) coupled to the tape reel (21),

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wherein the retraction system (22) drives rewinding of the elongate tape blade (30) on to the tape reel (21) (see paragraph [0025] and figure 2). As all of the features of claim 32 are disclosed in D1, this claim is anticipated by D1. Therefore, claim 32 lacks novelty under PCT Article 33(2).

1.10 Dependent Claims 33-41

1.10.1 Claim 33

The additional feature of claim 33 is identical to the feature of D1 in that a ratio of the curved width (W= 1.0591 inches) to the flat width (L= 1.625 inches) is less than 0.8 (W/L= 0.652) (see table 2). Accordingly, claim 33 is anticipated by D1. Therefore, claim 33 lacks novelty under PCT Article 33(2).

1.10.2 Claim 34

The additional feature of claim 34 is characterized in that the curved width is less than 26 mm. However, this feature is merely a matter of design option to a person skilled in the art, considering the tapes with various width in D1 (see paragraph [0039]). Accordingly, claim 34 would have been obvious over D1. Therefore, claim 34 does not involve an inventive step under PCT Article 33(3).

1.10.3 Claim 35

The additional feature of claim 35 is identical to the feature of D1 in that a ratio of curved height (a height H= 0.5079 inches) to flat width (L= 1.625 inches) is greater than 0.27 (H/L= 0.312) (see table 2). Accordingly, claim 35 is anticipated by D1. Therefore, claim 35 lacks novelty under PCT Article 33(2).

1.10.4 Claim 36

The additional feature of claim 36 is characterized in that the elongate blade includes a metal core and the metal core has an average thickness along its length that is less than 0.14 mm. However, this feature is merely a matter of design option to a person skilled in the art,

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considering the tape (30) made of metal and the tapes with various thickness (T) in D1 (see paragraphs [0026], [0039]). Accordingly, claim 36 would have been obvious over D1. Therefore, claim 36 does not involve an inventive step under PCT Article 33(3).

1.10.5 Claim 37

The additional feature of claim 37 is characterized in that the curved profile is located along a lengthwise portion of the elongate blade having a length less than a total length of the elongate blade. However, this feature would be easily conceived from D1 considering that the tape (30) includes the concave-convex shape (33) when it is reeled out, however the tape (30) is flattened when it is reeled in (see paragraph [0026]). Accordingly, claim 37 would have been obvious over D1. Therefore, claim 37 does not involve an inventive step under PCT Article 33(3).

1.10.6 Claim 38

The additional feature of claim 38 is characterized in that the curved profile is located along at least the first 132 inches of a length of the elongate blade. However, this feature would be easily conceived from D1 considering that the tape (30) includes the concave-convex shape (33) when it is reeled out, and the standout length (Smax) is 193 inches (see paragraph [0026] and table 2). Accordingly, claim 38 would have been obvious over D1. Therefore, claim 38 does not involve an inventive step under PCT Article 33(3).

1.10.7 Claim 39

The additional feature of claim 39 is characterized in that the elongate blade comprises: an elongate metal core having a first thickness, Tl; an upper polymer coating coupled to an upper surface of the elongate metal core, the upper polymer coating having a second thickness, T2; a lower polymer coating coupled to a lower surface of the elongate metal core, the lower polymer coating having a third thickness, T3. However, this feature would be easily conceived from D1 and D2 considering: the elongate blade (30) comprising an elongate metal core (the tape 30 made of metal) having a first thickness, Tl (a thickness T) in D1 (see paragraphs [0026], [0039] and figure 4); and a film (38), which is flexible material such as polyester, having a top portion (38a) that extends over and is attached to an upper surface (14a) of a

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WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2018/047759

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blade (14) and a bottom portion (38b) that extends over and is attached to a bottom surface (14b) of the blade (14) in D2 (see paragraphs [0020], [0024] and figure 6). And D1 and D2 are concerned with mutually related technical fields and there is no need for fundamental changes in the key features or for a new technical idea in combining the subject matters of D1 and D2. Accordingly, claim 39 would have been obvious over D1 in view of D2. Therefore, claim 39 does not involve an inventive step under PCT Article 33(3).

1.10.8 Claim 40

The additional feature of claim 40 is characterized in that T1 ≥ T2 + T3. However, this feature is merely a matter of design option to a person skilled in the art, considering the film (30) having a thickness of 0.001 to 0.015 inches in D2 (see paragraph [0020]). Accordingly, claim 40 would have been obvious over D1 in view of D2. Therefore, claim 40 does not involve an inventive step under PCT Article 33(3).

1.10.9 Claim 41

The additional feature of claim 41 is identical to the feature of D1 in that the retraction system (22) is a spring-based retraction system comprising a spring (the coil spring) coupled to the tape reel (21), wherein, as the elongate tape blade is unwound from the tape reel to extend from the housing, the spring stores energy and the spring releases energy driving rewinding of the elongate tape blade on to the tape reel (the coil spring 22 causes the reel 21 to reel in the tape 30) (see paragraph [0025] and figure 2). Accordingly, claim 41 is anticipated by D1. Therefore, claim 41 lacks novelty under PCT Article 33(2).

2. Industrial Applicability

Claims 1-41 are industrially applicable under PCT Article 33(4).

Electronic Acknowledgement Receipt

EFS ID:	34660079
Application Number:	16113695
International Application Number:	
Confirmation Number:	3697
Title of Invention:	Tape Measure with Tape Blade Profile Increasing Tape Standout
First Named Inventor/Applicant Name:	Jonathan F. Vitas
Customer Number:	142078
Filer:	James D. Borchardt/Andrea Dietzel
Filer Authorized By:	James D. Borchardt
Attorney Docket Number:	066749-1484
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Filing Date:	27-AUG-2018
Time Stamp:	17:46:07
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	066749-1484_Transmittal.pdf	81708 79be73998384726513 2ec3d2b73d4f44315e4008	no	2

Warnings:

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	066749-1484_SB08.pdf	89386 4a00a287a39ed41a6eb88e0b6305002f5e9d9b10	no	1
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Warnings:					
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		Total Files Size (in bytes):	2232020		

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
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If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Milwaukee Electric Tool Corporation
Title:	Tape Measure with Tape Blade Profile Increasing Tape Standout
Appl. No.:	16/113,695
Filing Date:	August 27, 2018
Examiner:	To Be Determined
Art Unit:	2855
Confirmation Number:	3697

INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR §1.56

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Submitted herewith on Form PTO/SB/08 is a listing of the documents known to Applicants in order to comply with Applicants' duty of disclosure pursuant to 37 CFR § 1.56.

A copy of each non-U.S. patent document and each non-patent document is being submitted to comply with the provisions of 37 CFR § 1.97 and §1.98.

The submission of any document herewith, which is not a statutory bar, is not intended as an admission that such document constitutes prior art against the claims of the present application or that such document is considered material to patentability as defined in 37 CFR §1.56(b). Applicants do not waive any rights to take any action which would be appropriate to antedate or otherwise remove as a competent reference any document which is determined to be a *prima facie* art reference against the claims of the present application.

TIMING OF THE DISCLOSURE

The listed documents are being submitted in compliance with 37 CFR §1.97(b)(3), before the mailing date of the first Office action on the merits.

RELEVANCE OF EACH DOCUMENT

All of the documents are in English.

Applicants respectfully request that each listed document be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08 be returned in accordance with MPEP §609.

Although Applicant believes that no fee is required for this Request, the Commissioner is hereby authorized to charge any additional fees which may be required for this Request to Deposit Account No. 18-0882.

Respectfully submitted,

Date December 20, 2018

By /James D. Borchardt/

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
16/113,695	08/27/2018	Jonathan F. Vitas	066749-1484

CONFIRMATION NO. 3697

PUBLICATION NOTICE

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142078
Reinhart (Milwaukee Tool)
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MILWAUKEE, WI 53202

Title: Tape Measure with Tape Blade Profile Increasing Tape Standout

Publication No.US-2019-0063893-A1
Publication Date:02/28/2019

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The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

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Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	16/113,695
				Filing Date	August 27, 2018
Date Submitted: June 26, 2019				**First Named Inventor**	Jonathan F. Vitas
				Art Unit	2855
(use as many sheets as necessary)				Examiner Name	CAPUTO, LISA M
Sheet	1	of	2	Attorney Docket Number	066749-1484

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

UNPUBLISHED U.S. PATENT APPLICATION DOCUMENTS

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FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	A1	CN202066436	12-07-2011	XIANJIA SHI		
	A2	CN202432942	09-12-2012	UNIV NINGBO		
	A3	CN202757538	02-27-2013	JIANGSU POSTS AND TELECOMM PLANNING AND DESIGNING INST CO LTD		
	A4	CN204612629	09-02-2015	UNIV HUAINAN NORMAL		
	A5	CN205482653	08-17-2016	ZHEJIANG GUOXIANG ELECTRICAL AND MECH ENG CO LTD		
	A6	CN2705772	06-22-2005	MEDID INTERNAT CORP		
	A7	DE19628318	03-26-1998	BEIERSDORF AG		
	A8	EP0100138	02-08-1984	FISCO PRODUCTS LTD		
	A9	EP1411319	04-21-2004	LI SHIN LIN		
	A10	EP1444479	08-11-2004	STANLEY WORKS		
	A11	EP1647797	06-20-2012	STANLEY BLACK AND DECKER INC		
	A12	EP2400258	11-26-2014	STANLEY BLACK AND DECKER INC		
	A13	WO02057710	07-25-2002	3M INNOVATIVE PROPERTIES CO		

Examiner Signature		Date Considered	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	16/113,695
				Filing Date	August 27, 2018
Date Submitted: June 26, 2019				**First Named Inventor**	Jonathan F. Vitas
				Art Unit	2855
(use as many sheets as necessary)				Examiner Name	CAPUTO, LISA M
Sheet	2	of	2	Attorney Docket Number	066749-1484

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]
	A14	WO03031903	04-17-2003	STANLEY WORKS		
	A15	WO2004063659	07-29-2004	FISCO TOOLS LIMITED ET AL.		
	A16	WO17172683	10-05-2017	APEX BRANDS INC		

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[6]

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Espacenet

Bibliographic data: CN202066436 (U) — 2011-12-07

Measuring tape

Inventor(s):	XIANJIA SHI ± (SHI XIANJIA)
Applicant(s):	XIANJIA SHI ± (SHI XIANJIA)
Classification:	**- international:** ***G01B3/10*** **- cooperative:**
Application number:	CN20112004769U 20110106
Priority number(s):	CN20112004769U 20110106

Abstract of CN202066436 (U)

The utility model discloses a measuring tape which comprises a casing (1) and a tape strip (2) wound in the casing (1). A fluorescent layer (3) is arranged on the surface of the tape strip (2). The thickness of the fluorescent layer (3) is 0.5 mm. When the measuring tape is used, scales can be conveniently read and a measuring result can be ensured.

(19)中华人民共和国国家知识产权局

(12)实用新型专利

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(22)申请日 2011.01.06

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(51)Int.Cl.
G01B 3/10(2006.01)

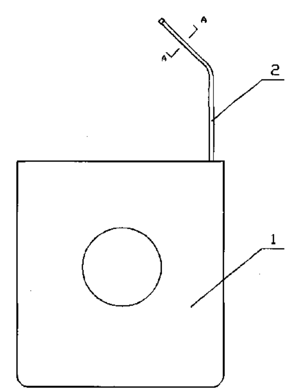
权利要求书 1 页　说明书 1 页　附图 1 页

(54)实用新型名称

卷尺

(57)摘要

本实用新型公开了一种卷尺，包括壳体 (1) 和卷在壳体 (1) 内的尺条 (2)，所述尺条 (2) 的表面设有荧光层 (3)，所述荧光层 (3) 的厚度为 0.5MM。该卷尺读取刻度方便、能保证测量结果。



CN 202066436 U

1. 一种卷尺，包括壳体 (1) 和卷在壳体 (1) 内的尺条 (2)，其特征在于：所述尺条 (2) 的表面设有荧光层 (3)。

2. 根据权利要求 1 所述的卷尺，其特征在于：所述荧光层 (3) 的厚度为 0.5MM。

卷尺

技术领域

[0001] 本实用新型涉及尺，具体讲是一种卷尺。

背景技术

[0002] 目前的卷尺包括壳体和卷在壳体内的尺条，这样在光线不好很好的环境下使用，卷尺上的刻度很难读取，而且还无法准确判断卷尺是否跟被测物贴合，直接影响测量结果。

实用新型内容

[0003] 本实用新型要解决的技术问题是，提供一种读取刻度方便、能保证测量结果的卷尺。

[0004] 本实用新型的技术方案是，提供一种具有以下结构的卷尺，包括壳体和卷在壳体内的尺条，所述尺条的表面设有荧光层。

[0005] 所述荧光层的厚度为 0.5MM。

[0006] 采用上述结构后，本实用新型与现有技术相比，具有以下优点：由于所述尺条的表面设有荧光层，这样即使在光线不好很好的环境下使用，卷尺上的刻度也很方便读取，而且能准确判断卷尺是否跟被测物贴合，能保证测量结果。

附图说明

[0007] 附图 1 是本实用新型的卷尺的结构示意图。

[0008] 附图 2 是图 1 的 A-A 剖面示意图。

[0009] 图中所示，1、壳体，2、尺条，3、荧光层。

具体实施方式

[0010] 下面结合附图对本实用新型卷尺作进一步说明。

[0011] 如图 1、图 2 所示，本实用新型的卷尺，包括壳体 1 和卷在壳体 1 内的尺条 2，所述尺条 2 的表面设有荧光层 3。

[0012] 所述荧光层 3 的厚度为 0.5MM。

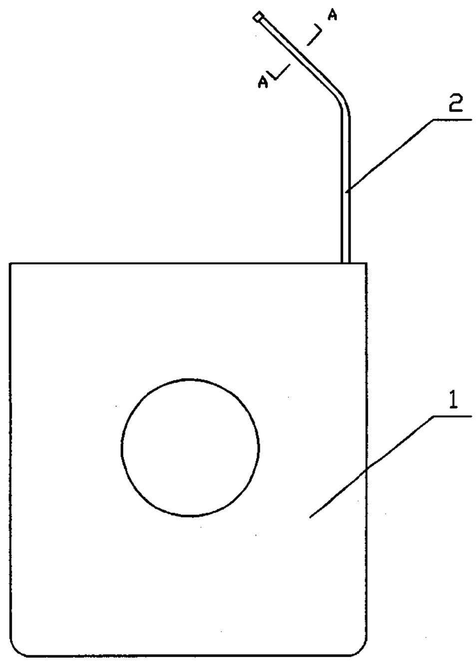


图 1

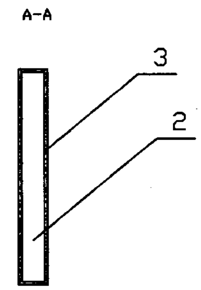


图 2

Espacenet

Bibliographic data: CN202432942 (U) — 2012-09-12

Novel steel tape

Inventor(s):	SAI MA; YILING BAO + (MA SAI, ; BAO YILING)	
Applicant(s):	UNIV NINGBO + (NINGBO UNIVERSITY)	
Classification:	**- international:** **- cooperative:**	***G01B3/10***
Application number:	CN20122004334U 20120106	
Priority number(s):	CN20122004334U 20120106	

Abstract of CN202432942 (U)

The utility model relates to a novel steel tape which comprises a shell body and a steel rule tape; the outer end of the steel rule tape is provided with a positioning hook; a button for positioning the steel rule tape is arranged on the shell body; the novel steel tape is characterized in that: transparent plastic films are arranged on the edges of both sides of the steel rule tape; the outlet of the steel rule tape of the shell body extends outwards for a certain distance horizontally; the novel steel tape has the advantages that: both sides of the rule tape are wrapped by plastics, so that the steel rule tape is safer and is not as sharp as before, a hand is not injured due to careless use; and meanwhile, the outlet of the rule tape of the steel tape is elongated, so that the rule tape does not swing up and down when being recovered and the hand is not injured.

(19) 中华人民共和国国家知识产权局

(12) 实用新型专利

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(21) 申请号 201220004334.2

(22) 申请日 2012.01.06

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(51) Int. Cl.
G01B 3/10 (2006.01)

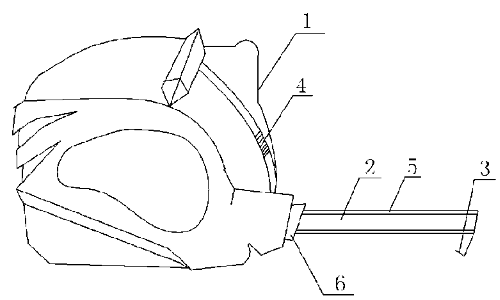
权利要求书 1 页 说明书 2 页 附图 1 页

(54) 实用新型名称

一种新型钢卷尺

(57) 摘要

本实用新型一种新型钢卷尺，包括壳体和钢尺带，钢尺带外端设有定位钩，壳体上还设有用于定位钢尺带的按钮，特点是钢尺带的两侧边缘设置有透明塑胶薄膜，壳体的钢尺带出口向外横向延伸一定距离，优点是用塑胶将尺带两边包裹住，使钢尺带本身更加安全，不会像以前那样锋利，避免使用不慎将手划破，同时将钢卷尺尺带出口处加长，防止尺带收回时上下摆动将手划破。



CN 202432942 U

1. 一种新型钢卷尺，包括壳体和卷绕在壳体内可以抽出缩回的钢尺带，钢尺带外端设有定位钩，壳体上还设有用于定位所述的钢尺带的按钮，其特征在于：所述的钢尺带的两侧边缘设置有透明塑胶薄膜。

2. 根据权利要求 1 所述的一种新型钢卷尺，其特征在于：所述的壳体的钢尺带出口向外横向延伸一定距离。

3. 根据权利要求 1 所述的一种新型钢卷尺，其特征在于：所述的一定距离为 1 ～ 3cm。

一种新型钢卷尺

技术领域

[0001] 本实用新型涉及一种测量工具，尤其是涉及一种新型钢卷尺。

背景技术

[0002] 卷尺是日常生活中常用的工量具， 大家经常看到的是钢卷尺，建筑和装修常用，也是家庭必备工具之一。现有的钢卷尺一般包括壳体和卷绕在壳体内可以抽出缩回的钢尺带，钢尺带外端设有定位钩，壳体上还设有定位钢尺带的按钮，具有结构紧凑，携带方便的优点，但是钢卷尺也存在以下缺陷：由于钢卷尺的尺带采用金属材料制作而成且厚度薄至几毫米，所以尺边很锋利，收回时容易把手划破；同时钢卷尺的尺带收回时，容易上下摆动将手划破，不利于工作。

发明内容

[0003] 本实用新型所要解决的技术问题是提供一种减小尺边锋利性的安全不伤手的新型钢卷尺。

[0004] 本实用新型解决上述技术问题所采用的技术方案为：一种新型钢卷尺，包括壳体和卷绕在壳体内可以抽出缩回的钢尺带，钢尺带外端设有定位钩，壳体上还设有用于定位钢尺带的按钮，钢尺带的两侧边缘设置有透明塑胶薄膜。

[0005] 所述的壳体的钢尺带出口向外横向延伸一定距离。

[0006] 所述的一定距离为 1 ～ 3cm。

[0007] 与现有技术相比，本实用新型的优点在于：本实用新型一种新型钢卷尺，包括壳体和钢尺带，钢尺带外端设有定位钩，壳体上还设有用于定位钢尺带的按钮，钢尺带的两侧边缘设置有透明塑胶薄膜，用塑胶将尺带两边包裹住，使钢尺带本身更加安全，不会像以前那样锋利，避免使用不慎将手划破。

[0008] 进一步由于壳体的钢尺带出口向外横向延伸一定距离，将钢卷尺尺带出口处加长，防止尺带收回时上下摆动将手划破。

附图说明

[0009] 图 1 为本实用新型新型钢卷尺的结构示意图；

[0010] 图 2 为本实用新型新型钢卷尺的俯视图。

具体实施方式

[0011] 以下结合附图实施例对本实用新型作进一步详细描述。

[0012] 具体实施例

[0013] 本实用新型一种新型钢卷尺，如图 1 和图 2 所示，包括壳体 1 和卷绕在壳体 1 内可以抽出缩回的钢尺带 2，钢尺带 2 外端设有定位钩 3，壳体 1 上还设有用于定位钢尺带 2 的按钮 4，钢尺带 2 的两侧边缘设置有透明塑胶薄膜 5。

[0014] 在此具体实施例中，壳体1的钢尺带出口6向外横向延伸一定距离，该一定距离为1～3cm。

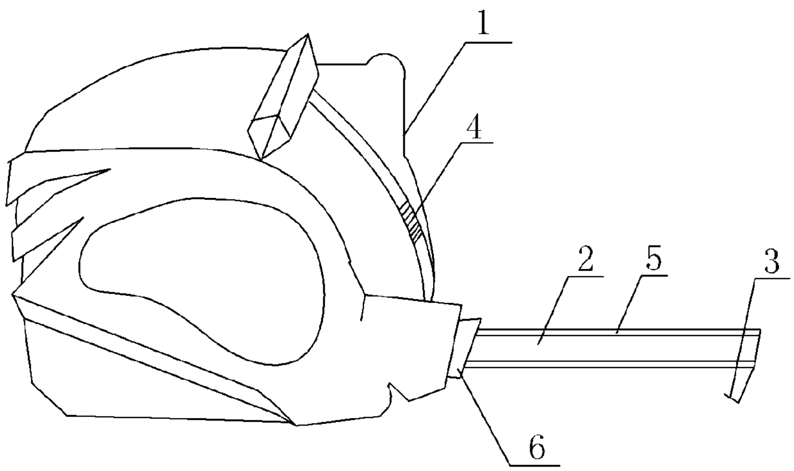


图 1

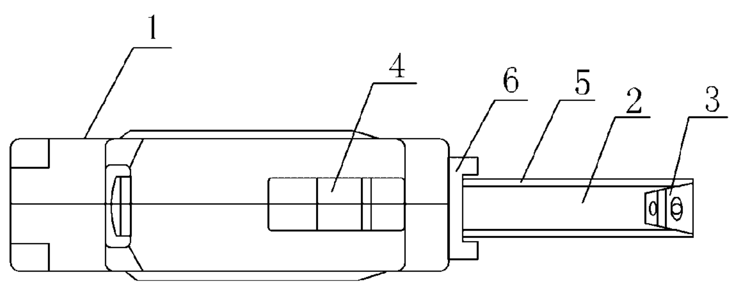


图 2

Espacenet

Bibliographic data: CN202757538 (U) — 2013-02-27

Anti-electric-shock measuring tape

Inventor(s): TANG HUAIKUN ± (TANG HUAIKUN)

Applicant(s): JIANGSU POSTS & TELECOMM PLANNING & DESIGNING INST CO LTD ± (JIANGSU POSTS & TELECOMMUNICATIONS PLANNING AND DESIGNING INSTITUTE CO., LTD)

Classification: **- international:** ***G01B1/00; G01B3/10***
- cooperative:

Application number: CN20122348019U 20120718

Priority number(s): CN20122348019U 20120718

Abstract of CN202757538 (U)

The utility model discloses an anti-electric-shock measuring tape including a shell and a telescopic tape part disposed in the shell and used for measuring. The tape part is coated with a plastic insulating layer. The anti-electric-shock measuring tape provided by the utility model has the following advantages. First, the anti-electric-shock measuring tape has an anti-electric-shock effect within the measuring range, so that the safe production is facilitated and the measurement operation safety in electric environment can be guaranteed. Second, the anti-electric-shock measuring tape is made of insulating and antiriot material, so that a waste phenomenon that traditional measuring tapes is easy to get corroded, rusted and damaged in a faintly-acid and humid environment can be avoided and a detect of leather measuring tapes that are not conductive while not suitable for single-person operation can be made up by the elasticity and the rigidity of the anti-electric-shock measuring tape. Third, the anti-electric-shock measuring tape is equipped with a compass, so that a function of recording general directions in practical measurement work for assisting survey and design workers can be realized and the survey workers can be reminded to mind electrical safety through the small-range disturbance of an indicator in intense electromagnetic field.

(19) 中华人民共和国国家知识产权局

(12) 实用新型专利

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(21) 申请号 201220348019.1

(22) 申请日 2012.07.18

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(51) Int. Cl.
G01B 3/10 (2006.01)
G01B 1/00 (2006.01)

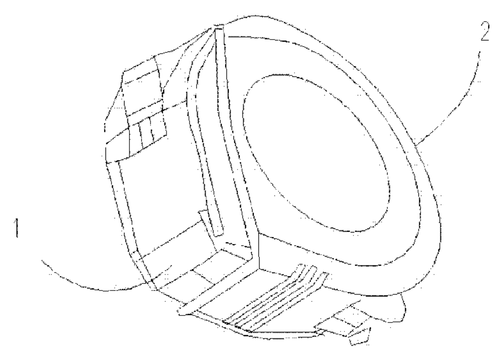
权利要求书 1 页 说明书 2 页 附图 2 页

(54) 实用新型名称

一种防触电卷尺

(57) 摘要

本实用新型公开了一种防触电卷尺，包括壳体和位于壳体内可伸缩的用于测量的尺部，所述尺部外包覆有一层塑料绝缘层。本实用新型具有以下优点：1. 卷尺量程内带有防触电效果，促进安全生产，保障电气环境下的测量作业安全；2. 卷尺采用绝缘、防腐材料，可以避免传统卷尺在弱酸性、潮湿环境下使用的易腐蚀、易生锈易损坏需要经常替换的浪费现象，且有弹性硬度可以弥补皮卷尺虽不导电但是不适合单人操作的特点；3. 卷尺带有指南针，一方面可以辅助勘察设计人员在具体测量工作中，需要记录大致方位的功能；另一方面在强电磁场环境下指针会小范围扰动提醒测量人员注意电气安全。



CN 202757538 U

1. 一种防触电卷尺，包括壳体和位于壳体内可伸缩的用于测量的尺部，其特征在于，所述尺部外包覆有一层塑料绝缘层；所述外壳为塑料绝缘制成的外壳。

2. 根据权利要求 1 所述的一种防触电卷尺，其特征在于，所述外壳上设有指南针，指南针外部设有塑料透明外罩。

3. 根据权利要求 1 所述的一种防触电卷尺，其特征在于，所述尺部为塑料制成的尺部，与绝缘层为一体。

一种防触电卷尺

技术领域

[0001] 本实用新型涉及一种测量设备，特别是适用于测量电力电源设备的一种防触电卷尺。

背景技术

[0002] 申请人作为一家是从事通信、建筑、信息化行业的甲级咨询设计单位，在员工的具体开展勘察设计工作中，经常会涉及到现场勘察电气设备、通信电源设备、带电通信设备，并需要精确测量相对具体、尺寸；存在潜在事故隐患，在同行其他设计单位曾发生过因为卷尺掉落在蓄电池组连接条和接线柱点上而导致卷尺融化、电池燃烧、基站通信中断的事故，从劳动保障、安全生产角度考虑，勘察设计员工不应使用钢卷尺开展测量工作，但是实际情况是市场没有绝缘材质的卷尺，在绝缘考虑上一般是采用外壳绝缘(如ABS材质)，而最容易接触带电体的卷尺量程本身没有绝缘；而皮尺由于材质过软很难一个人独自开展测量工作，不符合实际工作场景需要，因此传统的可导电的卷尺，不仅对人员安全有伤害，对动辄几百万的通讯设备而言，也存在重大安全隐患。

[0003] 卷尺的主要类型为钢卷尺、纤维卷尺等，几乎涉及到各行各业，是基础计量工具。纤维卷尺又分为圆盘式卷尺和布尺。前者一般外壳采用ABS塑料、卷尺采用的钢材如304不锈钢、碳钢、一般钢材拉扁平丝制成，钢卷尺在5米以内短距离比较常见，在长距离超过5米时需要使用皮尺。基本上前者是有缘导体，在接近和不慎碰到带电体时会迅速导电，存在潜在安全危害；后者一般使用在大尺寸测量上且需要人员辅助测量，单个人很难完成精确测量。从使用范围上来看，钢卷尺使用范围较多，几乎是工作和生活场景下每个人都会使用；其他行业的应用：如石材加工行业，经常要用到卷尺，但卷尺经常和水接触 无论是不锈钢的还是带油漆的刻度卷尺都很容易生锈。

实用新型内容

[0004] 实用新型目的：本实用新型所要解决的技术问题是针对现有技术的不足，提供一种防触电卷尺。

[0005] 为了解决上述技术问题，本实用新型公开了一种防触电卷尺，包括壳体和位于壳体内可伸缩的用于测量的尺部，所述尺部外包覆有一层塑料绝缘层。

[0006] 本实用新型中，所述外壳为塑料绝缘制成的外壳。

[0007] 本实用新型中，所述外壳上设有指南针，指南针外部设有塑料透明外罩。卷尺还带有指南针功能方便勘察设计人员辨识并标注查勘对象的方向。传统的金属卷尺，指南针无法安装，使用非金属绝缘卷尺后，可以将二者合二为一，方便了测量定向。外壳标记有南北，平时可以作为勘察设计人员的指南针功能使用，在进入电气环境下，可以通过磁针感应电场强度在从右往左测量时提醒测量人员电场强度，注意绝缘安全保护。

[0008] 本实用新型中，所述尺部为塑料制成的尺部，与绝缘层为一体。

[0009] 本实用新型中，所述壳体外设有一层塑料绝缘层，由此可以保证整体的强度。

[0010] 本实用新型不适宜使用场所：虽然有一定的抗酸特性，但该实用新型不适宜在有强酸、汽油环境下长期使用。

[0011] 有益效果：本实用新型具有以下优点：1、卷尺量程内带有防触电效果，促进安全生产，保障电气环境下的测量作业安全；2、卷尺采用绝缘、防腐材料，可以避免传统卷尺在酸性环境下使用的易腐蚀、易生锈易损坏需要经常替换的浪费现象；3、卷尺带有指南针，一方面可以辅助勘察设计人员在具体测量工作中，需要记录大致方位的功能；另一方面在强电磁场环境下指针会小范围扰动提醒测量人员注意电气安全。

附图说明

[0012] 下面结合附图和具体实施方式对本实用新型做更进一步的具体说明，本实用新型的上述和/或其他方面的优点将会变得更加清楚。

[0013] 图 1 为实施例 1 结构示意图。

[0014] 图 2 为实施例 1 尺部剖视图。

[0015] 图 3 为实施例 2 结构示意图。

具体实施方式

[0016] 实施例 1

[0017] 如图 1 和图 2 所示，本实施例公开了一种防触电卷尺，包括壳体 1 和位于壳体内可伸缩的用于测量的尺部 2，所述尺部中心部 1a 外包覆有一层塑料绝缘层 1b。所述外壳为塑料绝缘制成的外壳。

[0018] 实施例 2

[0019] 如图 3 所示，本实施例公开了一种防触电卷尺，所述尺部为塑料制成的尺部 1。所述外壳 2 为塑料绝缘制成的外壳。所述外壳 2 上设有指南针 4，指南针 4 外部设有塑料透明外罩 3。

[0020] 本实用新型提供了一种防触电卷尺，具体实现该技术方案的方法和途径很多，以上所述仅是本实用新型的优选实施方式，应当指出，对于本技术领域的普通技术人员来说，在不脱离本实用新型原理的前提下，还可以做出若干改进和润饰，这些改进和润饰也应视为本实用新型的保护范围。本实施例中未明确的各组成部分均可用现有技术加以实现。

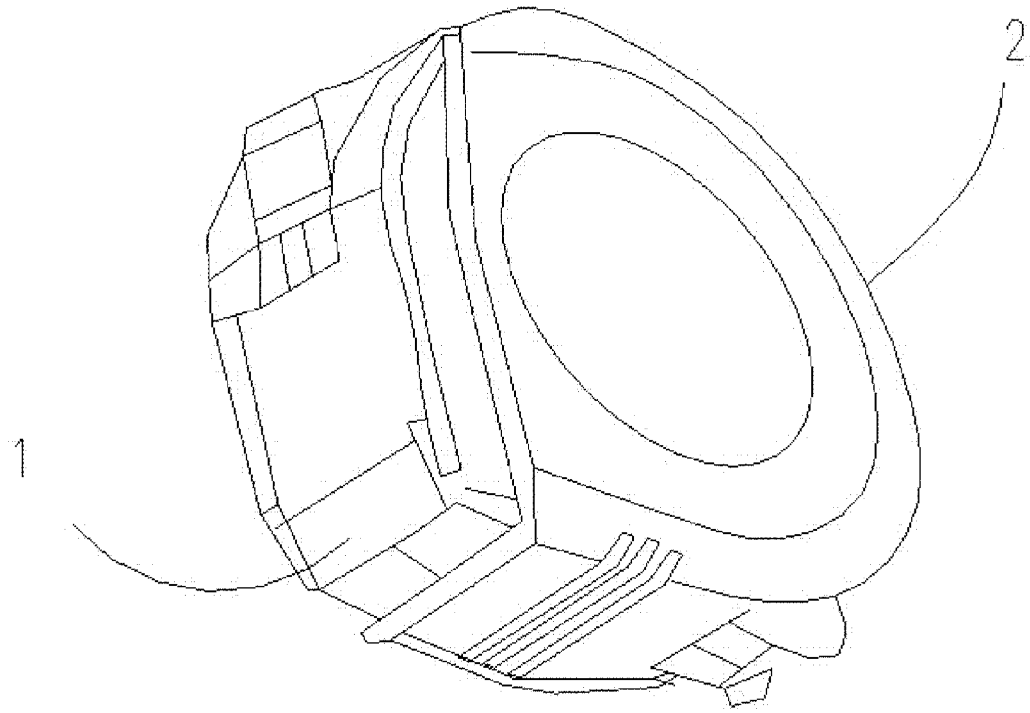


图 1

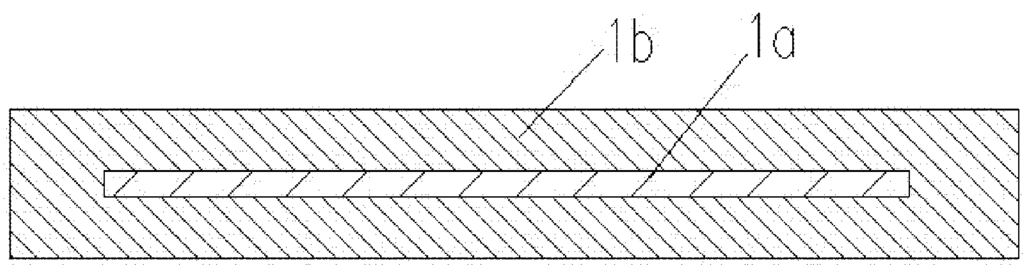


图 2

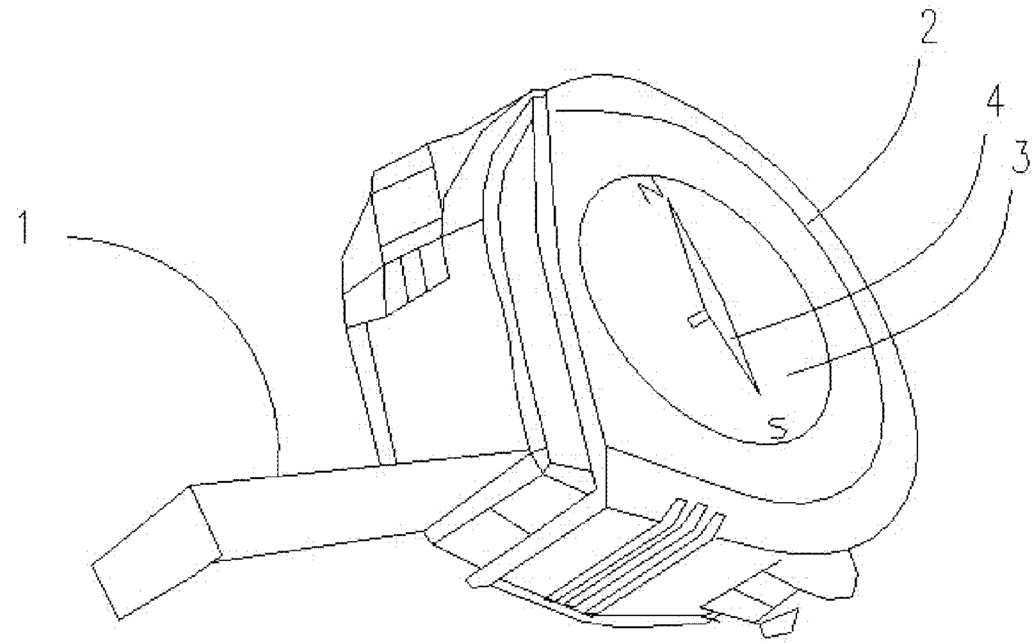


图 3

Espacenet

Bibliographic data: CN204612629 (U) — 2015-09-02

Multifunctional measuring reel

Inventor(s): WEI JING ± (WEI JING)

Applicant(s): UNIV HUAINAN NORMAL ± (HUAINAN NORMAL UNIVERSITY)

Classification:
- international: G01B3/10
- cooperative:

Application number: CN20152352388U 20150527

Priority number(s): CN20152352388U 20150527

Abstract of CN204612629 (U)

The utility model discloses a multifunctional measuring reel belongs to the measuring tool field. The utility model discloses a multifunctional measuring reel, including casing, blade and expansion end, be provided with screens switch and roll-up switch on the casing, the junction of casing and blade is provided with and prolongs the section, the scale initiating terminal of blade set up porosely, the one end of expansion end be provided with the notch, the other end is provided with the buckle, hole phase-match on this buckle and the blade is provided with two kinds of scales on the blade, for the length unit of measurement of difference, the blade surface is provided with the thin layer, blade edge is provided with the rubber layer. The utility model discloses avoided the unexpected roll-up of blade that leads to the fact because of misoperation, and the blade scale is because the long-term exposure leads to the fact the unclear problem of scale in outer wearing and tearing, the mark demand of the different measurand objects the when uniqueness of subassembly structure has also satisfied the gauge length is applicable to the several work demand, and the structure uniqueness is simple, with low costs, exploitativeness is high and easily use widely.

(19)中华人民共和国国家知识产权局

(12)实用新型专利

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(51)Int.Cl.
G01B 3/10(2006.01)

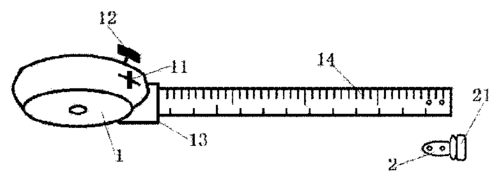
权利要求书1页 说明书3页 附图1页

(54)实用新型名称

一种多功能钢卷尺

(57)摘要

本实用新型公开了一种多功能钢卷尺，属于测量工具领域。本实用新型的一种多功能钢卷尺，包括壳体、尺身和活动端，壳体上设置有卡位开关和卷收开关，壳体和尺身的连接处设置有延长段，所述的尺身的刻度起始端设置有孔，所述的活动端的一端设置有槽口，另一端设置有卡扣，该卡扣与尺身上的孔相匹配，尺身上设置有两种刻度，为不同的长度计量单位，尺身表面设置有薄膜层，尺身边缘处设置有橡胶层。本实用新型避免了因为操作失误而造成的尺身突然卷收，及尺身刻度因为长期暴露在外的磨损造成刻度不清的问题，组件结构的独特性也满足了测量长度时的不同被测量物体的标记需求，适用于多种作业需求，结构独特简单、成本低、可实施性高且易于推广使用。



1. 一种多功能钢卷尺，包括壳体（1）、尺身（14）和活动端（2），其特征在于：所述的壳体（1）上设置有卡位开关（11）和卷收开关（12），壳体（1）和尺身（14）的连接处设置有延长段（13），所述的尺身（14）的刻度起始端设置有孔，所述的活动端（2）的一端设置有槽口（21），另一端设置有卡扣，该卡扣与尺身（14）上的孔相匹配。

2. 根据权利要求 1 所述的多功能钢卷尺，其特征在于：所述的尺身（14）的表面设置有薄膜层，尺身（14）的边缘处设置有橡胶层。

3. 根据权利要求 2 所述的多功能钢卷尺，其特征在于：所述的尺身（14）上设置有两种刻度，为不同的长度计量单位。

4. 根据权利要求 3 所述的多功能钢卷尺，其特征在于：所述的延长段（13）的底面设置有涂料层。

5. 根据权利要求 4 所述的多功能钢卷尺，其特征在于：所述的壳体（1）上还设置有指南针和温度计。

一种多功能钢卷尺

技术领域

[0001] 本实用新型涉及测量工具领域，更具体地说，涉及一种多功能钢卷尺。

背景技术

[0002] 钢卷尺是家庭装修、工程装潢、建筑施工、日常生活中不可或缺的一种工具，对钢卷尺的性能要求是：测量尺寸精准，方便耐用。而传统的钢卷尺功能简单、性能单一、技术含量低，特别是在丈量时需要借助标记工具对所需长度进行标记，十分不便，且常用钢卷尺的测量单位只有厘米和米，且由于尺身在测量过程中是直接暴露在外，所以尺身本身易磨损而导致刻度模糊，这会在测量过程中经常会造成误读的现象，这种现象在日常使用中时有发生，特别是在建筑行业、门窗制造行业等，这种现象最为突出。而有时在给瓷砖、玻璃等较硬且一般标记工具不易标记的器材进行测量长度的同时，需要另外找工具做记号或者裁划，这时，若使用一般的钢卷尺，则需要另外找人帮忙寻找可以标记的工具，然后放下尺子去裁划，费时费力的同时还影响了测量精度，与此同时，一般的钢卷尺的尺身边缘薄且硬，经常由于卷尺的突然抽缩而刮伤人体，存在安全隐患。

实用新型内容

[0003] 1. 实用新型要解决的技术问题

[0004] 本实用新型的目的在于克服现有技术中不足，提供了一种多功能钢卷尺，采用本实用新型的技术方案，避免了因为操作失误而造成的尺身突然卷收，及尺身刻度因为长期暴露在外的磨损造成刻度不清的问题，组件结构的独特性也满足了测量长度时的不同被测量物体的标记需求，适用于多种作业需求，使得钢卷尺的功能多样化，而且该组件结构独特简单、难以替代，成本低，可实施性高，易于推广使用。

[0005] 2. 技术方案

[0006] 为达到上述目的，本实用新型提供的技术方案为：

[0007] 一种多功能钢卷尺，包括壳体、尺身和活动端，所述的壳体上设置有卡位开关和卷收开关，壳体和尺身的连接处设置有延长段，所述的尺身的刻度起始端设置有孔，所述的活动端的一端设置有槽口，另一端设置有卡扣，该卡扣与尺身上的孔相匹配。

[0008] 作为本实用新型更进一步的改进，所述的尺身的表面设置有薄膜层，尺身的边缘处设置有橡胶层。

[0009] 作为本实用新型更进一步的改进，所述的尺身上设置有两种刻度，为不同的长度计量单位。

[0010] 作为本实用新型更进一步的改进，所述的延长段的底面设置有涂料层。

[0011] 作为本实用新型更进一步的改进，所述的壳体上还设置有指南针和温度计。

[0012] 3. 有益效果

[0013] 采用本实用新型提供的技术方案，与现有技术相比，具有如下有益效果：

[0014] (1) 本实用新型的一种多功能钢卷尺，包括壳体、尺身，壳体上设置有卡位开关和

卷收开关，卡位开关可控制用于测量作业的尺身的长度，卷收开关控制尺身的卷收，起到了保险开关的作用，因为尺身薄且硬，由卡位开关和卷收开关共同控制钢卷尺尺身的卷收，保证了使用时的安全，避免了因为操作失误而造成的尺身突然卷收，既保证了作业效率，又降低了人体受伤的可能性。

[0015] (2) 本实用新型的一种多功能钢卷尺，尺身的表面设置有薄膜层，尺身的边缘处设置有橡胶层，这样的结构设计，既避免了尺身刻度因为长期暴露在外的磨损造成刻度不清的问题，又对尺身易伤人的边缘进行了包裹，保证了测量精度的同时，又保障了人身安全。

[0016] (3) 本实用新型的一种多功能钢卷尺，尺身的刻度起始端设置有孔，活动端的一端设置有槽口，另一端设置有卡扣，该卡扣与尺身上的孔相匹配，活动端的槽口可用于固定石墨、钨钢刀或金刚石等标记工具，可满足测量长度时的不同被测量物体的标记需求，与尺身的孔相配合，可将活动端固定在尺身上，在方便标记的同时也保证了测量精度。

[0017] (4) 本实用新型的一种多功能钢卷尺，壳体和尺身的连接处设置有延长段，延长段的底面设置有涂料层，在进行需要两端标记的作业时，可以在一端标记完成后直接按压延长段，利用涂料层上的涂料在被测量物上进行另一端标记，在提高工作效率的同时又保证了测量精度。

[0018] (5) 本实用新型的一种多功能钢卷尺，尺身上设置有有两种刻度，为不同的长度计量单位，壳体上还设置有指南针和温度计，满足了多种作业需求，使得钢卷尺的功能多样化。

[0019] (6) 本实用新型的一种多功能钢卷尺，结构设计合理，原理简单，便于推广使用。

附图说明

[0020] 图 1 为本实用新型的一种多功能钢卷尺的结构示意图。

[0021] 示意图中的标号说明：

[0022] 1、壳体；11、卡位开关；12、卷收开关；13、延长段；14、尺身；2、活动端；21、槽口。

具体实施方式

[0023] 为进一步了解本实用新型的内容，结合附图对本实用新型作详细描述。

[0024] 实施例 1

[0025] 如图 1 所示，本实施例中的一种多功能钢卷尺，包括壳体 1、尺身 14 和活动端 2，壳体 1 上设置有卡位开关 11 和卷收开关 12，卡位开关 11 通过位于壳体 1 上的尺身 14 出口处的卡位片控制用于测量作业的尺身的长度，卷收开关 12 连通位于壳体 1 中心的收卷器控制尺身的卷收，起到了保险开关的作用，壳体 1 上还设置有指南针和温度计，尺身 14 的表面设置有薄膜层，尺身 14 的边缘处设置有橡胶层，尺身 14 上设置有两种刻度，为不同的长度计量单位，壳体 1 和尺身 14 的连接处设置有延长段 13，延长段 13 的底面设置有涂料层，该涂料层可填充涂料并且可更换，尺身 14 的刻度起始端设置有孔，所述的活动端 2 的一端设置有槽口 21，另一端设置有卡扣，该卡扣与尺身 14 上的孔相匹配，槽口 21 为半开放结构，在开口处设置有固定装置，用于固定放置在槽口 21 中的标记工具。

[0026] 使用时，先根据被测量物选择所需的标记工具，将标记工具放置在活动端 2 的槽口 21 中，然后将活动端 2 通过卡扣与尺身 14 固定，打开卷收开关 21，拉动活动端 2 使得尺

身 14 伸长到所需长度后用卡位开关 11 使得长度固定，利用在槽口 21 中的标记工具，对测量长度的一端进行标记，如果另一端也需要标记，则可以通过按压延长段 13，通过位于延长段 13 底面的涂料层，对被测量物进行标记，则测量完成。

[0027] 以上示意性的对本实用新型及其实施方式进行了描述，该描述没有限制性，附图中所示的也只是本实用新型的实施方式之一，实际的结构并不局限于此。所以，如果本领域的普通技术人员受其启示，在不脱离本实用新型创造宗旨的情况下，不经创造性的设计出与该技术方案相似的结构方式及实施例，应属于本实用新型的保护范围。

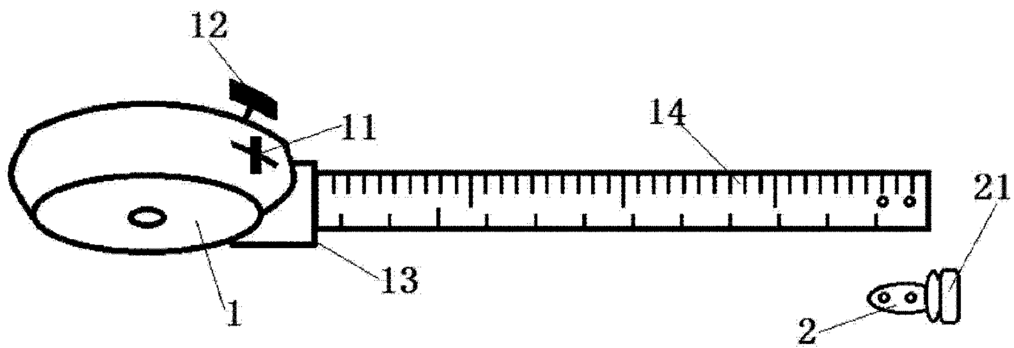


图 1

Espacenet

Bibliographic data: CN205482653 (U) — 2016-08-17

Steel measuring tape

Inventor(s): FENG JIANLONG ± (冯建龙)

Applicant(s): ZHEJIANG GUOXIANG ELECTRICAL AND MECH ENG CO LTD ± (浙江国翔机电工程有限公司)

Classification: **- international:** ***G01B3/10***
- cooperative:

Application number: CN20162209819U 20160318

Priority number(s): CN20162209819U 20160318

Abstract of CN205482653 (U)

The utility model discloses a steel measuring tape, which comprises an outer shell, shell up end, preceding lateral wall and back lateral wall are the cambered surface, openly, the reverse side and down the terminal surface be the plane, the shell up end is provided with the LED lamp, and it has the compass openly to inlay, lower terminal surface fixedly connected with draw -in groove, be provided with the ruler in the draw -in groove, the opening has been offered on shell front side wall and the back lateral wall respectively, be provided with gear, clockwork spring, pulley and battery in the shell, the pulley is close to the opening, the winding has the tape measure on the gear, clockwork spring and tape measure hub connection, gear, clockwork spring and pulley respectively are 2, the tape measure with the contact of pulley upper end, the tape measure surface is provided with the fluorescent layer, and the tape measure edge of telling is pasted and is had the inoxidizing coating. This steel measuring tape novel structure carries lightly convenient to use. Can measure under dim condition, can help others and take one's bearings fast, but the different direction of simultaneous measurement.

(19)中华人民共和国国家知识产权局

(12)实用新型专利

(10)授权公告号 CN 205482653 U

(45)授权公告日 2016.08.17

(21)申请号 201620209819.3

(22)申请日 2016.03.18

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代理人 冯子玲

(51)Int.Cl.

G01B 3/10(2006.01)

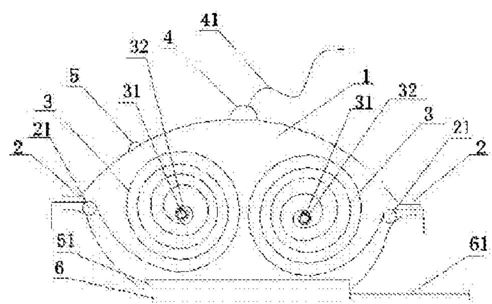
权利要求书1页 说明书2页 附图1页

(54)实用新型名称

一种钢卷尺

(57)摘要

本实月新型公开一种钢卷尺，包括外壳，所述外壳上端面、前侧壁和后侧壁呈弧面，正面、反面和下端面为平面，所述外壳上端面设置有LED灯，正面镶嵌有指南针，下端面固定连接有卡槽，所述卡槽内设置有直尺，所述外壳前侧壁和后侧壁上分别开设有开口，所述外壳内设置有齿轮、发条、滑轮和电池，所述滑轮靠近所述开口，所述齿轮上缠绕有卷尺，所述发条与卷尺轴连接，所述齿轮、发条和滑轮各为2个，所述卷尺与所述滑轮上端接触，所述卷尺表面设置有荧光层，所诉卷尺边缘粘贴有防护层。该钢卷尺造型新颖，携带轻巧，使用方便。可在昏暗条件下测量；能助人快速辨别方向；可同时测量不同的方向。



1.一种钢卷尺,其特征在于:包括外壳(1),所述外壳(1)上端面、前侧壁和后侧壁呈弧面,正面、反面和下端面为平面,所述外壳(1)上端面设置有紫外灯(5),正面镶嵌有指南针(7),下端面固定连接有卡槽(6),所述卡槽(6)内设置有直尺(61),所述外壳(1)前侧壁和后侧壁上分别开设有开口(2),所述外壳(2)内设置有齿轮(32)、发条(31)、滑轮(21)和电池(5),所述滑轮(21)靠近所述开口(2),所述齿轮(32)上缠绕有卷尺(3),所述发条(31)与卷尺轴连接,所述齿轮(32)、发条(31)和滑轮(21)各为2个,所述卷尺(3)在两个齿轮(32)上的缠绕方向相反,所述卷尺(3)与所述滑轮(21)上端接触,所述卷尺(3)表面设置有荧光层(34),所诉卷尺(3)边缘粘贴有防护层(33)。

2.根据权利要求1所述一种钢卷尺,其特征在于:所述外壳(1)的上端面上设置有圆环(4),所述圆环上连接有绳索(41)。

3.根据权利要求1所述一种钢卷尺,其特征在于:所述发条(31)的位置低于所述开口(2)的位置。

4.根据权利要求1所述一种钢卷尺,其特征在于:所述滑轮(21)上端与所述开口(2)在同一水平线上。

5.根据权利要求1所述一种钢卷尺,其特征在于:所述防护层(33)为透明胶带。

6.根据权利要求1所述一种钢卷尺,其特征在于:所述卷尺(3)正反面均标注有尺寸线和相应的数字。

7.根据权利要求1所述一种钢卷尺,其特征在于:所述指南针(7)的指针上涂覆有红色或黄色的荧光层。

一种钢卷尺

技术领域

[0001] 本实用新型涉及计量工具技术领域，具体地涉及一种钢卷尺。

背景技术

[0002] 卷尺是日常生活常用的工具，最为普及的是钢卷尺，建筑和装修常用，也是家庭必备的工具之一。钢卷尺造型小巧，携带轻巧，使用方便。然而，现有的钢卷尺在使用过程中仍有不足之处，比如，在昏暗条件下不易测量；不能辨别方向；不能同时测量不同的方向。

实用新型内容

[0003] 针对现有技术的不足，本实用新型提供一种有多种测量可能，功能多样的钢卷尺。

[0004] 为满足上述要求，本实用新型的技术方案是：一种钢卷尺，包括外壳，所述外壳上端面、前侧壁和后侧壁呈弧面，正面、反面和下端面为平面，所述外壳上端面设置有紫外灯，正面镶嵌有指南针，下端面固定连接有卡槽，所述卡槽内设置有直尺，所述外壳前侧壁和后侧壁上分别开设有开口，所述外壳内设置有齿轮、发条、滑轮和电池，所述滑轮靠近所述开口，所述齿轮上缠绕有卷尺，所述发条与卷尺轴连接，所述齿轮、发条和滑轮各为2个，所述卷尺在两个齿轮上的缠绕方向相反，所述卷尺与所述滑轮上端接触，所述卷尺表面设置有荧光层，所诉卷尺边缘粘贴有防护层。

[0005] 所述外壳的上端面上设置有圆环，所述圆环上连接有绳索。

[0006] 所述发条的位置低于所述开口的位置。

[0007] 所述滑轮上端与所述开口在同一水平线上。

[0008] 所述防护层为透明胶带。

[0009] 所述卷尺正反面均标注有尺寸线和相应的数字。

[0010] 所述指南针的指针上涂覆有红色或黄色的荧光层。

[0011] 本实用新型的有益效果是：造型新颖，携带轻巧，使用方便。可在昏暗条件下测量；能助人快速辨别方向；可同时测量不同的方向。

附图说明

[0012] 图1是本实用新型的结构示意图；

[0013] 图2是本实用新型的一种实施例结构示意图。

具体实施方式

[0014] 实施例1

[0015] 如图1、2所示的一种钢卷尺，包括外壳1，所述外壳1上端面、前侧壁和后侧壁呈弧面，正面、反面和下端面为平面，所述外壳1上端面设置有紫外灯5，正面镶嵌有指南针7，下端面固定连接有卡槽6，所述卡槽6内设置有直尺61，所述外壳1前侧壁和后侧壁上分别开设有开口2，所述外壳1内设置有齿轮32、发条31、滑轮21和电池5，所述滑轮21靠近所述开口2，

所述齿轮32上缠绕有卷尺3，所述发条31与卷尺轴连接，所述齿轮32、发条31和滑轮21各为2个，所述卷尺3在两个齿轮32上的缠绕方向相反，所述卷尺3与所述滑轮21上端接触，所述卷尺3表面设置有荧光层34，所诉卷尺3边缘粘贴有防护层33。

[0016] 所述外壳1的上端面上设置有圆环4，所述圆环上连接有绳索41。

[0017] 所述发条31的位置低于所述开口2的位置。

[0018] 所述滑轮21上端与所述开口2在同一水平线上。

[0019] 所述防护层33为透明胶带。

[0020] 所述卷尺3正反面均标注有尺寸线和相应的数字。

[0021] 所述指南针7的指针上涂覆有红色或黄色的荧光层。

[0022] 本实用新型钢卷尺，增加了更多的测量可能。两端同时可出尺的设计，使得操作时两人可同时进行测量，增大了测量距离，卷尺3正反面都设置有刻度，方便了同时测量不同断面，此外，下端面直尺61的设计可满足对平面水平要求较高且距离较短的范围的测量。上端面的圆环4和绳索41设计方便了使用者携带。指南针7的设计可方便使用者在昏暗条件下快速辨别方向。另外，在外壳1上设置有紫外灯5，所述卷尺3上设置有荧光层34，在昏暗条件下，打开紫外灯5照射卷尺3时，卷尺3上的刻度可清晰的展现出来。

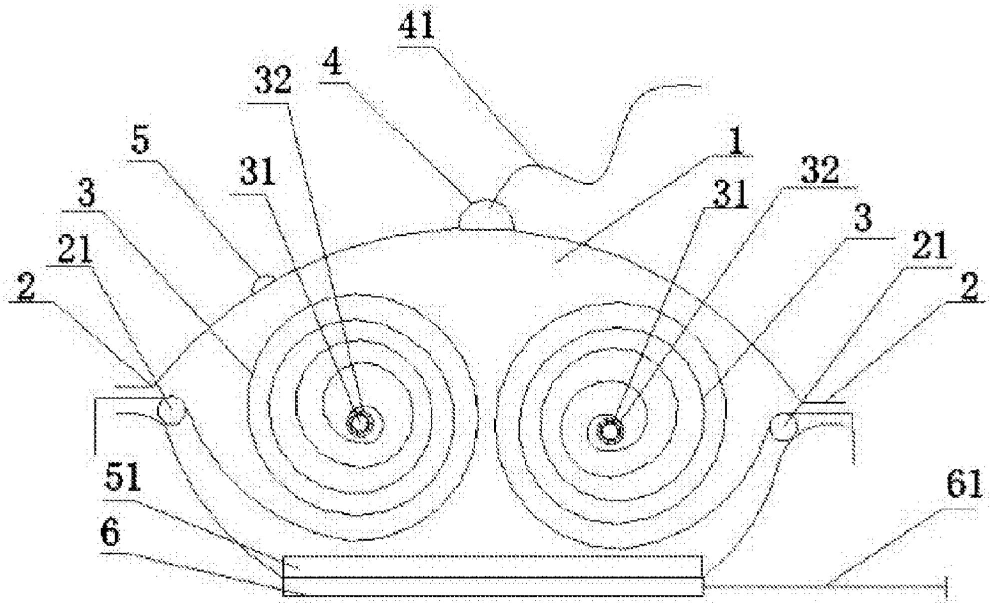


图1

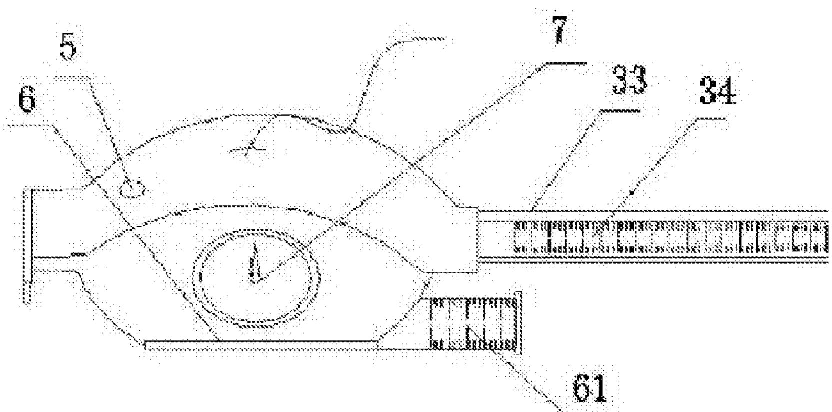


图2

Espacenet

Bibliographic data: CN2705772 (Y) — 2005-06-22

Band tape

Inventor(s): PELA HALALDO KALEINIO [ES] + (HALALDO KALEINIO PELA)

Applicant(s): MEDID INTERNAT CORP [ES] + (MEDID INTERNATIONAL CORP)

Classification:
- **international:** ***G01B3/10;*** (IPC1-7): G01B3/10
- **cooperative:**

Application number: CN2004204905U 20040303

Priority number(s): ES20030001784U 20030724

Also published as: ES1055357 (U) ES1055357 (Y)

Abstract of CN2705772 (Y)

The utility model relates to a band tape, comprising a measuring scale belt whose free end is provided with a nail shape object. The inner surface of the nail-shaped object which is in contact with the to be measured object is provided with an antiskid coating. The coating whose thickness is 0. 5-3mm is provided with the antiskid material of rubber, soft plastic, lacquer, or porous coating. The coating which can be provided with a rough contact surface can cover the entire nail shape object. In other conduct cases, the nail shape object is provided with a plurality of lateral tooth which can be arranged to slant in a direction opposite to the possible sliding direction of a sheath. The utility model can improve the fixing effect between the nail shape object and the measured object. As a result, the object is easy to be measured by users, and the measurement effect is improved.

[19] 中华人民共和国国家知识产权局

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G01B 3/10

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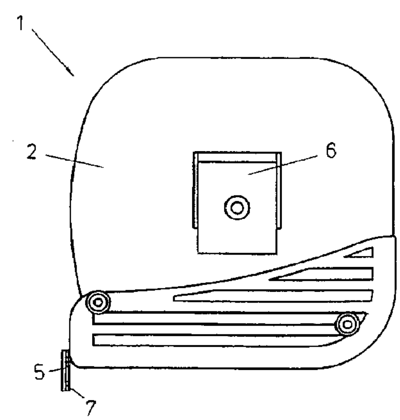
权利要求书 2 页 说明书 5 页 附图 3 页

[54] 实用新型名称 卷尺

[57] 摘要

本实用新型涉及一种卷尺，它包括一刻度尺带，该刻度尺带的自由端设置有一指甲状物。在与被测量物体相接触的指甲状物的内表面上设置有一防滑涂层。该涂层由选自橡胶、柔软塑料、漆或多孔涂料的防滑材料制成，并且该涂层的厚度为 0.5～3mm。该涂层可具有一粗糙的接触表面，并且该涂层可以覆盖住整个指甲状物。在其它的实施例中，所述指甲状物具有一些侧齿，这些侧齿可以被设置成沿着与护套可能滑动的方向相反的方向倾斜。本实用新型可以改进指甲状物与被测量物体之间的固定效果，从而使得使用者更容易对物体进行测量，而且也使测量更有效。



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1. 一种卷尺，它包括一刻度尺带（4），该刻度尺带的自由端设置有一指甲状物（5），其特征在于，在所述指甲状物（5）的与被测量物体相接触的表面上设置有一防滑涂层（7）。

2. 根据权利要求1所述的卷尺，其特征在于，所述防滑涂层（7）设置在所述指甲状物（5）的内表面上。

3. 根据权利要求1所述的卷尺，其特征在于，所述涂层（7）由选自橡胶、柔软塑料、漆或多孔涂料的防滑材料制成。

4. 根据权利要求1所述的卷尺，其特征在于，所述防滑材料涂层（7）的厚度为0.5～3mm。

5. 根据权利要求1所述的卷尺，其特征在于，所述防滑材料涂层的厚度为1～2mm。

6. 根据权利要求1所述的卷尺，其特征在于，所述涂层（7）设有一粗糙的接触表面，以便提高防滑效果。

7. 根据权利要求1所述的卷尺，其特征在于，所述防滑涂层（7）作为一护套将整个指甲状物（5）覆盖住。

8. 根据权利要求7所述的卷尺，其特征在于，所述指甲状物（5）设置有侧齿（8），以避免所述护套（7）发生移动，所述齿（8）沿着与所述护套（7）可能滑动的方向相反的方向倾斜。

9. 根据权利要求7所述的卷尺，其特征在于，所述指甲状物（5）设置有一大直径的孔（9），该孔（9）与设置在护套（7）上的一孔（10）相配合，所述设置在护套（7）上的孔（10）位于与被测量物体相接触的护套（7）的内部，指甲状物（5）的外部（11）被橡胶护套（7）完全覆

盖住，从而在所述孔（9，10）的区域内通过所述外部（11）在护套（7）上施加压力时将形成一气体真空，以便有助于将指甲状物（5）固定到被测量物体上。

卷尺

技术领域

正如其名称所表述的那样，本实用新型涉及一种卷尺，该卷尺的制造、构造和设计特征可实现特定的目的，从而具有良好的安全性和有效性，并提供了将在本说明书中进行详细描述的许多优点。

背景技术

已经知道存在一些卷尺，例如建筑领域中的木匠、砖匠等常用这些卷尺来测量长度。这些卷尺基本上包括一外壳，在该外壳内卷绕着尺带。这种尺带通常由金属制成，并且在该尺带上印制有测量刻度。这种卷尺还设置有用于使所述尺带缩回的装置，并且设置有用于把尺带锁定住的装置。

通常，在尺带的自由端设置有一指甲状物或突出片。该指甲状物或突出片垂直于所述尺带延伸，并且用作一测量止动件，当进行测量操作时，该指甲状物或突出元件用于把尺带的端部固定住。现有技术中的这些卷尺采用若干种类型的指甲状物，这些指甲状物通常由镀镍的平滑铁片制成。这种类型的卷尺的主要缺陷在于所述指甲状物很容易滑动，尤其当由一个人进行测量时，上述缺陷尤为突出。

发明内容

为了克服上述问题，本实用新型提出了一种新型卷尺，该卷尺设置有一指甲状物，该指甲状物的表面(优选为该指甲状物的内表面，即该指

甲状物与被测量物体相接触的表面)设置有一涂层，该涂层由诸如橡胶、柔软塑料、漆或多孔涂料(spongy paint)等防滑材料制成。

可以以粘接方式在卷尺指甲状物的所述表面上粘附厚度为0.5～3mm,更优选地为1～2mm的橡胶或柔软塑料薄片，从而在指甲状物上形成所述涂层。该涂层可以呈现出一粗糙的接触表面，以便提高防滑效果。涂层的厚度可自由决定，所用防滑材料的厚度通常约为1mm,在需要很大的防滑特性的情况下，防滑材料的厚度可为约2mm。

所述涂层的施加可以通过利用塑料注射设备将合成橡胶型的塑料或类似物沉积到所述表面上来进行，也可以简单地将具有粗糙防滑表面的柔软塑料注射到所述表面上来进行。另一种用于将所述由柔软且防滑的材料构成的涂层施加到指甲状物的内表面上的可行方法是通过辊、气枪、静电气氛或其它任何适宜可行的方法将漆或多孔涂料沉积到所述表面上，从而使多孔涂料或漆沉积到指甲状物的表面上，并使指甲状物的表面成为防滑表面。

应当特别注意这样一个事实，即随着指甲状物的厚度的增大，在停止测量位置或拉伸测量位置之间的位移(也就是说，根据测量是否从指甲状物的其中一个或另一个表面开始)变长。因此，如果防滑涂层为1mm厚，那么指甲状物的位移应增加1mm的长度，如果防滑涂层为2mm厚，那么所述位移将增加2mm的长度。

与被测量物体相接触的涂层表面可以是平滑的，但优选地是，该涂层表面形成小凸纹(relief)，以便提高防滑效果。所述凸纹可以是一些小的线条、点或任何其它适当的图案或花纹。这样，在所述表面和被测量物体之间的接触点就在这些接触凸点上增强了防滑效果。

所述防滑涂层可以覆盖住整个指甲状物，从而使该防滑涂层用作一护套。可以通过粘接方式或插入方式将所述护套固定到位，以便克服由

设置在指甲状物的侧边缘上的锯齿所施加的压力，其中这些锯齿沿着与护套可能滑动的方向相反的方向倾斜。

指甲状物还可以设置一大直径的孔，该大直径的孔与护套中的一孔相配合，所述护套中的孔被设置在与被测量物体相接触的护套的内部。在这种情况下，指甲状物的外部完全由所述橡胶护套覆盖住。在所述孔的区域内，通过所述护套在所述外部施加压力，就会形成一气体真空，这有利于把指甲状物固定到被测量的物体上。

附图说明

通过下面的描述并参照附图，可以清楚地理解本实用新型的卷尺的进一步的细节和特征，其中的附图示意性地表示出了一些优选的细节。这些细节是通过举例的方式描述的，所举的这些例子是可行实施例的一些可能的情况，但是本实用新型并不局限于所公开的这些细节。在附图中：

图1是本实用新型的卷尺的侧视图；

图2是图1所示卷尺的前视图；

图1a是本实用新型的卷尺的另一个实施例的侧视图；

图2a是图1a所示卷尺的前视图；

图3是本实用新型的卷尺的指甲状物的侧视图，其适于在该指甲状物上连接一防滑涂层；

图4是图3所示卷尺的指甲状物的前视图；

图5是卷尺的指甲状物的一个实施例的侧剖图，其中，卷尺指甲状物由一防滑涂层覆盖住，所述防滑涂层呈橡胶护套的形式；

图6是图5所示卷尺的指甲状物的平面示意图；

图7是图5和图6所示卷尺的指甲状物的前视图；

图8是卷尺的指甲状物的另一个实施例的侧视图，其中，防滑涂层仅被设置在卷尺指甲状物的内部；

图9是图8所示卷尺的指甲状物的平面示意图。

下面给出了本申请中所引用的各个部件的列表：

1 卷尺

2 外壳

3 制动件

4 刻度尺带

5 指甲状物

6 夹具

7 防滑涂层

8 指甲状物锯齿

9 指甲状物的孔

10 护套的孔

11 护套的外部

具体实施方式

下面将通过一些非限制性例子来描述本实用新型的卷尺。从本说明书所附的附图的图1，1a，2，2a中可以看到总体上由附图标记1所表示的该卷尺。

该卷尺1包括一外壳2和一制动件3，该制动件3作用在一刻度尺带4上，该刻度尺带4终止于一指甲状物5，该指甲状物5与刻度尺带大约成90度角。从图中可以看出，外壳2还设置有一侧部夹具6。

从图中可以清楚地看出指甲状物5如何在其与被测量物体相接触的表面上设置有一涂层7。所述涂层由防滑材料制成，并优选由橡胶来制成，但是，该涂层也可以由任何适当的柔软塑料、漆或多孔涂料等材料制成。

所述涂层7以粘接方式被粘接到卷尺1的指甲状物5的表面上，并且该涂层的厚度处于1～2mm的范围。所述涂层7具有粗糙的接触表面，以便提高与被测量物体之间的防滑效果，并且该涂层是通过塑料注射设备使合成橡胶类型的塑料或类似物沉积到所述指甲状物5的表面上所形成的，或者是通过把具有粗糙防滑表面的柔软塑料注射到所述指甲状物5表面上所形成的。但是，应当理解，采用其它的方法来形成该涂层也是有效的，例如，可利用辊、气枪、静电气氛使漆或适当的多孔涂料沉积到指甲状物5的表面上，或利用其它任何适宜的方法使漆或多孔涂料沉积到指甲状物5的表面上，从而形成所述防滑表面。

参照图1a, 2a, 5, 6, 7，被粘接到本实用新型的卷尺1的指甲状物5上的防滑涂层7可以覆盖住整个指甲状物5，使得该防滑涂层如同一个护套（见图5）。由防滑涂层7所形成的所述护套有效地设置在指甲状物5上，这是因为所述护套在它的侧部边缘具有许多锯齿8，这些锯齿8沿着与护套7可能会发生滑动的方向相反的方向倾斜。然而，应当理解，这些锯齿8是可选择的，护套可以不设这些锯齿，而是以粘接方式直接被粘接到指甲状物5的表面上。

参照图4，在指甲状物5上设置有一大直径的孔9，该孔9与设置在护套7上的一孔10相配合，所述设置在护套7上的孔10位于与被测量物体（图中未示出）相接触的该护套7的内部。在这种情况下，指甲状物5的外部11被橡胶护套7完全覆盖住。通过这种方式，当在所述孔9，10的区域内通过所述外部11在护套7上施加压力时，就会形成一气体真空，从而有助于把指甲状物5固定到被测量的物体上。

尽管已经参照附图对本实用新型作出了充分的描述，但是，应当理解，在所附的权利要求所概括的实质范围内，可以对本实用新型作出任何细节方面的改变。

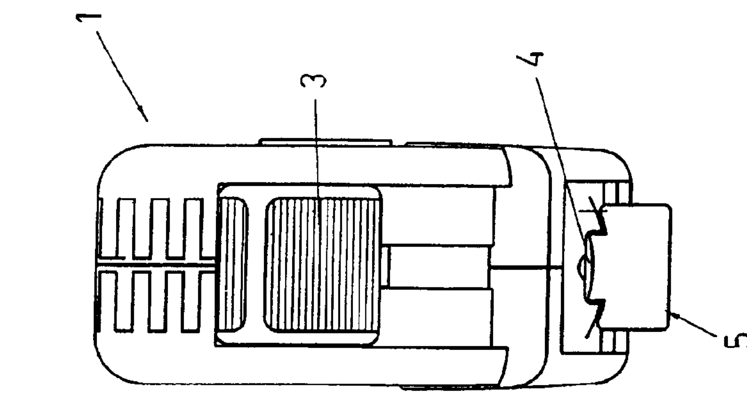

图2

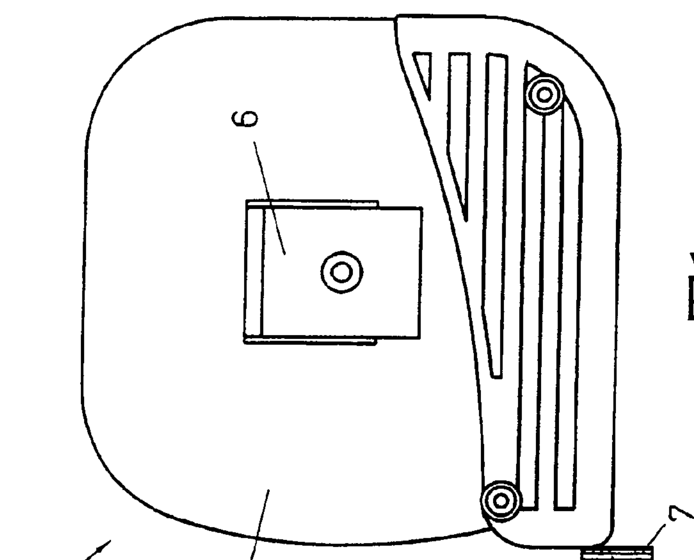

图1

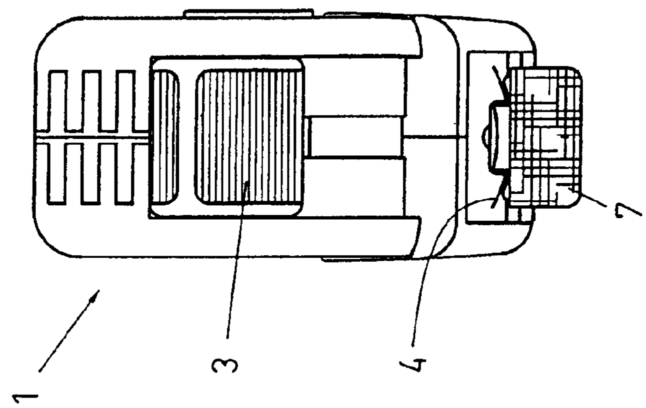

图2a

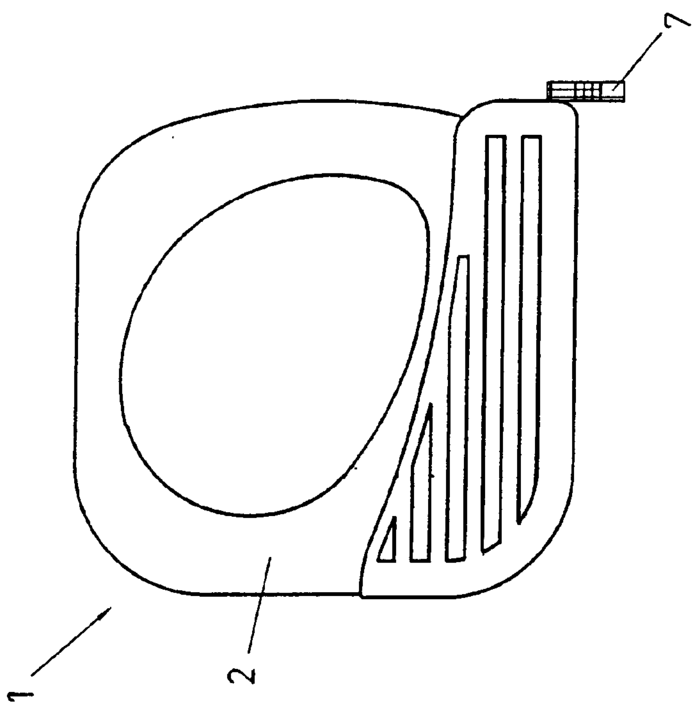

图1a

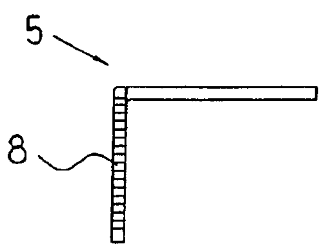

图3

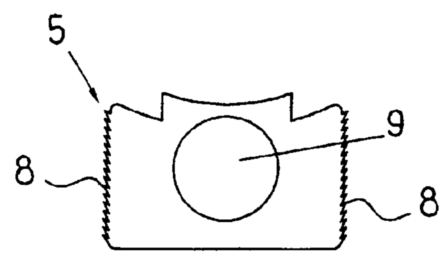

图4

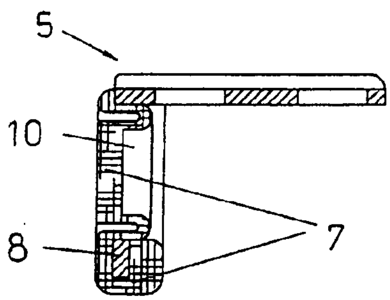

图5

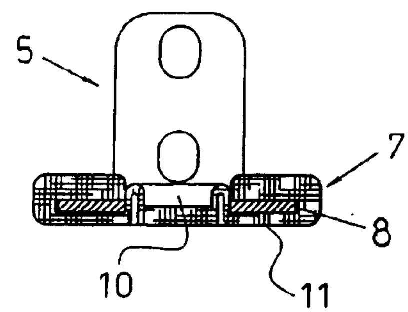

图6

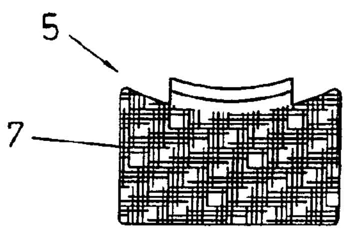

图7

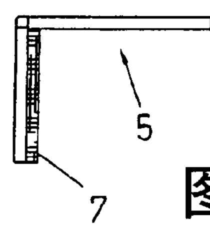

图8

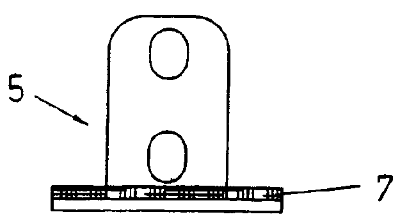

图9

Espacenet

Bibliographic data: DE19628318 (C1) — 1998-03-26

Dimensionally stable base for accurate, re-usable self-adhesive measuring tape

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Applicant(s): BEIERSDORF AG [DE] ± (BEIERSDORF AG, 20253 HAMBURG, DE)

Classification: - **international:** ***C09J7/02; C09J7/04; G01B3/10;*** (IPC1-7): C09J7/04; G01B3/10
- **cooperative:** **C09J7/205**; **C09J7/21**; **C09J7/243**; **G01B3/1082**; C09J2400/283; C09J2423/006; G01B2003/1097

Application number: DE19961028318 19960713

Priority number(s): DE19961028318 19960713

Abstract of DE19628318 (C1)

- The use of a dimensionally stable photographic paper base of paper coated with polyolefin on both sides or a dimensionally stable undrawn polypropylene (PP) film as base for a self-adhesive measuring tape is claimed. The front is printed with a coloured layer and then a scale, which is coated with a release layer, whilst the back is given primer and self-adhesive coatings/

(19) BUNDESREPUBLIK DEUTSCHLAND

DEUTSCHES PATENTAMT

(12) **Patentschrift**

(10) **DE 196 28 318 C 1**

(51) Int. Cl.⁶:
C 09 J 7/04
G 01 B 3/10

DE 196 28 318 C 1

(21) Aktenzeichen: 196 28 318.3-43
(22) Anmeldetag: 13. 7. 96
(43) Offenlegungstag: –
(45) Veröffentlichungstag der Patenterteilung: 26. 3. 98

Innerhalb von 3 Monaten nach Veröffentlichung der Erteilung kann Einspruch erhoben werden

(73) Patentinhaber:

Beiersdorf AG, 20253 Hamburg, DE

(72) Erfinder:

Zimmermann, Dieter, 21635 Jork, DE; Selaff, Oliver, 21502 Geesthacht, DE

(56) Für die Beurteilung der Patentfähigkeit in Betracht gezogene Druckschriften:

DE	42 11 510 A1
DE	88 06 763 U1
US	25 07 684

(54) Verwendung eines Trägermaterials für ein selbstklebendes Maßband

(57) Verwendung eines dimensionsstabilen fotographischen Papierträgers aus einem beidseitig mit Polyolefinen beschichteten Papier oder einer dimensionsstabilen ungereckten Polypropylenfolie als Trägermaterial für ein selbstklebendes Maßband, wobei auf die obere Seite des Trägermaterials eine Farbschicht aufgedruckt ist, auf die Farbschicht eine Skalierung aufgedruckt ist, auf die Skalierung ein Releaselack aufgebracht ist, auf die untere Seite des Trägermaterials ein Primer aufgetragen und auf dem Primer eine selbstklebende Beschichtung vorgesehen ist.

DE 196 28 318 C 1

Beschreibung

Die Erfindung betrifft die Verwendung eines dimensionsstabilen Papiers oder einer dimensionsstabilen ungereckten Polypropylenfolie als Trägermaterial für ein selbstklebendes Maßband.

Für die Messung kürzerer Längenabschnitte werden unterschiedliche Verfahren und Meßgeräte angewandt. So ist unter Handwerkern und auch im Do-It-Yourself-Bereich der Zollstock aus Holz oder Kunststoff sehr weit verbreitet. Daneben werden auch sehr häufig Maßbänder aus Metall oder einfache, nicht selbstklebend ausgerüstete Papierbänder angetroffen.

Die Verwendung der genannten Meßgeräte ist aber insbesondere für den ungeübten Laien nicht problemlos. Durch nicht zu vermeidendes Verrutschen der Geräte beim Messen tritt häufig eine unerwünschte Verzögerung des Meßvorganges ein. Überkopfarbeiten mit den Geräten sind auch für den geübten Profi ohne Hilfe kaum zu bewerkstelligen. Schließlich sind bei großen Flächen und Gegenständen, insbesondere wenn diese eine Wölbung aufweisen, die genannten Meßgeräte eher unpraktisch, denn sie erfordern dann ein mehrmaliges Anlegen und Ablesen sowie das ständige Anzeichnen. Für den Profi existieren dann noch Ultraschallmeßgeräte für genaue Distanzmessungen. Diese sind aber in der Anschaffung sehr teuer, und deren richtige Verwendung überfordert die meisten Personen, die sich nur gelegentlich handwerklich betätigen.

Daneben sind im Stande der Technik selbstklebend ausgerüstete Maßbänder vorbeschrieben, die aber mit Mängeln behaftet sind.

So beschreibt die französische Patentschrift FR 1.444.276 allgemein ein flexibles Band unbegrenzter Länge, das auf der Oberfläche von flexiblen Materialien wie Stoff, Papier oder Kunststoff fixiert werden kann. Das Band weist auf seiner Oberseite eine Aufteilung mit Längeneinheiten auf (Zentimeter oder Zoll), auf der Unterseite ist es mit einem Klebstoff versehen.

Das Band kann leicht vom Untergrund entfernt werden, ohne einen Rückstand zu hinterlassen.

In der Patentschrift wird aber die technische Ausführung des Bandes nicht näher dargelegt. Die meisten Träger für Klebebänder sind nicht ausreichend dimensionsstabil, so daß bei dem beschriebenen Band, beispielsweise beim Abrollen, wenn das Band auf Zug beansprucht wird, eine irreversible Dehnung des Trägers eintritt. Für genaues Arbeiten ist das Band somit ungeeignet. Des weiteren weist die auf der Oberseite angebrachte Bedruckung keine Releasebeschichtung aus Lack auf, so daß nicht ausgeschlossen werden kann, daß beim Abrollen des Bandes von der Rolle Teile der Bedruckung auf dem Kleber verbleiben, insbesondere wenn das Band vor der Verwendung längere Zeit aufbewahrt wird. Dies führt zu einer Beeinträchtigung des optischen Eindrucks des Bandes. Der Anwender ist nicht geneigt, ein derartiges Band einzusetzen.

In der deutschen Patentschrift DE 34 00 547 C2 wird ein Verfahren zur Vorbereitung einer Gebäudewand für die maßgenaue Anlage von Wandbekleidungselementen mit Hilfe eines Maßband es beschrieben. Als Maßband kommt dabei ein Klebstreifen zum Einsatz, der vorderseitig als Kennzeichnungsträger ausgebildet sowie mit Maßkennzeichnungen versehen ist und der rückseitig eine Selbstklebeauflage aufweist. Der Klebstreifen wird von einer Rolle abgewickelt und abschnittsweise in Richtung von zumindest einer Achse auf die vorzubereitende Gebäudewand aufgeklebt, so daß Wandbekleidungselemente nach Maßgabe der dadurch permanent auf der Gebäudewand befestigten Maße zugeschnitten und/oder montiert werden können.

Aber-auch in dieser Patentschrift ist nicht dargelegt wie das Maßband konkret aufgebaut ist, so daß die oben erwähnten Bedenken auch bei diesem Maßband zum Tragen kommen.

In der deutschen Offenlegungsschrift DE 40 15 958 A1 wird eine Vorrichtung zur Messung der Größe einer Person mit Hilfe eines mit einem verstellbaren Meßschiebers versehenen Meter- oder Zollmaßes offenbart.

Hierbei kommt ein aufrollbares Kunststoffband zum Einsatz, das auf seiner Rückseite Haftmittel für seine Befestigung an einer schiefen Fläche aufweist und das auf seiner Vorderseite mit einem Zentimeter- oder Zollmaß versehen ist sowie des weiteren mit einem entlang des Kunststoffbands verschiebbaren Meßschieber. Ebenfalls fehlt in dieser Patentanmeldung jegliche konkrete Beschreibung des Aufbaus des Kunststoffbandes.

Allgemein selbstklebende Maßbänder für unterschiedliche Einsatzzwecke werden weiterhin in den US-Patentschriften US 2,507,684 und US 3,797,120 beschrieben.

In der ersteren dient ein Maßband als Anzeigeinstrument für den Füllgrad beispielsweise von einer Flasche; in der zweiten wird dabei ein Maßband als Hilfsmittel bei einem Nähvorgang offenbart.

Alle die genannte Maßbänder sind demnach für Anwendungsfälle, in denen eine hohe Präzision des Maßband es erforderlich ist, eher ungeeignet, eine Eichfähigkeit der Maßbänder ist ausgeschlossen, ebenfalls auch die Langzeitlagerung.

Aufgabe der Erfindung war es, ein selbstklebendes Maßband zu schaffen, das bei seiner Verwendung die Nachteile des Standes der Technik nicht aufweist, das bei der üblichen Verarbeitungstemperatur und bei Zugbelastung dimensionsstabil, das eichfähig und somit sehr maßgenau ist.

Zur Lösung dieser Aufgabe schlägt die Erfindung die Verwendung eines dimensionsstabilen Papiers oder einer dimensionsstabilen ungereckten Polypropylenfolie als Trägermaterial für ein selbstkleben des Maßband vor, wie es in den Patentansprüchen näher gekennzeichnet ist.

Demnach weist das selbstklebende Maßband als Trägermaterial ein dimensionsstabiles Papier oder eine dimensionsstabile ungereckte Polypropylenfolie auf. Das Trägermaterial ist in einer bevorzugten Ausführung handeinreißbar.

Als dimensionsstabiles Papier für das Trägermaterial ist ein fotographischer Papierträger geeignet, wobei dieser insbesondere aus einem beidseitig mit wasserfestem Kunstharz überzogenen und wasserabweisend geleimten Papier oder aus einem beidseitig mit Polyolefinen beschichteten Papier besteht.

Das Trägermaterial weist beim bestimmungsgemäßen Gebrauch des selbstklebenden Maßbands, also beispielsweise beim Abrollen von der fertigen Maßbandrolle oder beim Anlegen und Verkleben, eine Längenänderung auf von weniger als 1 mm auf 1 m, insbesondere von weniger als 0,2 mm auf 1 m.

Auf die obere Seite des Trägermaterials ist eine Farbschicht gedruckt auf die eine Skalierung (bestehend insbesondere aus äquidistanten Strichen im Millimeter- oder Zehntelzollabstand oder jeder anderen beliebigen Teilung) aufgedruckt ist. Weiterhin ist auf die Skalierung ein Releaselack aufgebracht.

Als Lacke sind solche auf Basis Poly(vinylstearylcarbamat) oder vernetzter Polydimethylsiloxane geeignet. Des weiteren können Umsetzungsprodukte von Polyethylenimin und Stearylisocyanat Verwendung finden.

Auf der unteren Seite ist auf dem Trägermaterial ein Primer vorgesehen, auf den eine selbstklebende Beschichtung aufgetragen ist. Die selbstklebende Beschichtung ist in einer bevorzugten Ausführungsform eine Acrylatdispersion. Weiterhin kann diese hautverträglich und physiologisch unbedenklich sein, damit das selbstklebende Maßband gegebenenfalls für längere Zeitabschnitte auf der Haut verbleiben kann.

Weiterhin ist das selbstklebende Maßband rückstandsfrei vom Untergrund ablösbar, gleichzeitig ist es wiederverwendbar.

Das selbstklebende Maßband weist eine Dicke eine Dicke von 20 µm bis 200 µm, insbesondere von 40 µm bis 150 µm, auf.

Schließlich kann das selbstklebende Maßband zumindest an einer der seitlichen Kanten einen Zackenschnitt aufweisen, um das selbstklebende Maßband besonders einfach handeinreißbar zu machen, insbesondere das mit einer dimensionsstabilen ungereckten Polypropylenfolie als Trägermaterial.

Das selbstklebende Maßband ist hervorragend geeignet, die gestellten Anforderungen zu erfüllen.

Die erfindungsgemäße Verwendung eines dimensionsstabilen Papierträgers oder einer dimensionsstabiler ungereckter Polypropylenfolie als Trägermaterial garantiert, daß bei der üblichen Verarbeitungstemperatur und bei der normalen Zugbelastung des Maßbandes keine oder eine nur äußerst geringe irreversible Längenänderung auftritt, die keinerlei Einschränkung für die praktische Anwendung des Maßbandes zur Folge hat.

Weiterhin ist somit die Eichfähigkeit des selbstklebenden Maßbandes gewährleistet.

Durch die Verwendung eines Releaselacks ist die darunterliegende, aufgedruckte Skalierung gegen äußere Beschädigung geschützt. Weiterhin wird verhindert, daß, wenn das Maßband zu einer Rolle aufgewickelt ist, beim Abrollen eine Beeinträchtigung durch die selbstklebende Beschichtung der Trägerunterseite in Erscheinung tritt. Gleichzeitig reduziert sich die Kraft, die zum Abrollen des Maßbandes von der Rolle benötigt wird. Die Abrollkräfte sind dabei so eingestellt, daß beim Ablängen keine bedeutende Längenänderung des Maßbands auftritt und daß keine Übertragung der selbstklebenden Beschichtung auf die Maßbandoberseite oder keine Beschädigung derselben auftritt. Bevorzugt wird ein leichtes und geräuscharmes Abrollen.

Auf der anderen Seite bleibt das Maßband trotz der Releasebeschichtung beschriftbar.

Ein derartiges Maßband ermöglicht insbesondere für den Laien leichteres und genaueres Arbeiten, sowie das Messen ohne fremde Hilfe in Anspruch nehmen zu müssen. Ein Verrutschen des Meßgerätes ist vollkommen ausgeschlossen.

Die Verwendung dieses Maßbandes erlaubt insbesondere die Messung großer Gegenstände und die Montagevorbereitung großer Flächen ohne den Gegenstand oder die Fläche vorher anzeichnen zu müssen.

Darüber hinaus erleichtert es das Befestigen von Gegenständen, wenn diese äquidistant angebracht werden sollen.

Schließlich gelingt es bei Verwendung des selbstklebenden Maßbandes auch einer einzelnen Person, überkopf längere Abschnitte ohne eine zweite Person auszumessen.

Im folgenden soll anhand von Beispielen das selbstklebende Maßband näher beschrieben werden.

Beispiel 1

Ein hochwertiges Photopapier mit einem Flächengewicht von 112 g/m², beidseitig mit 15 g PE beschichtet, der Firma Schoeller (Osnabrück) wird nach einer Coronavorbehandlung einseitig vollflächig im Rasterdruck gelb bedruckt und sofort danach fortlaufend mit einer schwarzen Millimetereinteilung, die in Abschnitten zu genau 1 m Länge eingeteilt ist, nach dem Flexodruckverfahren bedruckt.

Danach wird an einer Maschine in einem Arbeitsgang der Druck mit einem Releaselack auf Basis Poly(vinylstearylcarbamat) versehen, die Rückseite (ebenfalls Corona-vorbehandelt) mit einem wäßrigen Reaktions-Primer beschichtet, getrocknet und sofort mit einer selbstklebenden Masse auf Basis einer hautverträglichen und physiologisch unbedenklichen Acrylatdispersion beschichtet (Neotac® 3020 der Firma Zeneca (Niederlande)).

Nach dem Schneiden und Konfektionieren ist das Maßband von der Rolle fertig.

Der eingesetzte Träger weist in den nach dem Bedrucken folgenden Arbeitsgängen eine Längenänderung von maximal 1‰ auf, d. h., von maximal 1 mm auf 1 m Länge. Das Produkt hat eine Reißfestigkeit von 70 N/cm und ist demnach eichfähig.

Die Hautverträglichkeit der selbstklebenden Masse wird dabei mittels einer speziellen Prüfmethode evaluiert, die auf der Methode nach Bandmann/Fregert (siehe Epicutantestung, Einführung in die Praxis, Springer-Verlag Berlin Heidelberg New York, 1982) basiert.

Dazu wird ein Muster des Maßbandes jeweils auf dem Rücken mehrerer Probanden für 24 Stunden appliziert. Die Probanden werden angehalten, in dieser Zeit weder zu duschen noch zu baden. Nach 24 Stunden wird das Muster entfernt. Weitere 24 Stunden später wird das Testareal zum ersten Mal begutachtet (doppelblinde Ermittlung der 24-h-Werte) noch einmal 24 Stunden später zum zweiten Mal (doppelblinde Ermittlung der 48-h-Werte).

Je nach auftretender epikutaner Reaktion läßt sich eine bestimmte Hautverträglichkeit feststellen.

Beispiel 2

In einem zweiten Beispiel wurde der Photopapierträger von Beispiel 1 ersetzt durch eine ungereckte PP-Folie der Firma Nowopol (Siegsdorf).

Die PP-Folie weist dabei die folgenden physikalischen Parameter auf:

Dicke: 90 µm
Gewicht: 85 g/m²
Höchstzugkraft (längs): 37 N/15 cm
Reißkraft: 30,2 N/15 cm
Schrumpf (45'/110°C): 0,0%.

Die weiteren Arbeitsgänge entsprechen denen aus Beispiel 1.

Abschließend wird das selbstklebende Maßband einseitig mit einem Zackenschnitt versehen, um die besonders einfache Handeinreißbarkeit zu gewährleisten.

Auch hier wird dabei zuvor die selbstklebende Masse einer oben beschriebenen Prüfmethode für die Hautverträglichkeit unterzogen.

Patentansprüche

1. Verwendung eines dimensionsstabilen fotographischen Papierträgers aus einem beidseitig mit Polyolefinen beschichteten Papier oder einer dimensionsstabilen ungereckten Polypropylenfolie als Trägermaterial für ein selbstklebendes Maßband, wobei
auf die obere Seite des Trägermaterials eine Farbschicht aufgedruckt ist,
auf die Farbschicht eine Skalierung aufgedruckt ist,
auf die Skalierung ein Releaselack aufgebracht ist,
auf die untere Seite des Trägermaterials ein Primer aufgetragen und
auf dem Primer eine selbstklebende Beschichtung vorgesehen ist.
2. Verwendung nach Anspruch 1, dadurch gekennzeichnet, daß das selbstklebende Maßband rückstandsfrei vom Untergrund abzulösen und wiederverwendbar ist.
3. Verwendung nach den Ansprüchen 1 oder 2, dadurch gekennzeichnet, daß das selbstklebende Maßband eine Dicke von 20 µm bis 200 µm, insbesondere von 40 µm bis 150 µm, aufweist.
4. Verwendung nach den Ansprüchen 1 bis 3, dadurch gekennzeichnet, daß das selbstklebende Maßband, insbesondere das mit einer dimensionsstabilen ungereckten Polypropylenfolie als Trägermaterial, zumindest auf einer der seitlichen Kanten einen Zackenschnitt aufweist.
5. Verwendung nach den Ansprüchen 1 bis 4, dadurch gekennzeichnet, daß das Trägermaterial handeinreißbar ist.
6. Verwendung nach den Ansprüchen 1 bis 5, dadurch gekennzeichnet, daß das Trägermaterial beim bestimmungsgemäßen Gebrauch des selbstklebenden Maßbandes eine Längenänderung aufweist von weniger als 1 mm auf 1 m, insbesondere von weniger als 0,2 mm auf 1 m.
7. Verwendung nach Anspruch 1, dadurch gekennzeichnet, daß der fotographische Papierträger aus einem beidseitig mit wasserfestem Kunstharz überzogenen und wasserabweisend geleimten Papier besteht.
8. Verwendung nach den Ansprüchen 1 bis 7, dadurch gekennzeichnet, daß die selbstklebende Beschichtung eine Acrylatdispersion ist.
9. Verwendung nach den Ansprüchen 1 bis 8, dadurch gekennzeichnet, daß die selbstklebende Beschichtung hautverträglich und physiologisch unbedenklich ist.

Espacenet

Bibliographic data: EP0100138 (A2) — 1984-02-08

Measuring tape.

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Applicant(s): FISCO PRODUCTS LTD [GB] ± (FISCO PRODUCTS LIMITED)

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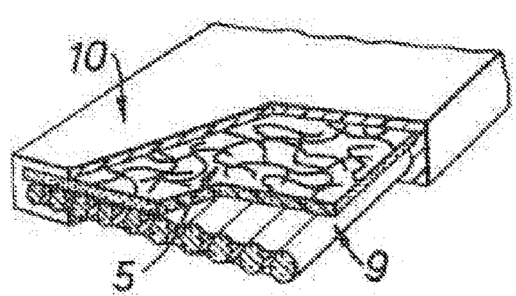
Abstract of EP0100138 (A2)

A measuring tape and a method of forming same in which glass yarn is used to form a longitudinal reinforcement layer and give dimensional stability to the tape and natural or artificial fibres in random order are combined with the glass yarn layer to give resistance to tearing and maintain flexibility.



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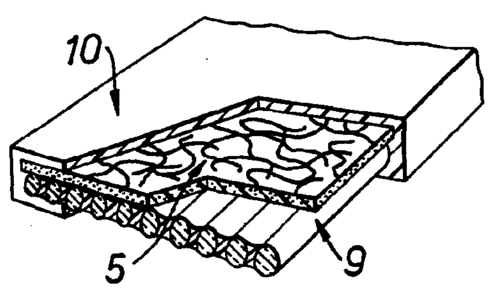
(54) Measuring tape.

(57) A measuring tape and a method of forming same in which glass yarn is used to form a longitudinal reinforcement layer and give dimensional stability to the tape and natural or artificial fibres in random order are combined with the glass yarn layer to give resistance to tearing and maintain flexibility.



EP 0 100 138 A2

TITLE

"Measuring tape"

INTRODUCTION

This invention relates to a measuring tape and to a method of forming a measuring tape.

PRIOR ART

Steel measuring tapes have been known for very many years and also linen or similar woven material covered in plastics has been used. In more recent years tapes made of glass fibre covered in plastics have been made. The plastics material used is normally polyvinyl chloride (PVC).

The incorporation of glass yarn (made up of strands) into the PVC of a measuring tape inhibits dimensional instability in the longitudinal direction but such tapes are prone to splitting in the longitudinal direction if the tape is snaged by, for example, a nail.

In order to avoid this longitudinal splitting of the tape, instead of longitudinal orientated yarn being incorporated in the PVC, a woven material has been incorporated. This material may be glass yarn for the warp threads and plastics filaments for the weft threads. This effectively prevents splitting but dimensional stability is poor.

It is also known to utilise so called 'non-woven' glass or other man-made fibres and possibly to utilise a bonding agent to provide a mat of such fibres arranged in random order. Such a mat exhibits great flexibility and strength and resistance to tearing.

OBJECT OF THE INVENTION

It is the main object of this invention to provide a measuring tape which has good dimensional stability and is resistant to tearing.

STATEMENTS OF INVENTION

According to the present invention there is provided a method of forming a measuring tape which includes combining glass yarn in parallel array with natural or artificial fibres in random order and providing on at least one face thereof a smooth plastics coating. Preferably the yarn and fibres are encased in a plastics covering. **The invention also includes the method as above** in which the yarn is combined with natural or artificial fibres in a bonding agent.

The invention also includes the method as above in which the glass yarn is established in its array by the use of a bonding agent to form a yarn layer, the fibres are established in their random order by bonding to form a fibre layer and the yarn and fibre layers are encased to form a lamination in a covering.

The invention further includes the method as above in which the glass yarn is established in its array by the use of a bonding agent to form a yarn layer, the fibres are established in random order by bonding to form two fibre layers and the yarn layer is sandwiched between the two fibre layers and the whole encased in a plastics covering.

Still further the invention includes the method as above and including establishing the glass yarn in its array by use of a bonding agent to form a yarn layer and encapsulating the yarn layer in a covering layer of plastics which incorporates natural or artificial fibres in random order.

Conveniently the covering is extruded around the yarn layer.

The fibre layer or layers may be composed of nylon, polyester, glass or carbon or other natural or artificial fibres in random order.

DRAWINGS

Figure 1 is a perspective view of a part of a known measuring tape incorporating glass yarn;

Figure 2 is a perspective view of a layer of PVC incorporating glass fibres in random order;

Figure 3 is a perspective view of glass yarn established in a layer by a bonding agent;

Figure 4 is a perspective view partly broken away to show the detail of a measuring tape constructed in accordance with the invention;

Figure 5 is a perspective view of a laminated pre-tape according to the invention;

Figure 6 is a perspective view partly broken away of a further embodiment of a measuring tape constructed in accordance with the invention; and

Figure 7 is a perspective view of an alternative form of pre-tape according to the invention.

SPECIFIC DESCRIPTION

Part of a conventional reinforced plastics measuring tape is illustrated in Figure 1 in which the tape 1 includes a plurality (in the order of forty) of glass yarns 2 which are encapsulated within a PVC covering 3, there being graduations 4 marked thereon. Such measuring tapes are quite well known.

Figure 2 illustrates a layer 5 in which natural or artificial fibres 6 are arranged in random order and incorporated within a PVC matrix 7. The fibre 6 may be incorporated within the PVC matrix 7 by any known technique, **for example by extruding or by moulding.**

Figure 3 illustrates a plurality of glass fibre yarns 2 similar to the yarns 2 of Figure 1 but in this instance the yarns have been adhesively secured together by a bonding agent 8 (although this is not essential) to form a glass yarn layer 9. Here again the layer 9 may be established by any known technique. The bonding agent may be as desired, for example, a plasticised PVC paste including stabilisers.

In accordance with the invention and referring now to Figure 4 a layer 5 made in accordance with the Figure 2 laminated with a layer 9 in accordance with Figure 3 and the two layers encapsulated in a PVC covering 10. This covering 10 may be established by any known technique, for example extruding or moulding. Instead of encapsulating the layers in the PVC, the plastics may be applied to one face or both faces as a coating.

It will be appreciated that the incorporation of the longitudinally extending yarn in layer 9 gives good dimensional stability to the tape and the incorporation of the random order fibres in layer 5 gives good strength and prevents splitting of the tape. At the same time adequate flexibility of the tape is achieved.

The layer or layers of random fibres may be established by the use of a bonding agent although, if the fibres are artificial, the layer or layers may be established simply by the use of heat and pressure.

An alternative embodiment is illustrated in Figure 5 in which a layer 9 in accordance with Figure 3 is sandwiched between two layers 5 in accordance with Figure 2. The three layer sandwich is then encapsulated in PVC by any known tecnique or faced on one or both faces with a coating of PVC

Yet a further embodiment is illustrated in Figure 6 in which a layer 9 of glass yarn in accordance with Figure 3 has formed around it by any known techinique, for example extrusion or moulding, an encapsulating covering 11 (or facing) which incorporates natural or artificial fibres 6 in random order in a similar manner to the layer 5 of Figure 2.

As an alternative method of construction, a pre-tape may be formed in accordance with Figure 7 in which longitudinal glass yarn 2 is combined with random natural or artificial fibres 6 in a bonding agent 8. This may be done by coating the yarn with a bonding agent and, while the agent is still uncured, passing the coated yarn through a container in which loose fibres are being circulated by hot air. Thus the yarn becomes coated with fibres and the bonding agent is cured.

CLAIMS

1. A method of forming a masuring tape which includes combining glass yarn in parallel array with natural or artificial fibres in random order and providing on at least one face thereof a smooth plastics coating.

2. The method as claimed in Claim 1, in which the glass yarn is established in its array by the use of a bonding agent to form a yarn layer, the fibres are established in their random order by bonding to form a fibre layer and the yarn and fibre layers are encased to form a lamination in a covering.

3. The method as claimed in Claim 1, in which the glass yarn is established in its array by the use of a bonding agent to form a yarn layer, the fibres are established in random order by bonding to form two fibre layers and the yarn layer is sandwiched between the two fibre layers and the whole encased in a plastics covering.

4. The method as claimed in Claim 1, in which the glass yarn is established in its array by the use of a bonding agent to form a yarn layer which is encapsulated in a covering layer of plastics which incorporates natural or artificial fibres in random order.

5. The method as claimed in any one of the preceding claims, in which the yarn is combined with natural or artificial fibres in a bonding agent.

6. The method of forming a measuring tape substantially as herein described with reference to Figures 4 or Figure 5 or Figure 6 or Figure 7 of the accompanying drawings.

7. A measuring tape when formed by the method as claimed in any one of the preceding claims.

8. A measuring tape as claimed in Claim 7, in which the natural or artifical fibres are composed of nylon, polyester, glass or carbon or other natural fibres.

FIG.1.

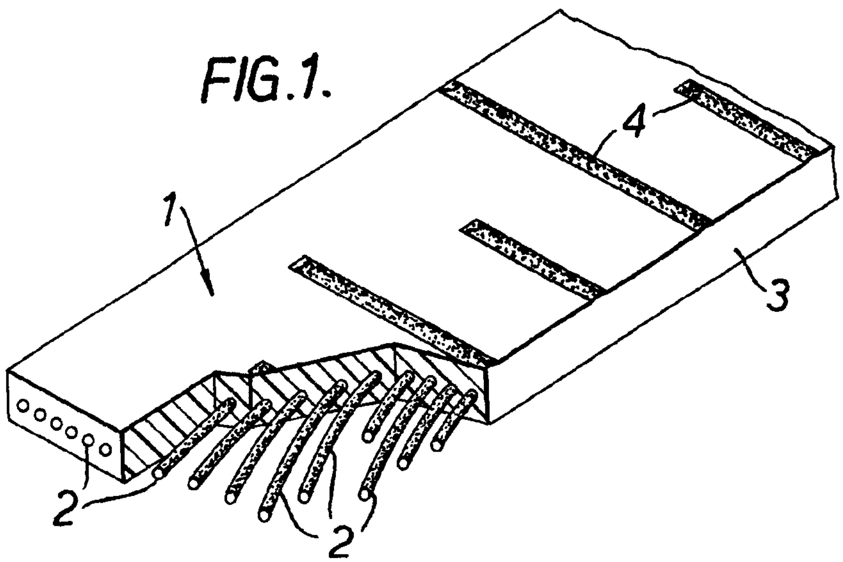


FIG.2.

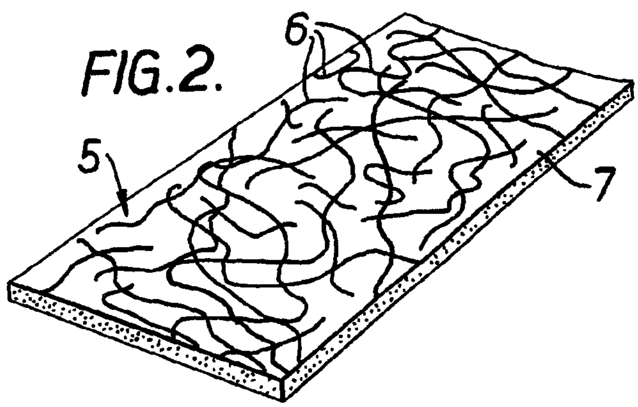


FIG.3.

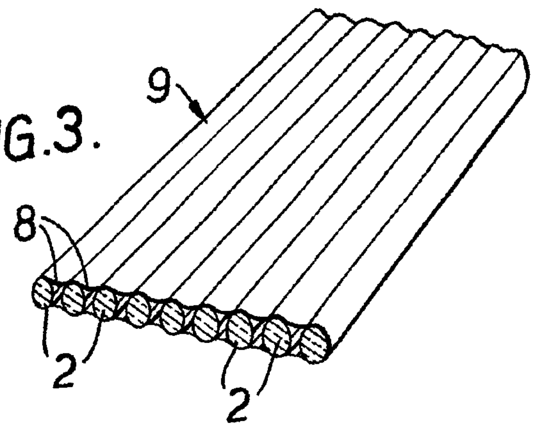


FIG.4.

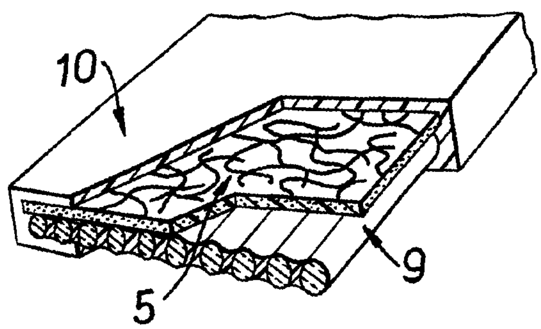


FIG.5.

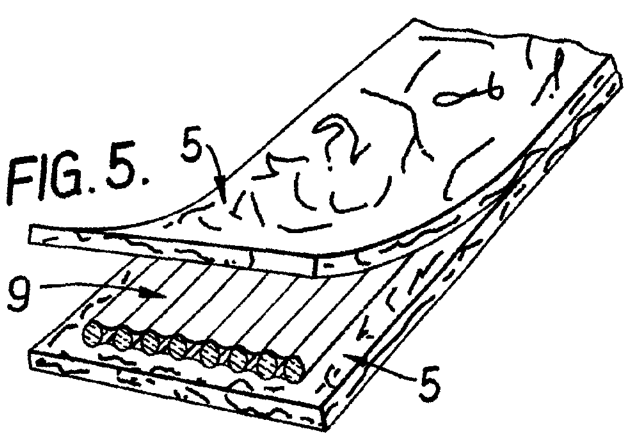


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FIG.6.

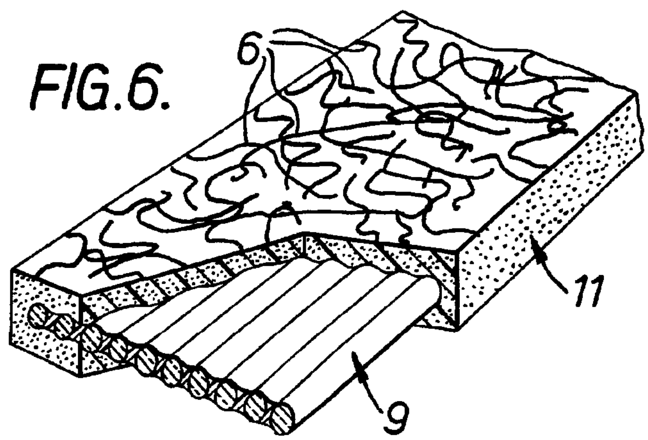
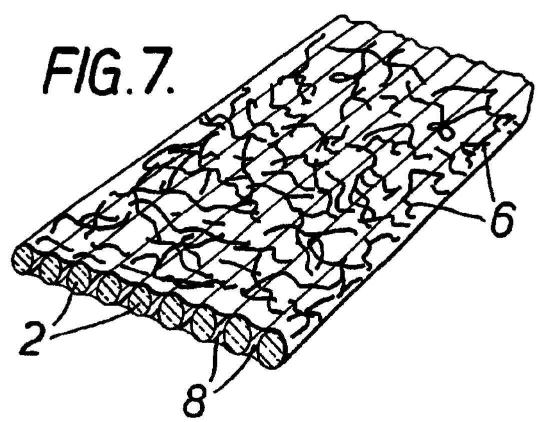


FIG.7.



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(54) **A structure of a measuring tape covered with polyester membrane thereon and the manufacturing method thereof**

(57) A structure of a measuring tape covered with polyester membrane thereon and the manufacturing method thereof are disclosed. The structure is composed of a thin measuring tape (10), a primer and a polyester membrane both formed on each tape surface. Both tape surfaces are brilliantly colored by coating with the primer thereon, then scale marks are printed thereon by a printing roller (25). Finally a 15μm thick polyester membrane (30) is formed on each tape surface by applying a thermal pressing force utilizing a pair of temperature rollers (36,38) at constant temperature of 150°C so as to offer the tape an anti-abrasive proprety and also ensure durability of the scale marks without exfoliating. The advantages of the present invention over the conventional technique are: falt and smooth tape surface, excellent anti-abrasive proprety and improved durability, good color matching between the primer and the scale marks thereby facilitating reading scale, and easy manufacturing with improved production efficiency and reduced product cost.

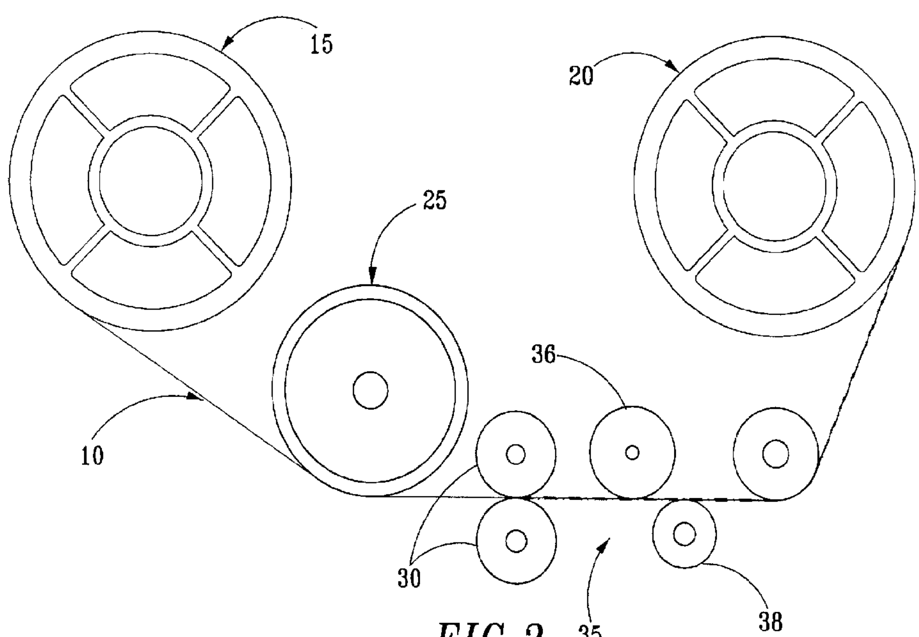

FIG.3

Description

BACKGROUND OF THE INVENTION

1. Field of the invention

[0001] The present invention relates to structure of measuring tape covered with polyester membrane thereon and the manufacturing method thereof, and more particularly, relates to the measuring tape mentioned above with enhanced anti-abrasive property, appreciably flat and smooth surface, able to be easily manufactured with low cost.

2. Description of the Prior Art

[0002] A measuring tape of a type rule is manufactured of a whole roll of thin tape through the steps of surface painting, printing scale marks thereon, irradiating light ray and drying. The friction resistant treatment for a conventional tape is generally performed after finishing the steps of printing scale marks and irradiating light ray. Here, the process of friction resistant treatment is accomplished b coating a layer of a transparent enamel paint on the surface of a tape for obtaining good appearance and enhancing anti-abrasive effect. However, there is a problem that a tape rule is frequently used, by drawing out and recoiling the tape hundreds of times, the tape will be abrased severely by frequent and forcible slide contact with the outlet edge of the ape on a tape rule. As a result, partial portion of a tape will be so worn out that the reading of scale marks thereof becomes vague whereby degrading measuring accuracy shortly afterwards. Anti-abrasive surface treatment for a conventional tape is incomplete!

[0003] Incidentally, manufacturers of tape rules soon discovered the fact that the anti-abrasive property of a tape will be improved to lengthen its life by coating a thin film on the tape surface, the usable materials include resin, fiber glass and nylon etc. But it is regretful that they discovered before long that no expected effect was obtained by using those materials. After a long time trials they discovered this time that applying polyester thin film coating on the tape surface might provide a far excellent anti-abrasive property for a tape than that provided by preciously used materials.

[0004] Polyester membrane has an excellent anti-corrosive property against acid and alkali, and moreover, is strongly resistant to grease and organic solvent invasion. The polyester membrane itself is self adhesive, and if associated with an appropriate heat and pressure, the polyester membrane is adhesive to a plurality of materials such as paper, PVC, copper, aluminum foil and iron. Therefore, as shown in Fig.1, the steps of conventional manufacturing method of a measuring tape formed with a polyester membrane thereon include:

1.laying out a whole roll of tape having an original metallic color;
2.attaching aluminum foils to both surfaces of the above mentioned tape;
3.printing scale marks on the aluminum foils attached to the surfaces of the tape;
4.forming a polyester membrane on each surface of the tape;
5.trimming, and removing burrs from both the aluminum foils and the polyester membranes;
6.returning the finished product of tape.

[0005] However, this conventional manufacturing method is too complicated because it requires the aid of a plurality of rollers, and has to go through with a tedious step of trimming, and removing burrs from the aluminum foils and process is intricate and the working time is prolonged. In addition, as bonding between the aluminum foil and the polyester membrane can not be perfect by allowing foam to exist therebetween, so that the product yield is reduced due to loosing surface flatness. Such a disadvantageous result is the most notorious defect that manufactures eagerly want to avert. Furthermore, the aluminum foil is used for enhancing the bonding force of the polyester membrane with the tape, but the visibility of scale marks printed on the grey aluminum foil is greatly influenced by the glare and shade made by incident light, and it causes the user of the tape difficult to read the numerals of the scale.

[0006] In order to eliminate the disadvantages and inconvenience inherent to the conventional technique mentioned above, the inventor of the present invention has carried out researches and trials for a long time concerning this matter, and succeeded in providing the present invention which is mow to be divulged hereinafter.

SUMMARY OF THE INVENTION

[0007] It is an object of the present invention to provide structure of a measuring tape covered with a polyester membrane thereon and the manufacturing method thereof having an excellent anti-abrasive property, and the polyester membrane is kept flatly and smoothly adhering to each tape surface so as to ensure improved tape durability.

[0008] It is another object of the present invention to provide the structure of the above mentioned measuring tape and the manufacturaing method thereof which is painted with a colored primer on each tape surface for the user of the tape to read scale marks thereon conveniently.

[0009] It is still another object of the present invention to provide the structure of the above mentioned measuring tape and the manufacturing method thereof which can be manufactured simply and efficiently to shorten production time.

[0010] To achieve these and other objects, gist of the present invention is directed to provide the manufacturing method in which including the steps of:

1.applying a primer on both surfaces of a tape having an original metallic color;
2.printing scale marks on both tape surfaces with a printing roller after painting the primer, then irradiating the tape with a light ray and drying it;
3.forming a glue containing polyester membrane on each tape surface by pressing with a pair of temperature rollers at a constant temperature of 150°C ;
4.returning the finished product of tape around the recoiling reel.

[0011] The whole roll of a tape is laid out and returned by incorporated operation of a sending reel and a recoiling reel. Between the above mentioned two reels there is a scale mark printing roller for printing the scale marks on the tape surfaces, and a pair of temperature rollers including an upper roller and a lower roller used for pressing glue containing polyester membranes delivered from an upper and a lower rolls on corresponding upper and lower tape surfaces firmly bonded such that foam can not exist therebetween. The tape surface is therefore maintained in smooth and flat state.

[0012] The surface of the upper roller is formed into an annular groove whose width being equal to that of the tape, whereas the width of the lower roller is smaller than that of the tape so that the step of trimming the tape edges and removing burrs can be performed simultaneously during proceeding the step of forming the polyester membrane on the tape. The structure of a finished tape comprises a tape with a primer and a polyester membrane formed on each tape surface.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The drawings disclose an illustrative embodiments of the present invention which serves to exemplify various advantages and objects hereof, and are as follow:

Fig. 1 is an approximate block diagram showing the steps of forming polyester membrane on a tape surface in a conventional technique;
Fig. 2 is an approximate block diagram showing the steps of forming polyester membrane on tape surface of the present invention;
Fig. 3 is a schematic layout of the components of apparatus used for the present invention;
Fig. 4 is an illustrative drawing showing the state of a pair of temperature rollers pressing the polyester membrane on a tape according to the present invention;
Fig. 5 is a drawing of a finished product of a tape according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0014] Hereinafter, the best mode for carrying out the present invention will be described more fully below with reference to attached drawing:

[0015] Referring to Fig.3 first, a whole roll of tape is applied a primer on both surfaces of a tape and the tape now becomes a colored tape 10. Then it is wound around a sending reel 15 which rotates associated with rotation of a returning reel 20 to recoil the finished product of tape. Next, the step of printing scale marks on the tape surfaces is carried out with a printing roller 25, then irradiating the tape 10 with a light ray and drying it. Then, a pair of rolled glue containing polyester membranes 30 are bonded firmly on the tape surfaces by pressing with a pair of temperature rollers 35 which is composed of an upper roller 36 and a lower roller 38 at a constant temperature of 150°C so that there are no foam produced between the tape surface and membrane. Finally, the finished product of tape 10 is returned to the recoiling reel 20.

[0016] Accordingly, as shown in the block diagram of Fig.2, the manufacturing method of the present invention comprises the steps of:

1.applying a primer on both surfaces of a tape having an original metallic color;
2.printing scale marks on both tape surfaces with the printing r oller after painting the primer, then irradiating the tape with a light and drying it;
3.forming a glue containing polyester membrane on each tape surface by pressing with a pair of temperature rollers at a constant temperature of 150°C ;
4.retruning the finished product of tape around the recoiling reel.

[0017] Comparing the above manufacturing process of the present invention with that of cited conventional technique shown in the block diagram of fi.gl, step 5, trimming, and removing burrs form both the aluminum foil and the polyester membrane for the conventional technique is not required for the present invention thereby contributing to simplifying the manufacturing process.

[0018] Now the reson why the step 5 for conventional technique is not required for the present invention will be explained as follows. Referring to Figs, 4 and 5, the surface of the upper temperature roller 36 is formed into an annular groove 37 whose width being equal to that of the tape 10, whereas the width of the lower temperature roller 38 is a little bit smaller than that of the tape 10 so that the step of trimming the tape edges and removing burrs can be preformed simultaneously during proceeding the step of forming the polyester membrane 30 on the tape 10.

[0019] Besides, it is beneficial to select a primer whose color well matches that of the scale marks on the tape. For example, the combination of a yellow primer with black scale marks may result in exhibiting a strong contrast which facilitates the user of the tape rule to read the scale correctly and quickly.

[0020] In all, the structure of the tape made according to the present invention comprises a tape with a primer and a polyester membrane formed on each tape surface. The tape made according to the present invention exhibits advantages which the tape made of a conventional technique can not cope with, those advantages are: flat and smooth tape surface, excellent anti-abrasive property and improved durability, good color matching between the primer and the scale marks thereby facilitating reading scale, and easily manufacturable with improved production efficiency and reduced product cost.

[0021] Many changes and modifications in the above described embodiment of the invention can, of course, be carried out without departing from the scope thereof. Accordingly to promote the progress in science and the useful arts, the invention is disclosed and is intended to be limited only by the scope of the appended claims.

Claims

1. A manufacturing method for structure of a measuring tape covered with polyester membrane thereon comprising the steps of:

   (1)applying a primer on each surface opf a tape having an original metallic color;
   (2)printing scale marks on both tape surfaces with a printing roller after printing the primer, then irradiating the tape with a light ray and drying it;
   (3)forming a glue containing polyester membrane on each tape surface by pressing with a pair of temperature rollers;
   (4)returning the finished product of tape around a recoiling reel.

2. The manufacturing method as claimed in claim 1, wherein said pair of temperature rollers are kept at a constant temperature of 150°C.

3. The manufacturing method as claimed in claim 1, wherein the surface of the upper roller of said pair of temperature rollers is formed into an annular groove.

4. The manufacturing method as claimed in claim 3, wherein the width of said annular groove formed on the surface of said upper roller is equal to that of said tape.

5. The manufacturing method as claimed in claim 1, wherein the thickness of said polyester membrane is 15μm.

6. The manufacturing method as claimed in claim 1, wherein said polyester membrane is applied to both surfaces of said tape.

7. The manufacturing method as claimed in claim 1, wherein said polyester membrane is adhered to the surface of said tape by means of thermal pressing force exerted by said pair of temperature rollers.

8. Structure of a measuring tape covered with polyester membrane comprising:

   a thin measuring tape;
   a primer formed on each tape surface; and
   a polyester membrane formed on each tape surface,
   both surfaces of said tape are brilliantly colored by coating with said primer thereon, then scale marks are printed further thereon, finally a polyester membrane is formed on each tape surface so as to offer said tape an anti-abrasive property and also ensure durability of sad scale marks on said tape without exfoliating.

9. The structure of a measuring tape as claimed in claim 8, wherein the thickness of said polyester membrane is 15μm.

10. The structure of a measuring tape as claimed in claim 8, wherein said polyester membrane is applied to both surfaces of said tape.

11. The structure of a measuring tape as claimed in claim 8, wherein the color of said primer is yellow.

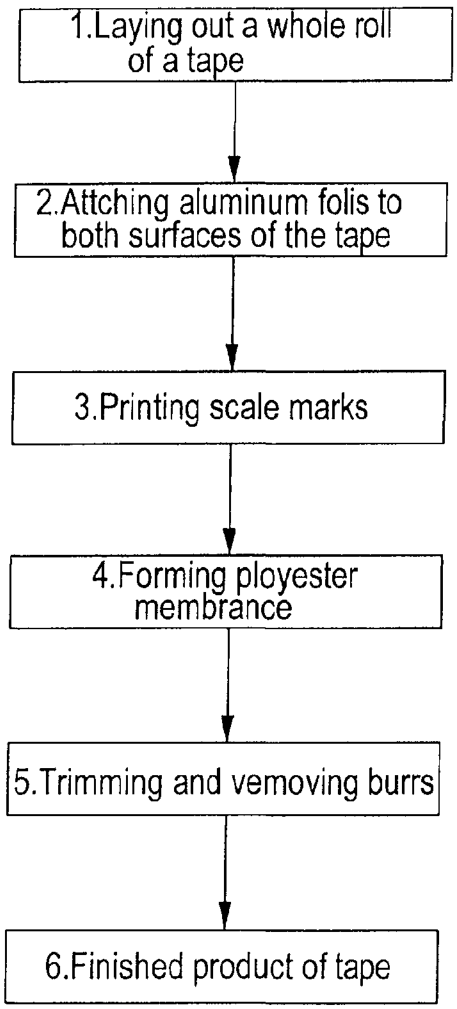
1.Laying out a whole roll of a tape
2.Attching aluminum folis to both surfaces of the tape
3.Printing scale marks
4.Forming ployester membrance
5.Trimming and vemoving burrs
6.Finished product of tape

FIG. 1

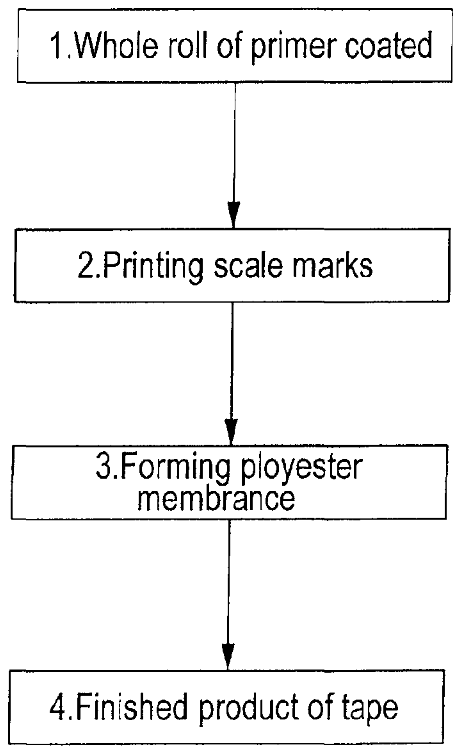
1.Whole roll of primer coated
2.Printing scale marks
3.Forming ployester membrance
4.Finished product of tape

FIG. 2

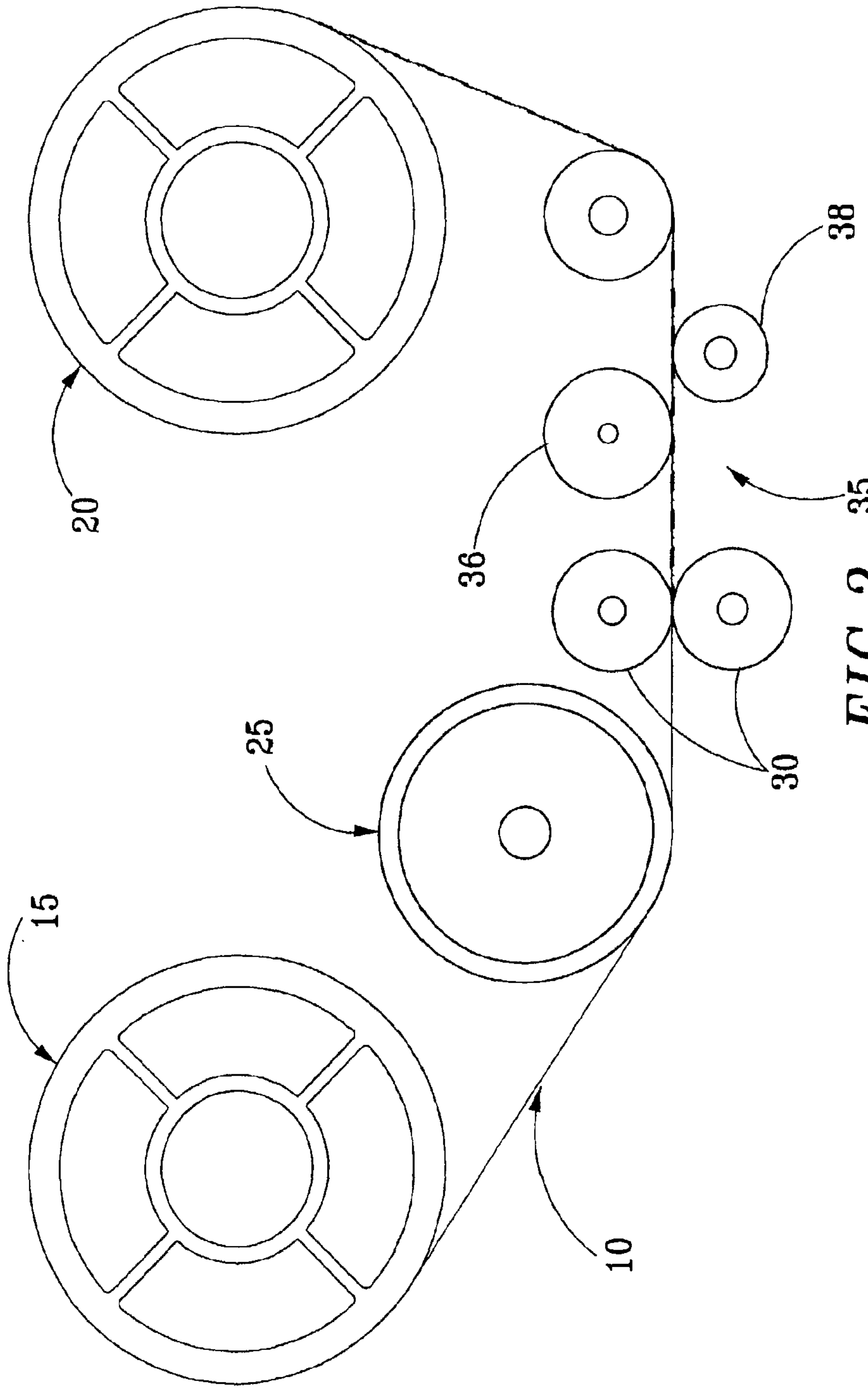

FIG.3

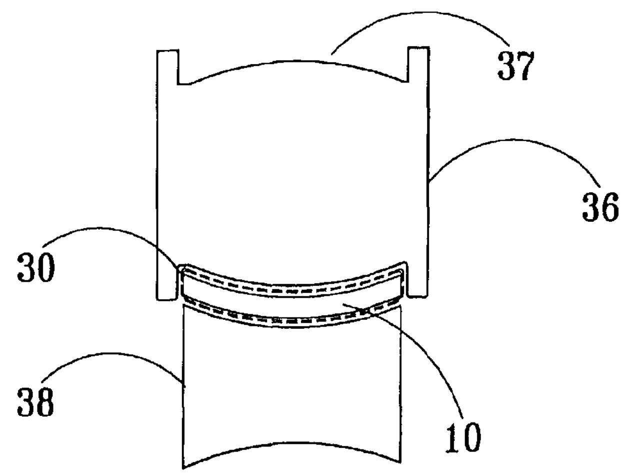

FIG.4

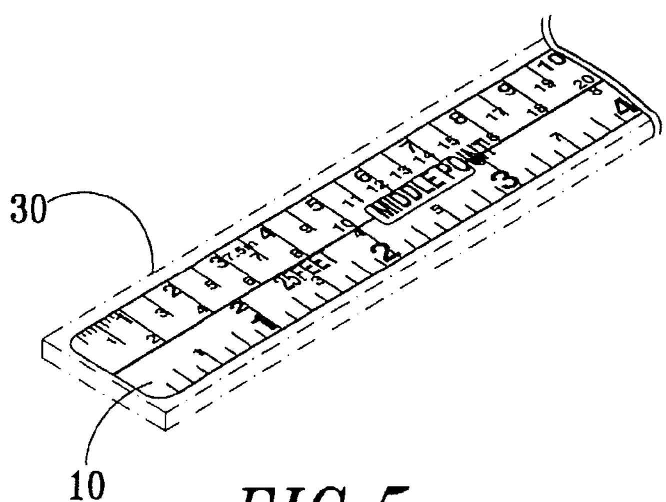

FIG.5

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 02 3020

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 6 440 502 B1 (LEE SHIH-LIN) 27 August 2002 (2002-08-27) * column 2, line 49 - column 3, line 10; figure 2 *	1-11	G01B3/10 B32B15/08
X	US 2001/053436 A1 (LI SHIH LIN) 20 December 2001 (2001-12-20) * page 2; figures 2,3 *	1-11	
X	US 5 738 743 A (LEE SHIH TUNG) 14 April 1998 (1998-04-14)	8-11	
A	* column 2, line 22 - column 3, line 65; figures 1,2 *	1-7	
X	GB 1 318 778 A (ROBONE CHESTERMAN LTD) 31 May 1973 (1973-05-31)	8-11	
A	* page 1, line 46 - page 2, line 32; figures 1,2 *	1-7	
X	US 5 895 539 A (HSU CHENG-HUI) 20 April 1999 (1999-04-20)	8-11	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
A	* column 1, line 62 - column 2, line 46; figures 1-3 *	1-7	G01B B32B
X	DE 21 42 499 A (KELLER BAYER MASS IND) 15 March 1973 (1973-03-15)	8-11	
A	* page 6 - page 7; figures 1-6 *	1-7	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	24 March 2003	Beyfuß, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
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(54) **Rule assembly with blade standout**

(57) A retractable rule assembly (10) includes a housing assembly (12) and a reel (14) rotatably mounted in the housing assembly. An elongated blade (16) formed of a ribbon of metal having one end connected to the reel is constructed and arranged with respect to the housing assembly to extend from a position tangential to the reel outwardly through a spaced opening (22) in the housing assembly. A coil spring (32) formed of a ribbon of metal has a construction and arrangement between the housing assembly and the reel to rotate the reel in the housing assembly in a direction to wind up the elongated blade when extending outwardly of the housing assembly opening in a normal concavo-convex cross-sectional configuration onto the reel in an abutting volute coil formation in a flattened cross-sectional configuration. A blade holding assembly is constructed and arranged to be manually actuated to hold the blade in any position of extension outwardly of the housing assembly opening and to release the blade from any position in which it is held. The blade has a blade width, thickness and height of concavo-convex curvature sufficient to enable the blade to stand out arcuately a length measured along the blade of at least 10.5 feet (approximately 3.2 m) with a horizontal linear length of standout thereof being greater than 97% of the arcuate length of standout.

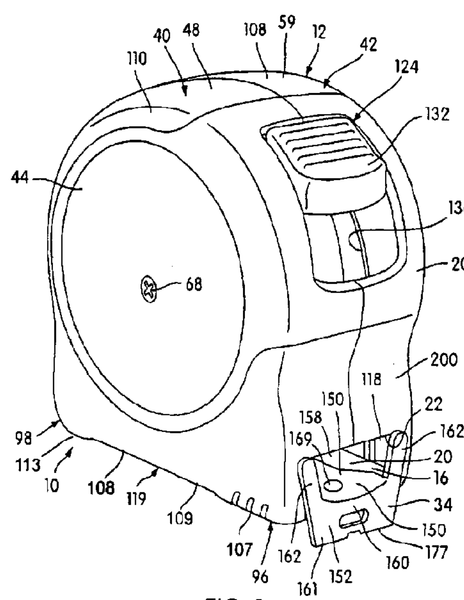

FIG. 1

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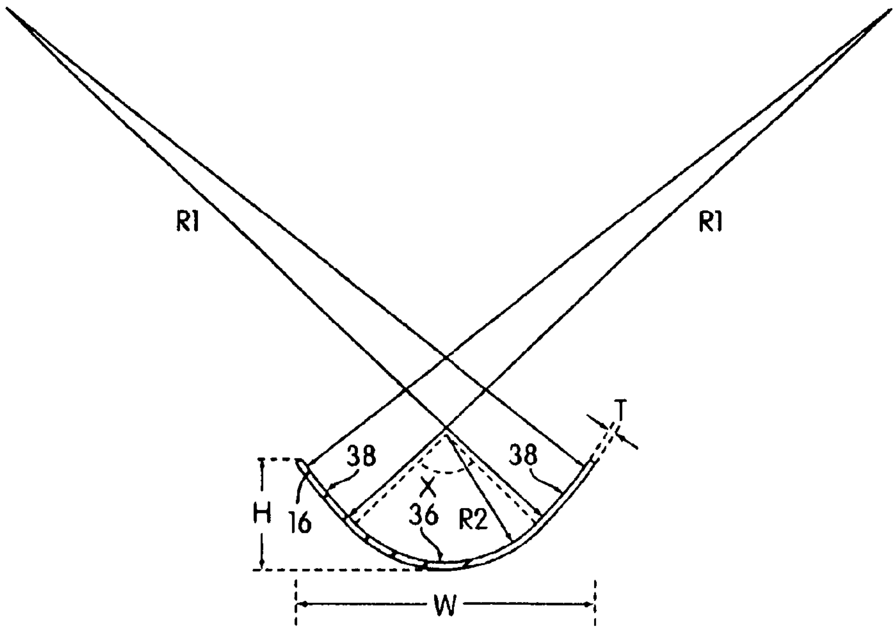

FIG. 7

Description

[0001] The present invention is generally related to retractable tape rule assemblies and more particularly to tape rule assemblies of the spring retractable type.

[0002] Spring retractable rule assemblies have been available commercially for many years. One of the most desirable characteristics commercial rule assemblies can possess is a relatively long blade standout. To date, as a practical matter, that standout length of most blades has rarely exceeded 7 feet (approximately 2.1 m) or at most approximately 9 feet (approximately 2.7 m). Standout is generally measured by the length of the rule assembly blade that can be extended in a self-sustaining manner without the blade buckling under its own weight. An important characteristic of standout relates to the vertical bend that the blade takes in its maximum self-sustained extension. This is generally expressed in terms of the height the housing assumes from a horizontal surface when the free end of the blade is just touching the horizontal surface. The vertical height of the housing above the horizontal surface, the position at which the free end of the blade touches the horizontal surface and the vertical projection of the position of the housing onto the horizontal surface roughly define three points of a right angle triangle. The hypotenuse of the triangle represents a close approximation of the actual length of the blade extending from the housing and the horizontal leg of the triangle represents the linear horizontal extension of the blade. It is generally recognised to be desirable to maintain the ratio between the linear horizontal extension to the actual extension as near to one as possible. There always exists a need to provide a retractable rule assembly that will provide greater standout with a greater ratio of linear horizontal standout to actual standout.

[0003] An objective of the present invention is to fulfil the need expressed above.

[0004] In accordance with the present invention in one aspect there is provided a retractable rule assembly comprising a housing assembly; a reel rotatably mounted in said housing assembly; an elongated blade formed of a ribbon of metal having one end connected to said reel constructed and arranged with respect to said housing assembly to extend from a position tangential to said reel outwardly through a spaced opening in said housing assembly; a coil spring formed of a ribbon of metal having a construction and arrangement between said housing assembly and said reel to rotate said reel in said housing assembly in a direction to wind up the elongated blade when extending outwardly of said housing assembly opening in a normal concavo-convex cross-sectional configuration onto said reel in an abutting volute coil formation in a flattened cross-sectional configuration; and a blade holding assembly constructed and arranged to be manually actuated to hold the blade in any position of extension outwardly of said housing assembly opening and to release the blade from any position in which it is held;

the retractable rule assembly including any one or more of the following features, namely:-

(i) said blade having a blade width, thickness and height of concavo-convex curvature sufficient to enable the blade to stand out arcuately a length measured along the blade of at least 10.5 feet (approximately 3.2 m) with a horizontal linear length of standout thereof being greater than 97% of the arcuate length of standout; and/or

(ii) said elongated blade having a width in the flattened configuration thereof having a dimension within the range of 1.10" - 1.5" (approximately 2.8 to 3.8 cm), a height in the concavo-convex configuration thereof having a dimension within the range of 0.25"-0.40" (approximately 0.6 to 1.0 cm) and a thickness in either configuration thereof having a dimension within the range of 0.0045" to 0.0063" (approximately 0.011 to 0.016 cm);
and/or

(iii) wherein the concavo-convex cross-sectional configuration of said blade includes an arcuate central section having a predetermined radius of curvature and integral arcuate end sections each having the same radius of curvature, the radius of curvature of said central section being a dimension within the range of 0.30" to 0.60" (approximately 0.8 to 1.5 cm) and the radius of curvature of said end section being a dimension within the range of 1.0" to 5.0" (approximately 2.5 to 12.7 cm).

[0005] In accordance with the present invention in another aspect there is provided a retractable rule assembly comprising a housing assembly; a reel rotatably mounted in said housing assembly; an elongate blade having one end connected to said reel and being arranged to extend from said reel outwardly through an opening in said housing assembly for use; a coil spring coupled between said housing assembly and said reel and arranged to rotate said reel in said housing assembly in a direction to wind up the elongate blade onto said reel for storage; the blade being formed so as to have a flattened cross-sectional configuration when wound on the reel and to have a concavo-convex cross-sectional configuration when extending outwardly of said housing assembly opening in normal use, the concavo-convex cross-sectional configuration having a height measured as the perpendicular distance between the apex of the blade and a line joining the side edges of the blade; and a blade holding assembly arranged to be manually actuated to hold the blade in any position of extension outwardly of said housing assembly opening and to release the blade from any such position in which it is held; the blade being formed so as to be capable of extending unsupported from the housing in an arcuate standout configuration having a horizontal linear length of standout measured as the horizontal dis-

tance between the said opening and the distal end of the blade;
the retractable rule assembly including any one or more of the following features, namely:-

(i) that said blade has a blade width, thickness and height of concavo-convex curvature sufficient to enable the blade to stand out for an arcuate length measured along the blade of at least 10.5 feet (approximately 3.2 m) with a horizontal linear length of standout greater than 97% of the arcuate length of standout
and/or

(ii) that said elongated blade has a width in the flattened configuration thereof having a dimension within the range of 1.10" - 1.5" (approximately 2.8 to 3.8 cm), a height in the concavo-convex configuration thereof having a dimension within the range of 0.25" - 0.40" (approximately 0.6 to 1.0 cm) and a thickness in either configuration thereof having a dimension within the range of 0.0045" to 0.0063" (approximately 0.011 to 0.016 cm)
and/or

(iii) that the concavo-convex cross-sectional configuration of said blade includes an arcuate central section having a predetermined radius of curvature and integral arcuate end sections each having the same radius of curvature, the radius of curvature of said central section being a dimension within the range of 0.30" to 0.60" (approximately 0.8 to 1.5 cm) and the radius of curvature of said end section being a dimension within the range of 1.0" to 5.0" (approximately 2.5 to 12.7 cm).

[0006] In accordance with one preferred combination of features, there may be provided in accordance with the present invention a retractable rule assembly that includes a housing assembly and a reel rotatably mounted in the housing assembly. An elongated blade formed of a ribbon of metal is mounted on the reel. One end of the blade is connected to the reel. The blade is constructed and arranged with respect to the housing assembly to extend from a position tangential to the reel outwardly through a spaced opening in the housing assembly. A coil spring that is formed of a ribbon of metal has a construction and arrangement between the housing assembly and the reel to rotate the reel in the housing assembly in a direction to wind the elongated blade about the reel when the blade is extending outwardly of the housing assembly opening. The blade has a "normal" concavo-convex cross-sectional configuration when extended and has a flat cross-sectional configuration when it is wound about the reel so that the wound reel is disposed about the reel in an abutting volute coil formation. A blade holding assembly is provided which is manually actuated to hold the blade in any position of extension outwardly of the housing assembly opening and to release the blade from any position in which it is held. The blade has a blade width, thickness and height of concavo-convex curvature sufficient to enable the blade to stand out arcuately a length measured along the blade of approximately 11 feet (approximately 3.4 m) with a horizontal linear length of standout thereof greater than 97% of the arcuate length of standout.

[0007] Preferably, the width of the elongated blade in its flattened configuration is within the range of 1.10" - 1.5" (approximately 2.8 to 3.8 cm); the height of the elongated blade in its concavo-convex configuration is within the range of 0.25"-0.40" (approximately 0.6 to 1.0 cm); and the thickness of the elongated blade in either configuration thereof is within the range of 0.0045" to 0.0063" (approximately 0.011 to 0.016 cm).

[0008] The geometry of the cross-section of the extended blade is also important in increasing blade standout. Preferably, the concavo-convex cross-sectional configuration of the elongated blade includes an arcuate central section having a predetermined radius of curvature and integral arcuate end sections each having the same radius of curvature (i.e., the radius of curvature of one integral arcuate end section is equal to the radius of curvature of the opposite integral arcuate end section); preferably, the radius of curvature of the central section is a dimension within the range of 0.35" to 0.60" (approximately 0.8 to 1.5 cm) and the radius of curvature of each end section is a dimension within the range of 1.0" to 5.0" (approximately 2.5 to 12.7 m).

[0009] In some preferred forms it can be arranged that the radius of curvature of said central section is a dimension within the range of 0.40" to 0.50" (approximately 1.0 to 1.3 cm) and the radius of curvature of said end section is a dimension within the range of 2.0" to 4.0" (approximately 5.1 to 10.2 cm).

[0010] Preferably the metal ribbon of said spring has a width which is 95%-120% of the width of the metal ribbon of said blade in its flattened configuration, more preferably the metal ribbon of said spring is 100% - 110% of the width of the metal ribbon of the blade. It is preferred that said housing assembly does not substantially exceed 3.65" (approximately 9.3 cm) in height, more preferably that said housing assembly does not substantially exceed 3.25" (approximately 8.3 cm) in height.

[0011] In one preferred form, it may be arranged that said holding assembly includes a holding member mounted on said housing assembly for arcuate movement in opposite directions between a normally inoperative position and a holding position, said holding member having (i) an interior free end movable into wedging engagement with the tangentially extending portion of said blade to hold the same against an interior holding surface in the housing assembly when said holding member is in said holding position and (ii) an exterior thumb engaging portion configured to be moved digitally to move said holding member from the normally operative position thereof to the holding position thereof, said interior free end portion including a central recess of a width to operatively accommodate the width of said mounting portion of said hook member.

[0012] In some preferred forms, the thickness of the metal ribbon of said spring (32) is 0% - 25% thinner than the thickness of the metal ribbon of the blade.

[0013] Conveniently it may be arranged that the height of the housing assembly does not substantially exceed 3.65 inches (approximately 9.3 cm) for a blade length that is at most approximately 33 feet (approximately 10 m), wherein the height of the housing assembly does not substantially exceed 3.45 inches (approximately 8.76 cm) for a blade length that is at most approximately 30 feet (approximately 9 m), and wherein the height of the housing assembly does not substantially exceed 3.25 inches (approximately 8.3 cm) for a blade length that is at most approximately 8 meters.

[0014] Further preferred forms include a retractable rule assembly wherein said elongated blade has a width in the flattened configuration thereof having a dimension within the range of 1.10" - 1.5" (approximately 2.8 to 3.8 cm), a height in the concavo-convex configuration thereof having a dimension within the range of 0.25"-0.40" (approximately 0.6 to 1.0 cm) and a thickness in either configuration thereof having a dimension within the range of 0.0045" to 0.0063" (approximately 0.011 to 0.16 cm) and wherein said blade stands out arcuately a length measured along the blade of from at least 10.5 feet (approximately 3.2 m) up to approximately 13 feet (approximately 4 m).

[0015] In a particularly preferred arrangement said elongated blade has a width in the flattened configuration thereof having a dimension within the range of 1.25" - 1.39" (approximately 3.17 to 3.53 cm), a height in the concavo-convex configuration thereof having a dimension within the range of 0.30"-0.35" (approximately 0.76 to 0.89 cm) and a thickness in either configuration thereof having a dimension within the range of 0.005" to 0.0056" (approximately 0.013 to 0.014 cm). Conveniently, said elongated blade has a width of approximately 1.25" (approximately 3.17 cm), a height in the concavo-convex configuration thereof approximately of 0.32" (approximately 0.81 cm) and a thickness in either configuration thereof of approximately 0.0051" (approximately 0.013 cm).

[0016] It is contemplated to provide a wide range of tape assembly embodiments having increased blade standout. More particularly, in the more specific aspects of the present invention, it is a further objective to provide a retractable rule assembly having a blade constructed according to any one or more of the features or the principles briefly described above to provide any one or more of the improved standout characteristics previously described with any combination of the following additional features:

1. A retractable rule assembly wherein a relatively short free end portion of the blade has a clear film of plastic material adhered to a concave side thereof.

2. A retractable rule assembly wherein the metal ribbon of the spring has a width which is 95%-120% of the width of the metal ribbon of the blade.

3. A retractable rule assembly wherein the blade has an end hook member on the free end thereof, the end hook member being formed of sheet metal of a predetermined thickness to include a concavo-convex mounting portion having a U-shaped hook portion bent at a generally right angle from an end thereof, the end hook member being mounted on the free end of the blade with the mounting portion thereof secured in limited sliding engagement with a concave side of the free end of the blade so that the rule can be measured externally from an exterior surface of the U-shaped hook portion or internally from an interior surface of the U-shaped hook portion, the U-shaped hook portion including a bight section extending transversely from a convex side of the free end of the blade and spaced leg sections extending beyond transversely spaced corners of the free end of the blade.

4. A retractable rule assembly wherein the housing assembly includes a pair of cooperating housing members, each including an end wall having a peripheral wall extending from a periphery thereof and terminating in a free edge, the housing members being fixed together with their free edges interengaged by a plurality of bolts extending through one of the housing members and threadedly engaged in the other at spaced positions adjacent the peripheral walls thereof and by a fixed reel spindle having a non-circular interengaging recess-projection connection at each end thereof with the central interior of the adjacent end wall, each end of the spindle being interiorly threaded to threadedly receive a bolt therein extending through a central hole in the adjacent end wall and the recess-projection connection between the central hole and threaded interior.

5. A retractable rule assembly wherein the housing assembly includes a fitment defining a part of the housing assembly opening adjacent a convex side of the blade, the fitment having a plurality of tangentially extending transversely spaced elongated ridges defining surfaces for engaging the convex side of the blade extending tangentially from the reel to said housing assembly opening.

6. The housing assembly includes a bottom wall having an exterior portion at an end position adjacent the housing assembly opening which projects below the exterior surface portion extending therefrom toward an opposite end to provide a finger grip enhancing configuration.

7. The housing opening has a height dimension which exceeds the height dimension of the blade an amount that is at least approximately equal to the amount the hook portion extends below the bottom end surface of the housing assembly at the housing opening.

[0017] In the broader aspects of the present invention, it is an objective to provide any known retractable rule assembly with improved blade standout by constructing a blade therefor to have the blade cross-sectional geometry briefly described above and/or the blade dimensions as previously described.

[0018] Embodiments of the invention will now be described by way of example with reference to the accompanying drawings in which:

FIG. 1 shows a perspective view of a tape rule assembly constructed according to the principles of the present invention;
FIG. 2 shows a front of elevational view of the tape rule assembly;
FIG. 3 shows a side of elevational view of the tape rule assembly;
FIG. 4 shows a cross-sectional view of the tape rule assembly taken through the line 4-4 in FIG. 2 showing a blade thereof in a fully retracted configuration;
FIG. 5 is a view similar to FIG. 4 except showing the blade in a fully extended configuration;
FIG. 6 is a cross-sectional view taken through the line 6-6 in FIG. 3;
FIG. 7 is a transverse cross-sectional view taken through a portion of the extended blade;
FIG. 8 is a transverse cross-sectional view taken through a portion of the blade when the blade is in a flattened configuration;
FIG. 9 is a table showing a comparison of the construction and standout characteristics of a plurality of exemplary prior art tape rule assemblies with an embodiment of the tape rule assembly constructed according to the principles of the present invention;
FIG. 10 is a schematic representation of an extended tape blade extending from a housing assembly to illustrate the linear length-out, arcuate length-out of the blade and the rotational angle of the housing assembly; and
FIG. 11 is a cross-sectional view of a fragment of the tape rule assembly taken through the line 11-11 of FIG. 4.

[0019] FIGS. 1-3 show an exterior view of a retractable rule assembly that is generally designated 10 and is constructed according to an embodiment of the present invention. The rule assembly 10 includes a housing assembly 12 and a reel 14 that is rotatably mounted inside the housing assembly 12 (best seen in the cross-sectional views of FIGS. 4-6). The reel 14 is mounted in the housing assembly 12 by a reel spindle 15 that is secured within the housing assembly 12 (FIGS. 4-6). An elongated tape rule blade 16 is mounted on the reel 14.

[0020] The blade 16 is formed of a ribbon of metal, the preferred metal being steel, and the top concave surface of the blade is printed with measuring lines and digits (not shown) for measuring lengths and distances. One longitudinal end 18 of the blade 16 is connected to the reel 14 and a second longitudinal free end 20 of the blade 16 extends generally outwardly of the reel 14. The blade 16 is constructed and arranged with respect to the housing assembly 12 to extend generally from a position tangential of the reel 14 outwardly through a spaced opening 22 provided in the housing assembly 12 (as shown, for example, in FIG. 4).

[0021] Preferably the reel 14 is made of a molded plastic and is provided with slots or openings 24, 26 in a central cylindrical wall portion 28 thereof. The one end 18 of the blade terminates in a hook-like structure 30 that hookingly engages an edge of the wall portion 28 of the reel 14 at opening 24 to connect the end 18 of the blade 16 to the reel 14 (FIGS. 4, 5).

[0022] A coil spring 32 has a construction and arrangement between the housing assembly 12 and the reel 14 to rotate the reel 14 with respect to the housing assembly 12 in a direction to wind the elongated blade 16 about the reel when the blade 16 is extending outwardly of the housing assembly opening 22. The coil spring 32 is generally enclosed within the central wall portion 28 of the reel 14 (FIGS. 4-6). One longitudinal end 35 of the coil spring 32 hookingly engages an edge of the wall portion 28 of the reel 14 that defines the opening 26; a second longitudinal end 37 of the blade 16 hookingly engages the spindle 15. The spindle 15 is rigidly mounted to the housing assembly 12 in a manner considered in detail below. Preferably the spring 32 is a thin, flat ribbon of metal, the preferred metal being steel.

[0023] The blade 16 is generally movable between a fully retracted position outwardly of the housing assembly 12 to a fully extended position. The fully retracted position of the blade 16 is shown in FIG. 4 and the fully extended position of the blade is shown (in fragmentary view) in FIG. 5. It can be appreciated from a comparison of FIG. 4 and FIG. 5 that as the blade is unwound from the reel 14, the coil spring 32 is wound around the rigidly fixed spindle 15. This winding of the spring around the spindle stores energy in the spring to provide spring powered rewinding of the blade 16 around the reel 14 when the extended blade is released.

[0024] The blade 16 is constructed of a ribbon of sheet metal that is shaped during the manufacturing to have a normal or memory configuration that has a generally arcuate or concavo-convex transverse cross-section. When a portion of the blade 16 is wound about the reel 14, the wound portion has a flat transverse cross-section (FIGS. 6 and 8) and the wound layers of the coiled blade provide the wound blade with an abutting volute coil configuration. A representative transverse cross-section of the extended blade 16 showing its concavo-convex configuration is illustrated in FIG. 7. It can therefore be understood from a comparison of FIGS. 4-5 (and from a comparison of FIGS. 7-8) that when the blade 16 is wound around the reel 14, it has the flat cross-section of FIG. 8 and when the blade 16 is withdrawn from the housing assembly 12 to measure an object, it returns to the concavo-convex cross-section shown in FIG. 7. Thus, the coil spring 32 is constructed and arranged between the housing assembly 12 and the reel 14 to rotate the reel 14 about the spindle with respect to the housing assembly 12 in a direction to wind up the elongated blade 16 when extending outwardly of the housing assembly opening 22 in a normal concavo-convex cross-sectional configuration onto the reel 14 in an abutting volute coil formation in a flattened cross-sectional configuration. The concavo-convex cross-section provides the extended blade with rigidity and maintains the blade essentially straight in the longitudinal direction.

[0025] The concavo-convex cross-section of the blade generally provides the unsupported blade 16 with blade standout. As described in greater detail below, the blade 16 has a blade width, thickness and height of concavo-convex curvature sufficient to enable the blade 16 to standout arcuately a length measured along the blade of at least 10.5 feet with a horizontal linear length of standout thereof that is greater than 97 percent of the arcuate length of standout. As also described in greater detail below, the concavo-convex transverse cross-section of the blade 16 is provided with a geometry that also improves blade standout.

[0026] Generally, one skilled in the art will understand that the length of blade standout depends on many factors, including (but not limited to) blade width (i.e. the transverse width of the blade measured when the blade is in its flattened condition shown, for example, in FIG. 8 and designated F); the height of the blade 16 in the concavo-convex configuration (designated H in FIG. 7); blade thickness (designated T in FIG. 7); and the geometry of the blade transverse cross-section when the same is in its normal concavo-convex than configuration. Preferably, the blade 12 has a width in the flattened condition thereof having a dimension within the broad range of from approximately 1.10 inches to approximately 1.5 inches; a height H in the concavo-convex configuration thereof having a dimension within the broad range of approximately 0.25 inch to approximately 0.40 inch; and a thickness in either configuration thereof having a dimension within the broad range of approximately 0.0045 inch to approximately 0.0063 inch. More preferably, the blade 12 has a width in the flattened condition thereof having a dimension within the narrower range of from approximately 1.25 inches to approximately 1.39 inches; a height H in the concavo-convex configuration thereof having a dimension within the narrower range of approximately 0.30 inch to approximately 0.35 inch; and a thickness in either configuration thereof having a dimension within the narrower range of approximately 0.005 inch to approximately 0.0056 inch. Most preferably the blade 16 width is approximately 1.25 inch, the blade height H is approximately 0.32 inch and the blade thickness T is approximately 0.0051 inch. A blade constructed according to these embodiments has a blade standout of up to approximately 13 feet. More specifically, a blade construction having dimensions within the broadest ranges identified immediately above for the width F, height H and thickness T can have a blade standout in the preferred broad range of at least 10.5 feet to approximately 13 feet; a blade construction having dimensions within the more preferred narrower ranges identified immediately above for the width F, height H and thickness T can have a blade standout in the range of at least 10.5 feet to approximately 12.5 feet; and a blade construction having the most preferred dimensions identified immediately above for the width F, height H and thickness T has a blade standout of approximately 11 feet.

[0027] The concavo-convex cross-section of the blade 16 has a unique geometry (shown in FIG. 7) that increases in the standout ability. The concavo-convex cross-sectional configuration of the blade 16 includes an arcuate central section 36 and integral arcuate end sections 38. Each arcuate end section 38 has the same radius of curvature (indicated for one of the two end sections 38 in FIG. 7 by the line designated R1). The central section 36 has a radius of curvature designated R2 (FIG. 7). The radii of curvature R1 for the two end sections 38 are greater than the radius of curvature R2 of the central section 36. The central section having a radius R2 extends through an angular extent designated X in FIG. 7. Preferably angle X is approximately 84 degrees.

[0028] Preferably the arcuate central section 36 has a radius of curvature R2 that is a dimension within the broad range of approximately 0.30" to approximately 0.60"; and the radius of curvature R1 of each end section 38 is a dimension within the broad range of approximately 1.0" to approximately 5.0". More preferably the arcuate central section 36 has a radius of curvature R2 that is a dimension within the narrower range of approximately 0.40" to approximately 0.50" and the radius of curvature R1 of each end section 38 is a dimension within the narrower range of approximately 2.0" to approximately 4.0". Most preferably, the arcuate central section 36 has a radius of curvature R2 of approximately 0.46" and the radius of curvature of each end section R1 is approximately 3.0".

[0029] The transverse cross-sections of prior art tape blades are either constant curves (i.e., constant radius of curvature) or are constant curves in the center of the blade with straight (i.e. flat) sections at each transverse end of the cross-section when the blade is extended. Blades constructed to have either these basic cross-sections are less stable during blade standout and show a greater tendency to buckle than blades having cross-sections constructed according to the present invention.

[0030] FIG. 9 shows a comparison of the construction and standout capabilities of three prior art rule assemblies (shown in the first six rows of the table and indicated with a bracket) with a preferred embodiment of the rule assembly 10 embodying the present invention (shown in the last five rows of the table). As the first column of FIG. 9 indicates, typical prior art rule blades did not exceed one inch in width (measured in the flattened, coiled configuration of the blade). The second column indicates that prior art blade thickness for a one inch blade ranged from 0.0045 inch to 0.0056 inch and produced blade having a standout length of from approximately 7 feet to approximately 9 feet as indicated in FIG. 9, the third column.

[0031] The embodiment of the rule assembly embodying the present invention shown in FIG. 9 has a blade width of 1.250 inches (in the flat configuration) and a blade thickness of 0.0051 inch. Preferably, the blade described in FIG. 9 has a concavo-convex cross-section in the extended configuration as described above and as shown in FIG. 8.

[0032] The last five columns in FIG. 9 compare the standout characteristics of the three prior art tape assemblies with the tape assembly 10 embodying the invention. The standout characteristics of the blade of a given tape assembly are best understood by comparing the arcuate (i.e., actual) length-out measured along the surface of the blade with the linear length-out of the blade. These two characteristics are often expressed as a percentage of linear length-out to arcuate length-out. FIG. 10 shows a schematic diagram that illustrates what is meant by arcuate length-out and linear length-out.

[0033] Arcuate length-out is represented by arcuate line C in FIG. 10 and is a measure of the total length of the extended portion of the blade. Linear length-out is designated B in FIG. 10 and is a measure of the linear length of the projection of the extended blade on an imaginary horizontal surface below the tape assembly 10. Line A designates the height the housing assembly 10 is required to be above the horizontal surface when the housing assembly 12 is angularly oriented with respect to the surface at an angle D to position the arcuately extending blade so that the free end thereof just touches the surface. Thus, angle D generally represents the degree of tape rule housing assembly rotation (with respect to the horizontally extending surface) required to achieve maximum standout for a given length of extended tape.

[0034] The comparison of the prior art and the embodiment given in FIG. 9 indicates that the maximum prior art arcuate length-out that could be achieved with a one inch wide blade was approximately nine feet. Because of the relatively shallow (relative to the present invention) cross-sectional blade height H of approximately 0.21 inch (not shown in FIG. 9) typically used in prior art one inch blades and because of the relatively high thickness of the metal of the prior art blades (which thickness is required for the arcuate length-out to be achieved), however, the linear length-out B was approximately 93 inches. This results in a percent of linear to arcuate length-out of approximately 86 percent. It can be appreciated that the third embodiment of the prior art shown in the fourth through the sixth rows of FIG. 9 shows relatively little bending for seven feet of standout (96% linear to arcuate length-out), but that this embodiment bends a very large degree when two additional feet of the blade are extended. This high degree of arcuate bending of the 1 inch blade at standout lengths approaching 9 feet makes the task of measuring a large distance difficult for a single person using the prior art tape rule assembly. As indicated in FIG. 9, the present invention provides a rule assembly that can achieves seven feet to approximately 11 feet of arcuate length-out while maintaining the percent of linear to arcuate length-out in the approximate range of 99 percent to 98 percent. This greatly facilitates the task of measuring a length for the tape assembly user. Greater degrees of standout with a comparable percentage of linear to arcuate length-out can be achieved by making the blade wider. It is, for example, within the scope of the present invention to provide a blade width of 1.5 inches or greater.

[0035] It can be understood by one skilled in the art that the 1.25 inch blade width of a preferred embodiment of the assembly 10 allows the blade height H to be increased without increasing the overall blade curvature to a degree that would make reading the gradations and lettering printed on the concave surface of the blade 16 difficult. This construction results in a blade with relatively high height H that is also easy to read. (In contrast, one inch blades having a curve height of the extended blade of over 0.21 become very difficult to read and are thus not commercially practical.) Increasing the blade width of the blade of the present embodiment also allows the printing on the blade to be made larger, thus making measurements easier by making the blade easier to read. When the preferred 1.25 inch blade (flat width F) is in its concavo-convex cross-sectional configuration (FIG. 7), the height H thereof, as mentioned above, is approximately 0.32 inch and the curved or arcuate width W is approximately 1.018 inches. This relatively wide width W of the extended blade also facilitates reading a measurement from the blade 16.

[0036] The blade of the rule assembly 10 is thus able to achieve the approximately 11 feet of standout while improving the percent of linear to arcuate length-out relative to the prior art. This length of standout is achieved while the bottom surface of the housing is angled approximately 45 degrees with respect to the horizontal surface S (as indicated in the right most column of FIG. 9) which is comparable to the three prior art rule assembly embodiments shown in FIG. 9.

[0037] One skilled in the art will appreciate that when the rule assembly 10 is provided with a 33 foot long blade, a coil spring 32 must be provided to accommodate outward movement of the blade 16 to its fully extended position. It can be appreciated that it is desirable to construct a rule assembly 10 so that the housing assembly 12 is small enough and compact enough to fit easily in one hand of a user. Because the rule assembly 10 has a wide blade, the width of the housing assembly 12 is comparably wide. It is desirable to construct a retractable rule assembly 10 so that the height and length of the housing assembly 12 (also called the "footprint" of the housing assembly 12) are as small as possible. Because both the spring 32 and the blade 16 can be quite long in some embodiments of the invention (up to approximately 33 feet of blade length, for example), the spring 32 must be carefully constructed so that it provides sufficient spring forced to retract the fully extended blade and yet fits within a housing assembly 12 having a footprint that is dimensioned to easily fit in a user's hand.

[0038] The coil spring is constructed of a coiled ribbon of metal (typically steel). The spring force provided by the spring is approximately directly proportional to the spring width and the spring thickness. A thick spring undesirably increases the height and length of the housing assembly 12, however. It has been found that the most desirable construction of a rule assembly embodying the present invention has a coil spring that is relatively thin and relatively wide compared to prior art springs. Preferably the spring 32 of the rule assembly 10 has a width that is approximately 95 percent to approximately 120 percent of the width of the blade (for a given blade width in the broad range set forth above for the flattened blade). More preferably, the spring has a width that is approximately 100 percent to approximately 110 percent of the width of the metal ribbon of the blade, and is most preferably 100% of (i.e., equal to) the blade width (as shown in FIG. 9). Because the spring width is relatively great, the spring can be made the same thickness as or thinner than the blade 16. The reduction in the spring thickness relative to blade thickness (as compared to the prior art), allows the housing assembly 12 to be constructed so that it has a minimal footprint to provide a housing assembly 12 that can be easily gripped in one hand.

[0039] Typical springs used with prior art one-inch blades have a width that is less than the width of the blade, usually in the range of 0.8 to 0.89 inch. FIG. 9 shows a typical value of 0.875-inch for the spring width for all three embodiments of the one-inch blades described in the figure. Prior art spring thickness ranges from about 0.0051 to about 0.0060 inch. Generally, prior art spring thickness is approximately 0.0003-0.0006 greater than the blade thickness. Thus, prior art construction uses springs that are thicker and significantly narrower than the blade. It can be appreciated that although it is possible to use this prior art construction in the embodiments of the present invention, it is undesirable because the relatively thick spring of the prior art would result in a housing assembly footprint that too large to fit comfortably within the average user's hand. Thus there is a need for a new spring construction that can be used with the blade 16 that will allow the footprint of the housing assembly to be made small to be comfortably grippable using one hand.

[0040] It can thus be understood that the relatively wide spring allows the thickness of the spring to remain relatively small and this allows the footprint of the housing assembly to be small enough to be easily gripped in a single hand of the most users. More specifically, preferably, when the spring width is approximately equal to the blade width, the spring 32 of the present invention is 0 percent to 10 percent thinner than the blade 16. As another example, if the spring 32 is made one hundred twenty percent the width of the blade 16, the spring 32 is preferably 0 percent to 25 percent of thinner than the blade. In terms of actual measurement, this means that typically the spring thickness is up to 0.0005 inch thinner than the thickness of the blade. Furthermore, because the spring of the present embodiment is made wide relative to the width of the blade, the overall length of the spring can be made shorter relative to the length of prior art springs for comparable measuring blade 16 lengths. For example, a typical one inch wide, 25 foot long prior art blade has a spring that is approximately 240 inches in length; the length of a wide spring 32 embodying the present invention for the rule assembly 10 having a 25 foot blade is approximately 230 inches.

[0041] By increasing the spring width of the spring 16, the thickness of the spring can be decreased and the length decreased while still providing sufficient spring force to retract the blade without increasing the footprint of the housing assembly to an undesirable degree. Examples of specific housing assembly 12 heights for particular blade lengths will be considered below after other structural details of the construction of the rule assembly 10 are considered.

[0042] The housing assembly 12 is further constructed to easily and comfortably fit in a hand of the user because it optimizes the use of space within the housing assembly 12 to house the blade 16, coil spring and other cooperating components. The details of the internal structure of the housing assembly 12 and the blade 16 mounted therein are shown in FIGS. 4-6 and 11. Preferably the housing assembly 12 and the reel 14 are constructed of a molded plastic. As best appreciated from FIG. 6, the housing assembly 12 includes a pair of cooperating molded plastic housing members 40, 42. Each housing member 40, 42 includes an end wall 44, 46, respectively, having a peripheral wall 48, 50, respectively, extending from a periphery thereof and terminating in a free edge 52, 54, respectively. The pair of cooperating housing members 40, 42 are movable toward one another in an axial direction into cooperating relation to define the housing assembly (where "axial direction" refers to the direction of the axis of rotation of the reel defined by the spindle).

[0043] When the housing members 40, 42 are fixed together in the assembled rule assembly 10, the free edges 52, 54 are interengaged as shown in FIG. 6. A plurality of axially extending bolts 58 extend through one of the housing members 42 and threadedly engage the other housing member 40 (FIG. 11) at spaced positions adjacent the peripheral walls 48, 50. The housing members 40, 42 are also fixed together by the threaded engagement of bolts 68 with the fixed reel spindle 15. The axially extending spindle 15 is fix at a central portion of the housing assembly 12. Specifically, the fixed spindle 15 has a noncircular interengaging recess-projection connection (shown in FIG. 6 and described below) at each end thereof generally with a central interior region 62, 64, respectively, of the end walls 44, 46 of the housing assembly 12. Each end of the fixed spindle 15 is interiorly threaded to threadedly receive the bolts 68 therein. The bolts 68 extend through central holes 70, 72 formed in the respective adjacent end walls 44, 46 of the housing assembly and threadedly engage internal threading 73 in each end of the spindle 15. Each bolt 68 extends through a recess-projection connection, generally designated 75, when each bolt 68 is disposed in a respective central hole 70, 72 and threaded interior 73. A metal clip 77 is secured to one side of the housing assembly by one of the bolts 68.

[0044] Preferably the fixed spindle 15 is constructed of a molded plastic or nylon. The construction of the recess-projection connections 75 between the ends of the spindle 15 and the walls 44, 46 is shown in cross-section in FIG. 6. Each recess-projection connection 75 is identical. Specifically, projections 74 having exterior noncircular cross-sections are integrally formed on the walls 44, 46 and are received within recesses 76 having complementary non-circular interior cross-sections formed on each end of the spindle 15. The noncircular interior and exterior cross-sections cooperate to prevent rotation of the spindle 15 with respect to the housing assembly 12 when the ends of the spindle 15 are mounted on the projections 74 in the assembled rule assembly 10. Each end of the spindle 15 extends through a hole 79 of circular cross-section formed in opposite sides of the reel 14. The portions of the spindle 15 that extend through the holes 79 in the reel 14 have circular exterior cross sections. A flange 81 on the spindle 15 engages an annular groove 83 in the reel 14 surrounding the hole 79 to guide the rotation of the reel on the spindle. Thus, the reel 14 is rotatably mounted on the spindle 15 for bi-directional rotational movement of the reel with respect to the housing assembly 12. As can best be appreciated from FIGS. 4 and 6, the spindle 15 is internally slotted to receive the one longitudinal end 37 of the spring 32 to thereby secure the one end 37 of the spring to the spindle.

[0045] The molded plastic reel 14 includes two reel members 78, 80 (FIG. 6). Reel member 78 includes the integral cylindrical wall portion 28 about which the blade 12 is wound. Reel member 80 is essentially disk shaped. Each reel member 78, 80 includes an outwardly extending cylindrical wall portion 88, 90, respectively, formed around the hole 79. An annular edge portion 84 on the wall portion 82 is received within an annular groove 86 formed within reel member 80 to help hold the reel 14 together. The abutting engagement of the wall portions 88, 90 on the reel with the end walls 44, 46 of the housing assembly 12 maintain the edge portion 84 within the groove 86 in the assembled rule assembly.

[0046] The housing members 40, 42 include portions along the abutting free edges thereof 52, 54, respectively, of tongue and groove construction (FIG. 6) to help secure the molded housing members 40, 42 of the assembled rule assembly 10 together. Specifically, at a top portion of the housing assembly 12, a wall portion 92 formed on edge 54 is received within a groove 94 formed along a portion of the edge 52; and an integral wall portion 93 formed on edge 52 is disposed in underlying, abutting relation to wall portion 50 of the housing member 44. At a bottom portion of the housing assembly 12, a wall portion 95 formed along a length of edge 54 is received within a recess 97 formed on a portion of the wall portion 48 of housing member 40.

[0047] When viewed from the side elevational view, the housing assembly 12 includes only two corner portions (see FIG. 4, for example), generally designated 96, 98. One corner 96 is adjacent the housing assembly opening 22 and the other corner portion 98 is at an opposite bottom end of the housing assembly 12. The two bolts 58 are positioned in the only two corner portions 96, 98, respectively, of the housing assembly 12. Thus, it can be appreciated that the housing assembly 12 is secured together using threaded fasteners in only three locations (from the point of view of one looking at the side elevational view of, for example, FIG. 4): at the opposite corners 96, 98 (bolts 58) at the bottom portion of the housing assembly 12 and in the center of the housing assembly 12 (bolts 68). This use of the bolts 68 on opposite ends of the reel spindle 15 allows the housing assembly 12 to be secured together without using any bolts in a peripheral top portion or portions of the housing assembly 12.

[0048] This arrangement of the bolts helps reduce the size of the footprint of the housing assembly 12 to allow the housing assembly 12 for a 33-foot long blade embodying the invention to have up to 13 feet of blade standout, for example, to easily fit in a hand of a user. Specifically, it is possible to provide tape assemblies embodying the present invention wherein the height (and length) of the housing assembly does not substantially exceed 3.65 inches for a blade length that is at most approximately 33 feet; wherein the height (and length) of the housing assembly does not substantially exceed 3.45 inches for a blade length that is at most approximately 30 feet; and wherein the height (and length) of the housing assembly does not substantially exceed 3.25 inches for a blade length that is at most approximately 8 meters.

[0049] As best appreciated from FIGS. 3-4, because the housing assembly does not require bolts in the upper periphery of the housing assembly 12, the top portion 108 of the housing assembly 12 can be made to have a relatively arcuate profile (FIG. 2, for example) that generally conforms to the profile of the reel, thus minimizing the footprint of the housing assembly 12, eliminating corners in the upper portion of the housing assembly and providing a comfortable curved top surface to receive the palm of a user's hand. This arc-shaped upper surface of the housing assembly 12 also increases impact resistance of the housing assembly 12 in case the assembly 10 is dropped.

[0050] A peripheral portion of housing assembly 12 is provided with a rubber-like coating 110 around the gripped portion of the housing assembly 12 to provide increased frictional engagement between the housing assembly and a user's hand and to provide a relatively soft comfortable surface for the user's hand.

[0051] The housing assembly 12 includes a bottom wall 109 (FIGS. 4-5) having an exterior portion 107 at an end position adjacent the housing assembly opening 22 which projects below an exterior surface portion 108 extending therefrom toward an opposite end 113 of the bottom wall 109 to provide a finger grip enhancing configuration, generally designated 119 for a gripping hand of the user. More specifically, the bottom wall 109 (FIGS. 3-4) has a forward end portion 107 adjacent the housing assembly opening 22 and a rearward end portion 113 at the opposite end of the bottom wall 109; the portion 108 of the wall 109 therebetween is generally recessed to provide the finger grip enhancing configuration 119 for the gripping hand of the user. This recessed area or gripping area 119 on the bottom of the housing assembly 12 is preferably completely covered with the overmolded rubber or rubber-like polymeric material. It can thus be appreciated that the housing assembly 12 is constructed to be easily held in one hand of a user such that the user's fingers engage the finger grip enhancing portion 119 and the user's palm and thumb are generally in overlying relation with a top portion of the housing assembly.

[0052] The housing assembly includes a fitment 118 (FIG. 11) which forms a part of the housing assembly opening 22 adjacent a convex side of the blade 16. The fitment 118 is an essentially U-shaped structure having a transversely extending cross member 115 and two upstanding arms 117 extending upwardly from opposite sides of the cross member 115. The cross member 115 defines the lower edge of the housing opening; a bottom surface 170 of the cross member 115 is flush with the adjacent surface portion 107 of the bottom wall 109 so that a bottom surface portion 170 of the fitment 118 forms part of the bottom surface of the housing assembly 12 adjacent the opening 22. The fitment 118 is preferably an integral molded plastic structure. The fitment 118 is held within appropriately sized opposing recesses 121, 123 (FIG. 11) formed in the respective housing members 40, 42 and which recesses are disposed on opposite sides of the opening 22 when the housing members 40, 42 are secured together. The cross member 115 of the fitment 118 has a plurality of tangentially extending, transversely spaced elongated ridges 120 which define surfaces 125 along the bottom of the opening 22 for engaging and supporting the convex side of the blade 16 extending tangentially from the reel 14 of the housing assembly opening 22. Thus, the ridges 120 slidably engage the convex side of the blade 16 and provide a low friction engagement between the housing assembly 12 and blade 16.

[0053] A holding assembly, generally designated to 124, is constructed and arranged to be manually actuated to hold the blade 16 in any position of extension outwardly of the housing assembly opening 22 and to release the blade 16 from any position in which it is held. The structure and operation of the holding assembly 124 is best appreciated from a comparison of FIGS. 4-5. The holding assembly 124 includes a holding member 126 mounted on the housing assembly 12 for movement in opposite directions between a normally inoperative position (FIG. 4) and a holding position (FIG. 5). It can be appreciated that the blade holding member 126 is an arcuate member that is movable along an arcuate path between the two positions as aforesaid. The holding member 126 has an interior free end portion 128 that is movable into wedging engagement with the tangentially extending portion of the blade 16 to engage and hold the blade against an interior holding structure 130 (FIG. 5) on the housing assembly 12 when the holding member 126 is in its holding position. The free end portion 128 includes a central recess 129 (FIG. 2, for example) that is described in detail below. The holding member 126 has an exterior thumb engaging portion 132 configured to be moved digitally to selectively move the holding member 126 from its normally inoperative position and its holding position. The exterior thumb engaging portion 132 is best seen in FIGS. 1-2.

[0054] Preferably the holding member 126 is an integral structure made of an appropriate durable flexible plastic. The thumb engaging portion 132 is connected by an integral outwardly extending neck portion 134 to an elongated arcuate flexible body portion 133 that terminates in the interior free end 128. The outwardly extending portion 134 is slidably held within and guided by a slot 136 formed within a front part of housing assembly 12 by the members 40, 42. The movement of a lower portion of the holding member 126 is guided by a pair of tabs 131 integrally formed on respective housing members 40, 42 (only one tab is shown in the figures). An integral locking structure 138 on the holding member 126 engages holding structure 140 (FIG. 5) integrally formed on the housing assembly 12 to releasably lock the holding member 126 in the holding position in wedging engagement with the blade 16.

[0055] More specifically, to lock the blade 16 in a given position of extension, the user (while holding the blade 16 outwardly of the housing assembly 12 against the spring force of the coil spring 32) slides the thumb engaging portion 132 downwardly with respective to the housing assembly 12 causing the locking structure 138 to slide over a ramped surface 142 on the holding structure 140 and causing the free end 128 to move in a locking direction with respect to the blade 16. The flexible plastic locking structure 138 bends resiliently outwardly slightly as it passes over the holding structure 140. After the free end 128 contacts the blade 16, continued movement of the thumb engaging portion 132 in the locking (downward) direction thereafter wedges the free end 128 of the flexible body portion 133 against blade 16 to hold the blade 16 in place against the spring force of the coil spring 32 and moves the locking structure 138 into abutting engagement with a locking surface 141 on the holding structure 140. The holding member flexes slightly as the free end 128 is wedged against the blade 16. The abutting engagement between the locking structure 138 and the locking surface 141 locks the holding member 126 in its holding position. It can be understood from FIG. 5 that the blade 16 is held in an extended position (against the spring force of the coil spring 32) between the free end 128 of the body portion 133 and the interior holding structure 130 by the downward force exerted by the wedged body portion 133. The interior holding structure 130 (not visible in detail) is a series of longitudinally spaced, transversely extending ribs that are constructed and arranged to support the convex side of the blade 16. When viewed from the point of view of FIG. 5 (i.e., on a transversely directed line of sight), the top surfaces (not visible in the FIGS.) of the ribs cooperate to provide a generally downwardly sloped support (in a direction toward the opening 22) for the blade 16; and when viewed from the front, (i.e., on a longitudinally directed line of sight) the top surfaces (not visible in the figures) of each rib of the interior holding structure 130 are transversely spaced in a concave array to receive and support the convex side of the blade.

[0056] To release the blade 16, the user pulls upwardly on the thumb engaging portion 132 which causes the locking structure 138 on the plastic holding member 126 to move resiliently outwardly and past the locking surface 141 to release the holding member 126 from engagement with a blade 16. The holding member 126 resiliently returns to its normal arcuate shape. It can be appreciated from FIG. 2 that the recess 129 on the free end 128 of the holding member 126 defines two transversely spaced teeth 147 which have spaced arcuate side surfaces 144 sized to conform to the concave surface of the blade 16 to hold the same in locked position.

[0057] It can be understood that the use of the holding member 126 when a measurement is being taken is optional. When taking a measurement, the user typically holds the housing assembly 12 in one hand and manually pulls the blade 16 out of the housing assembly 12 with the other hand. When a sufficient length of blade 16 has been withdrawn from the housing assembly 12, the user can lock the blade 16 with respect to the housing assembly 12 using the holding member 126 to prevent the blade 16 from retracting back into the housing assembly 12 (under the spring force of spring 32) when the user releases the blade 12. When the measurement has been taken, the user simply releases the holding member 126 from holding engagement with the blade 16 by moving the free end 128 thereof out of wedging engagement with the blade 16 in the manner described above. If the holding member 126 is not used during the taking of a measurement, the user can simply hold the blade 16 with his other hand while the measurement is being taken or, alternatively, the hook member 34 can be placed in hooking engagement with the workpiece to hold the blade 16 outwardly of the housing assembly 12 in a controlled and steady manner against the spring force of spring 32 while the measurement is being taken.

[0058] When the blade 12 is released after taking the measurement, the spring 32 rotates the reel 14 with respect to the housing assembly 12 in a blade-winding direction to wind the blade 12 around the reel 14. A relatively short free end portion of the blade 16 has a clear film 158 of plastic material adhered to the concave side thereof (FIG. 11) to protect the blade 12 while the same is out of the housing assembly 12 and while the blade 12 is being retracted under the spring force of the spring 32 back into the housing assembly 12. Preferably the film is made of polyurethane and is adhered to the blade by an acrylic adhesive. It is also contemplated to use Mylar® and Nylon® to construct the film. Preferably the film has a thickness dimension within the range of approximately 0.006 inches to approximately 0.014 inches. It is possible in embodiments of the invention to apply this film to the blade of any known tape rule assembly.

[0059] Preferably the self adhering film 158 is placed over several leading inches (preferably within a broad range of approximately 2 inches to approximately 12 inches) of the free end 20 of the blade 16, including the portion of the blade on which the hook member 34 is disposed so that preferably the film goes under the hook member 34 all the way to the free end 20 of the blade 16. More preferably, the film 158 is applied a length from the free end 20 of the blade 16 that is less than 10.5 inches; and most preferably, the length of the blade 16 from the free end thereof that is covered by the film 158 is approximately 6 inches. It is generally desirable to have the film-covered portion end at approximately the point on the blade 16 where the volutes of the coiled blade are in overlying relation to one another when the blade 16 is in its fully retracted configuration. Typically in a tape rule assembly, the tape blade starts to wrap on itself at approximately 9.5 inches when a typical reel size of approximately 2.9 inches in outer diameter is used in the construction. The film 158 is provided because most failures in a rule blade 16 occur within the first six inches of the free end of the blade 16 from cracks or tearing. The cracks or tearing occur because when the blade is wound back around reel under the spring force of the coil spring, the free end of the blade tends to "whip" as it enters the opening 22, causing the last several inches of the blade 16 to hit against the housing assembly 12. This can cause cracking or breaking of the free end of the blade 16 over time. The protective film 158 prevents these cracks and tears and other damage to the blade 16 associated with blade whipping.

[0060] The free end of the blade 16 is frequently handled by the user and this handling can over time cause the numbering and markings on the concave side of the blade 16 to wear off or become difficult to read. The film 158 prevents this damage because it covers the numbering and markings on the free end of the blade and thereby protects the same from being worn off.

[0061] The construction of the hook member 34 and the manner in which it is disposed on the free end 20 of the blade 16 is best seen in FIGS. 1-4, 11. Preferably the end hook member 34 is formed of sheet metal of predetermined thickness and includes a concavo-convex mounting portion 150 (FIG. 11) having a U-shaped hook portion 152 bent at a generally right angle from an end of the concavo-convex mounting portion 150. The hook member 34 is mounted on the free end 20 of the blade 16 with the mounting portion 150 thereof secured in limited sliding engagement with a concave side of the free end 20 of the blade 16 and in overlying relation thereto.

[0062] More specifically, the mounting portion 150 is provided with large holes 167 (FIG. 4) and a plurality of rivets 169 extend through the holes 167 to slidably mount the hook member 34 to the blade 16 for limited longitudinal relative movement between the hook member 34 and the blade 16 (i.e., the diameter of each hole 167 is greater than the diameter of the associated rivet 169 by an amount approximately equal to the desired amount of hook movement). The limited sliding engagement allows the blade 16 to be measured externally from an external surface 161 of the U-shaped hook portion or internally from an internal surface 163 of the U-shaped hook portion 152. In other words, the sliding movement of the hook member 34 allows an accurate measurement to be taken with either surface 161 or 163 in abutting relation with the workpiece; the holding member 34 slides longitudinally with respect to the blade 16 a distance approximately equal to the thickness of the hook portion 152 (where the thickness is measured from surface 161 to surface 163) so that a measurement taken with either surface 161 or 163 in abutting engagement with the workpiece will yield an accurate measurement.

[0063] The U-shaped hook portion 152 includes a bight section 160 extending transversely downwardly from a convex side of the free end of the blade 16 and spaced leg sections 162 extending beyond transversely spaced corners 171 of the free end of the blade. The bight section 160 of the hook portion 152 of the hook member 34 provides an under-catch structure that can hookingly engage a workpiece to facilitate extension of the blade 16 and to temporarily secure the blade to the workpiece while a measurement is being taken. As can be appreciated from FIG. 11, the leg sections 162 extend beyond the longitudinally extending edges of the blade 16 to provide a side catch surface on each side of the blade that 16 can be used to hook the blade to an object or workpiece. The side catch structure provided by the legs 162 can function to secure the free end of the blade 16 during a measurement. The side catch structure provided by the leg sections 162 also allow the blade 16 to be easily and steadily held in a tilted position relative to a surface of the workpiece, thereby allowing a longitudinally extending edge of the blade 16 to be held against the workpiece. More specifically, when the convex side of the blade 16 is against the workpiece, the longitudinal edges are normally spaced from the surface because of the concavo-convex cross-section of the blade 16. The legs 162 of the hook member 34 provide a side catch that can be hooked over an edge of the workpiece to allow the user to hold steadily a longitudinal edge of the blade very close to or directly against the workpiece when the convex side of the blade 16 is against the workpiece, which facilitates reading a measurement. This is helpful in taking measurements because the curve height H of the cross section is preferably approximately 0.32 of an inch so that the curve height of the blade is relatively high.

[0064] The upper portions of the leg sections 162 extend generally upwardly and outwardly above the concave side of the blade 16 (FIG. 11) to provide structure above the concave surface of the blade 16 to hookingly engage the workpiece to facilitate extension of the blade 16 and to hold the free end of the blade 16 while a measurement is being read. For example, the blade 16 can be placed against a workpiece such that the concave side of the blade 16 is facing the workpiece and such that the opposite longitudinal edges of the blade 16 abut a surface on the workpiece at a point where they measurement is to be read. When the blade 16 is in this position, the upwardly extending portions of the legs 162 on the hook member 34 can be used to hold the free end 20 of the blade 16 against the workpiece.

[0065] It can also be appreciated from FIGS. 1-2 that the hook-shaped portion 152 of the hook member 34 provides an aesthetically pleasing "face" appearance on the front of the rule assembly 10 when the blade 16 is in the fully retracted position. Transversely spaced corners 171 on the free end 20 of the blade 16 are mitered (FIG. 4) inwardly from opposite longitudinal edges of the blade 16; the leg sections 162 of the hook member 34 extend beyond the mitered corners 171 on the opposite edges of the end 20 of the blade 16. The mitered corners 171 prevent the user from being scratched or cut by the corners on the end of blade 16. Preferably each corner 171 is mitered inwardly from the respective opposite longitudinal edge starting at a distance of approximately 3/32 of an inch from the free end of the blade 16.

[0066] Preferably, the housing opening 22 has a height dimension that exceeds the height dimension of the hook member mounting portion 150 and its connection with the free end of the blade 16 by an amount which is at least approximately equal to the amount the hook portion 152 of the hook member 34 extends below a bottom end surface 170 of the housing assembly 12 at the housing opening 22 when the hook member 34 is at the housing opening 22 (FIG. 11). This height of the opening 22 is provided to prevent possible damage to the hook member 34 when the blade 16 is fully retracted and the hook member 34 is impacted (by dropping or the like) in a direction that tends to move the hook member 34 upwardly with respect to the opening 22.

[0067] The details of the construction of the housing opening 22 can be appreciated from FIGS. 4 and 11. It can be appreciated that the axially extending fastener 58 in the corner 96 must be spaced upwardly in the housing assembly 12 a sufficient distance to allow the opening

22 to have sufficient height to protect the hook member during impact. The location of this fastener 58 in the corner 96 is restricted by the dimensions of the corner 96. Specifically, the arcuate path followed by the arcuate holding member 126 between its inoperative position and its blade holding position defines the interior extent of the bottom corner 96 of the housing assembly and a lower front wall portion 200 at the front of the housing assembly 12 generally defines the forward extent of the bottom corner 96. Thus, it can be appreciated FIG. 4 that the tape assembly 10 must be constructed so that the holding member 126 and the front wall portion 200 cooperate to allow the fastener 58 to be positioned upwardly relative to the housing assembly 12 sufficiently to allow the housing opening 22 to have the height as aforesaid. The heights of prior art housing openings are generally restricted by the position of a fastener over the housing opening. Prior art housing assembly construction prevented the fastener from being spaced upwardly far enough to provide an opening having a height dimension large enough to protect the hook member from impact damage as aforesaid. The present embodiment overcomes this problem by constructing the lower front wall portion 200 of the housing assembly so that it is essentially flush with the central portion 204 of the front of the housing assembly. By positioning the lower front wall portion 200 essentially flush with the central front wall portion 204, the associated axially extending fastener 58 can be moved upwardly sufficiently to allow the housing assembly opening 22 to have a height as recited sufficient to protect the hook member in the event of impact. Specifically, the increased housing opening height allows the bottom edge 177 to move upwardly to a position flush with the bottom surface 170 of the housing assembly 12 adjacent the opening 22 before the mounting portion 150 of the hook member 34 impacts any downwardly facing surfaces on the housing assembly 12.

[0068] It can be appreciated from FIG. 4 that in the exemplary embodiment of the tape assembly 10, the interior free end 128 of the holding member 126 is disposed generally above the mounting portion 150 of the hook member 34 when the hook member 34 is at the opening 22. The recess 129 is provided in the free end 128 of the holding member 126 so that if the hook member 34 is caused to move upwardly in the opening 22 because of an impact, the free end 128 of the holding member 126 does not prevent upward movement of the hook member 34 in the opening 22 so that the bottom edge 177 can move upwardly to a position flush with exterior housing assembly 12 bottom end surface 170. More particularly, the central recess 129 is of a width to operatively accommodate the width of the hook member mounting portion 150. Therefore when the hook member 34 is forced upwardly in housing opening 22 by an impact, the mounting portion 150 moves upwardly into the recess 129, thereby allowing the bottom edge 177 of the hook member 34 to move upwardly sufficiently so that it is flush with the bottom end surface 170 of the housing assembly adjacent the opening 22. If the recess 129 were not provided, the free end 128 of the holding member 126 could possibly restrict the upward movement of the mounting portion 150 so that an impact on the hook portion 152 of the holding member 34 could bend of the hook member 34 against the holding member 126. The recess 129 precludes the possibility of this type of damage to the hook member 34 by allowing the holding member 34 to move upwardly in the housing assembly opening 22 at least far enough to allow the bottom edge 177 to move flush with the surface 170 at the bottom end of the housing assembly 12.

[0069] The opening 22 is constructed to allow the hook member 34 to move upwardly in the opening 22 until the upper edges of the mounting portion 150 impacts structure at the top of the opening 22. More specifically, it can be appreciated from FIGS. 4 and 11 that the lateral edges of the mounting portion 150 adjacent the hook portion 152 provide upwardly facing surfaces 206 which engage one or more downwardly facing surfaces 208 defining the housing opening 22 to limit the upward movement of the hook member 34 within the opening 22. The lateral longitudinally extending edges 210 of the blade 16 extend upwardly and outwardly beyond the upwardly facing surfaces 206 of the hook member mounting portion 150, but the edges 210 do not limit the upward movement of the hook member 34 in the opening 22. This is because when the hook member 34 moves upwardly in the opening 22 during impact, the edges 210 of the blade 16 engage the downwardly facing housing opening surfaces 208 and deflect resiliently outwardly before the mounting portion 150 of the hook member 34 engages of the upwardly facing surfaces 206. In other words, in the exemplary embodiment of the tape assembly 10 shown, the concavo-convex cross sectional curve height of the blade 16 is such that the edges 210 are normally above the upwardly facing surfaces 206 on the mounting structure 150 of the hook member 34. When the hook member 34 at the opening 20 is moved upwardly with respect to the housing assembly opening 22 by an impact, the edges 210 of the blade 16 impact the upper portion of the opening 22 first, causing the edges 210 of the blade to flex outwardly in opposite directions, slightly flattening the blade 16 to a degree sufficient to allow the mounting portion 150 of the hook member 34 to move toward and into contact with the downwardly facing surfaces 208 at housing opening 22. When the upwardly facing surfaces 206 on a mounting portion abut the downwardly facing surfaces 208 at the opening 22, the hook member 34 reaches the upper limiting position of its upward movement in the housing opening. This upper limiting position is usually not reached, however, because preferably the tape assembly 10 is constructed and arranged such that the bottom edge 177 of the hook member 34 moves upwardly to a position flush with the surface 170 on the bottom of the housing assembly 12 before the upwardly facing surfaces 206 on the hook member 34 impact the downwardly facing surfaces 208 on the housing assembly 12. When the bottom end 177 of the hook member 34 is flush with the bottom end surface 170 of the housing assembly, the hook member 34 is protected with further impact, thereby preventing damage to the hook member 34.

[0070] It can be understood that the coiled blade 16 has a tendency to unwind and return to a straight (in the longitudinal direction), extended configuration of concavo-convex cross-section. This tendency provides a downward force on the free end 20 of the fully retracted blade 16 with respect to the housing assembly opening 22 that maintains the extended portion of the fully retracted blade 16 against the bottom of the housing assembly interior at the opening 22 and thereby normally maintains a portion of the hook member 34 of the fully retracted blade 16 below the bottom surface 170 of the exterior of the housing assembly 12. This allows the tape assembly user to easily hook the hook member 34 on a structure such as a workpiece because a portion of the hook member 34 is normally below the surface 170.

[0071] One skilled in the art will understand that the embodiment of the tape rule assembly 10 shown in the figures and described above is exemplary only and not intended to be limiting. It is within the scope of the invention to provide any known tape rule assembly with any or all of the features of the present invention. For example, the clear film of plastic material can be applied to any known tape rule assembly. Similarly, an end hook member embodying the present invention can be applied to any known rule assembly.

[0072] The features of the housing assembly including the molded plastic construction, the shape of the housing, the use of relatively few bolts, the elimination of bolts in the upper portion of the housing assembly, the manner in which the spindle is mounted therein, the height dimension of the housing assembly opening relative to the dimension of the downwardly extending portion of the hook member on the free end of the blade and construction of the finger engaging portion on the bottom surface of housing assembly can be used separately or in combination on any existing tape rule assembly.

[0073] Similarly, the geometry of the cross-section of the blade and the general teachings of the dimensions and construction of the blade and coil spring can be used on any existing tape rule assembly.

[0074] The construction of the fitment, including the construction of the tangentially extending transversely spaced elongated ridges thereof can be used on any known tape rule assembly. It can also be understood that even though it is preferable to construct the tape rule assembly having the ridges on a separate fitment, it is contemplated to provide an embodiment of the tape rule assembly in which the ridges are formed integrally on the housing members of the housing assembly. It can also be appreciated that it is contemplated to use any of the aforementioned features singly or in any appropriate combination on a tape rule assembly that has a spring-powered retractable blade or, alternatively, on any tape rule assembly in which the blade is manually retracted.

[0075] It can be appreciated by one skilled in the art that it is within the scope of the present invention to apply the teachings presented herein to construct a tape measure of a wide range of sizes and that it is not intended to limit the invention to the embodiments or to the specific measurements or ranges of measurements presented herein. It can be understood, for example, that it is within the scope of the invention to construct a retractable tape measure assembly that includes a one inch wide (i.e., flattened width) tape blade with increased standout. Because it is contemplated to provide tape measure assemblies with the features of the invention enumerated herein separately or in any combination, it can be understood that a wide range of tape measure assemblies having one inch wide blades could be constructed. More specifically, a tape measure assembly having one inch wide blade could include for example, a cross-section blade geometry; a small footprint housing; a hook member; a protective film; a housing opening height and hook member size; and/or a fitment with transversely extending ribs all as described above in any combination.

[0076] The following numbered clauses numbered 1 to 26 form part of the description and correspond to the claims of the parent application number 00306642.0 as filed.

1. A retractable rule assembly comprising
a housing assembly (12);
a reel (14) rotatably mounted in said housing assembly;
an elongated blade (16) formed of a ribbon of metal having one end connected to said reel constructed and arranged with respect to said housing assembly to extend from a position tangential to said reel outwardly through a spaced opening in said housing assembly;
a coil spring (32) formed of a ribbon of metal having a construction and arrangement between said housing assembly (12) and said reel (14) to rotate said reel in said housing assembly in a direction to wind up the elongated blade (16) when extending outwardly of said housing assembly opening in a normal concavo-convex cross-sectional configuration onto said reel in an abutting volute coil formation in a flattened cross-sectional configuration; and
a blade holding assembly (124) constructed and arranged to be manually actuated to hold the blade (16) in any position of extension outwardly of said housing assembly opening (22) and to release the blade from any position in which it is held;
said blade (16) having a blade width (F), thickness (T) and height (H) of concavo-convex curvature sufficient to enable the blade to stand out arcuately a length measured along the blade of at least 10.5 feet (approximately 3.2 m) with a horizontal linear length of standout thereof being greater than 97% of the arcuate length of standout.

2. A retractable rule assembly as defined in claim 1 wherein said elongated blade (16) has a width (F) in the flattened configuration thereof having a dimension within the range of 1.10" - 1.5" (approximately 2.8 to 3.8 cm), a height (H) in the concavo-convex configuration thereof having a dimension within the range of 0.25"-0.40" (approximately 0.6 to 1.0 cm) and a thickness (T) in either configuration thereof having a dimension within the range of 0.0045" to 0.0063" (approximately 0.011 to 0.016 cm).

3. A retractable rule assembly as defined in Claim 1 or 2 wherein the concavo-convex cross-sectional configuration of said blade (16) includes an arcuate central section (36) having a predetermined radius of curvature (R2) and integral arcuate end sections (38) each having the same radius of curvature (R1), the radius of curvature (R2) of said central section (36) being a dimension within the range of 0.30" to 0.60" (approximately 0.8 to 1.5 cm) and the radius of curvature (R1) of said end section (38) being a dimension within the range of 1.0" to 5.0" (approximately 2.5 to 12.7 m).

4. A retractable rule assembly as defined in any preceding claim
wherein the metal ribbon of said spring (32) has a width which is 95%-120% of the width of the metal ribbon of said blade (16) in its flattened configuration.

5. A retractable rule assembly as defined in claim 4 wherein the metal ribbon of said spring (32) is 100% - 110% of the width of the metal ribbon of the blade (16).

6. A retractable rule assembly as defined in any preceding claim
wherein said housing assembly does not substantially exceed 3.65" (approximately 9.3 cm) in height.

7. A retractable rule assembly as defined in claim 6 wherein said housing assembly does not substantially exceed 3.25" (approximately 8.3 cm) in height.

8. A retractable rule assembly as defined in any preceding claim
wherein a free end portion of said blade (16) has a clear film of plastic material (158) adhered to a concave side thereof.

9. A retractable rule assembly as defined in any preceding claim
wherein said blade (16) has an end hook member (34) on the free end (20) thereof, said end hook member (34) being formed of sheet metal of a predetermined thickness to include a concavo-convex mounting portion (150) having a U-shaped hook portion (152) bent at a generally right angle from an end thereof, said end hook member (34) being mounted on the free end of said blade (16) with the mounting portion thereof secured in limited sliding engagement with a concave side of the free end of said blade (16) so that said rule can be measured externally from an exterior surface of said U-shaped hook portion (152) or internally from an interior surface of said U-shaped hook portion, said U-shaped hook portion including a bight section (160) extending transversely from a convex side of the free end (20) of said blade (16) and spaced leg sections (162) extending beyond transversely spaced corners of the free end of said blade.

10. A retractable rule assembly as defined in any preceding claim
wherein said housing assembly includes a pair of cooperating housing members (40, 42), each including an end wall (44, 46) having a peripheral wall (48, 50) extending from a periphery thereof and terminating in a free edge (52, 54), said housing members (40, 42) being fixed together with their free edges interengaged by a plurality of bolts (68) extending through one of said housing members and threadedly engaged in the other at spaced positions adjacent the peripheral walls thereof and by a fixed reel spindle (15) having a non-circular interengaging recess-projection connection at each end thereof with the central interior of the adjacent end wall, each end of said spindle being interiorly threaded to threadedly receive a bolt therein extending through a central hole (70, 72) in the adjacent end wall and the recess-projection connection between the central hole and threaded interior.

11. A retractable rule assembly as defined in any preceding claim
wherein said housing assembly includes a fitment (118) defining a part of the housing assembly opening (22) adjacent a convex side of said blade (16), said fitment (118) having a plurality of tangentially extending transversely spaced elongated ridges (120) defining surfaces for engaging the convex side of said blade (16) extending tangentially from said reel (14) to said housing assembly opening (22).

12. A retractable rule assembly as defined in any preceding claim
wherein said holding assembly (124) includes a holding member (126) mounted on said housing assembly (12) for arcuate movement in opposite directions between a normally inoperative position and a holding position, said holding member having (i) an interior free end (128) movable into wedging engagement with the tangentially extending portion of said blade (16) to hold the same against an interior holding surface (130) in the housing assembly when said holding member (126) is in said holding position and

(ii) an exterior thumb engaging portion (132) configured to be moved digitally to move said holding member (126) from the normally operative position thereof to the holding position thereof, said interior free end portion (128) including a central recess of a width to operatively accommodate the width of said mounting portion of said hook member (34).

13. A retractable rule assembly comprising
a housing assembly (12);
a reel (14) rotatably mounted in said housing assembly;
an elongated blade (16) formed of a ribbon of metal having one end connected to said reel constructed and arranged with respect to said housing assembly to extend from a position tangential to said reel outwardly through a spaced opening in said housing assembly;
a coil spring (32) formed of a ribbon of metal having a construction and arrangement between said housing assembly (12) and said reel (14) to rotate said reel in said housing assembly in a direction to wind up the elongated blade (16) when extending outwardly of said housing assembly opening in a normal concavo-convex cross-sectional configuration onto said reel in an abutting volute coil formation in a flattened cross-sectional configuration; and
a blade holding assembly (124) constructed and arranged to be manually actuated to hold the blade (16) in any position of extension outwardly of said housing assembly opening (22) and to release the blade from any position in which it is held;
said elongated blade (16) having a width (F) in the flattened configuration thereof having a dimension within the range of 1.10" - 1.5" (approximately 2.8 to 3.8 cm), a height (H) in the concavo-convex configuration thereof having a dimension within the range of 0.25"-0.40" (approximately 0.6 to 1.0 cm) and a thickness (T) in either configuration thereof having a dimension within the range of 0.0045" to 0.0063" (approximately 0.011 to 0.016 cm).

14. A retractable rule assembly as defined in Claim 13 wherein the metal ribbon of said spring (32) has a width which is 95%-120% of the width of the metal ribbon of said blade (16) in its flattened configuration.

15. A retractable rule assembly as defined in any preceding claim
wherein the thickness of the metal ribbon of said spring (32) is 0% - 25% thinner than the thickness of the metal ribbon of the blade (16).

16. A retractable rule assembly as defined in any preceding claim
wherein the height of the housing assembly (12) does not substantially exceed 3.65 inches (approximately 9.3 cm) for a blade length that is at most approximately 33 feet (approximately 10 m), wherein the height of the housing assembly does not substantially exceed 3.45 inches (approximately 8.76 cm) for a blade length that is at most approximately 30 feet (approximately 9 m), and
wherein the height of the housing assembly does not substantially exceed 3.25 inches (approximately 8.3 cm) for a blade length that is at most approximately 8 meters.

17. A retractable rule assembly as defined in Claim 13, 14, 15 or 16
wherein the concavo-convex cross-sectional configuration of said blade (16) includes an arcuate central section (36) having a predetermined radius of curvature (R2) and integral arcuate end sections (38) each having the same radius of curvature (R1), the radius of curvature (R2) of said central section (36) being a dimension within the range of 0.30" to 0.60" (approximately 0.8 to 1.5 cm) and the radius of curvature (R1) of said end section (38) being a dimension within the range of 1.0" to 5.0" (approximately 2.5 to 12.7 cm).

18. A retractable rule assembly comprising
a housing assembly (12);
a reel (14) rotatably mounted in said housing assembly;
an elongated blade (16) formed of a ribbon of metal having one end connected to said reel constructed and arranged with respect to said housing assembly to extend from a position tangential to said reel outwardly through a spaced opening in said housing assembly;
a coil spring (32) formed of a ribbon of metal having a construction and arrangement between said housing assembly (12) and said reel (14) to rotate said reel in said housing assembly in a direction to wind up the elongated blade (16) when extending outwardly of said housing assembly opening in a normal concavo-convex cross-sectional configuration onto said reel in an abutting volute coil formation in a flattened cross-sectional configuration; and
wherein the concavo-convex cross-sectional configuration of said blade (16) includes an arcuate central section (36) having a predetermined radius of curvature (R2) and integral arcuate end sections (38) each having the same radius of curvature (R1), the radius of curvature (R2) of said central section (36) being a dimension within the range of 0.30" to 0.60" (approximately 0.8 to 1.5 cm) and the radius of curvature (R1) of said end section (38) being a dimension within the range of 1.0" to 5.0" (approximately 2.5 to 12.7 cm).

19. A retractable rule assembly as defined in claim 18 wherein the radius of curvature (R2) of said central section (36) being a dimension within the range

of 0.40" to 0.50" (approximately 1.0 to 1.3 cm) and the radius of curvature (R1) of said end section (38) being a dimension within the range of 2.0" to 4.0" (approximately 5.1 to 10.2 cm).

20. A retractable rule assembly as defined in Claim 18 wherein the radius of curvature (R2) of said central section (36) is approximately 0.46" (approximately 1.17 cm) and the radius of curvature (R1) of said end section (38) is approximately 3.0" (approximately 7.6 cm).

21. A retractable rule assembly as defined in Claim 18, 19 or 20
wherein said elongated blade (16) has a width (F) in the flattened configuration thereof having a dimension within the range of 1.10" - 1.5" (approximately 2.8 to 3.8 cm), a height (H) in the concavo-convex configuration thereof having a dimension within the range of 0.25"-0.40" (approximately 0.6 to 1.0 cm) and a thickness (T) in either configuration thereof having a dimension within the range of 0.0045" to 0.0063" (approximately 0.011 to 0.16 cm) and wherein said blade stands out arcuately a length measured along the blade of from at least 10.5 feet (approximately 3.2 m) up to approximately 13 feet (approximately 4 m).

22. A retractable rule assembly as defined in Claim 21 wherein said elongated blade (16) has a width (F) in the flattened configuration thereof having a dimension within the range of 1.25" - 1.39" (approximately 3.17 to 3.53 cm), a height (H) in the concavo-convex configuration thereof having a dimension within the range of 0.30"-0.35" (approximately 0.76 to 0.89 cm) and a thickness (T) in either configuration thereof having a dimension within the range of 0.005" to 0.0056" (approximately 0.013 to 0.014 cm).

23. A retractable rule assembly as defined in Claim 22 wherein said elongated blade (16) has a width (F) of approximately 1.25" (approximately 3.17 cm), a height (H) in the concavo-convex configuration thereof approximately of 0.32" (approximately 0.81 cm) and a thickness (T) in either configuration thereof of approximately 0.0051" (approximately 0.013 cm).

24. A retractable rule assembly comprising:

a housing assembly (12);

a reel (14) rotatably mounted in said housing assembly;

an elongate blade (16) formed of a ribbon of metal having one end connected to said reel and being arranged to extend from said reel outwardly through an opening (22) in said housing assembly for use;

a coil spring (32) formed of a ribbon of metal coupled between said housing assembly (12) and said reel (14) and arranged to rotate said reel in said housing assembly in a direction to wind up the elongate blade (16) onto said reel (14) for storage;

the blade (16) being formed so as to have a flattened cross-sectional configuration when wound on the reel and to have a concavo-convex cross-sectional configuration when extending outwardly of said housing assembly opening (22) in normal use, the concavo-convex cross-sectional configuration having a height measured as the perpendicular distance between the apex of the blade and a line joining the side edges of the blade; and

a blade holding assembly (124) arranged to be manually actuated to hold the blade (16) in any position of extension outwardly of said housing assembly opening (22) and to release the blade from any such position in which it is held;

the blade (16) being formed so as to be capable of extending unsupported from the housing in an arcuate standout configuration having a horizontal linear length of standout measured as the horizontal distance between the said opening (22) and the distal end (20) of the blade (16);

characterised in that said blade (16) has a blade width, thickness and height of concavo-convex curvature sufficient to enable the blade to stand out for an arcuate length measured along the blade of at least 10.5 feet (approximately 3.2 m) with a horizontal linear length of standout greater than 97% of the arcuate length of standout.

25. A retractable rule assembly comprising:

a housing assembly (12);

a reel (14) rotatably mounted in said housing assembly;

an elongate blade (16) formed of a ribbon of metal having one end connected to said reel and being arranged to extend from said reel outwardly through an opening (22) in said housing assembly for use;

a coil spring (32) formed of a ribbon of metal coupled between said housing assembly (12) and said reel (14) and arranged to rotate said reel in said housing assembly in a direction to wind up the elongate blade (16) onto said reel (14) for storage;

the blade (16) being formed so as to have a flattened cross-sectional configuration when wound on the reel and to have a concavo-convex cross-sectional configuration when extending outwardly of said housing assembly opening (22) in normal use, the concavo-convex cross-sectional configuration having a height measured as the perpendicular distance between the apex of the blade and a line joining the side edges of the blade; and

a blade holding assembly (124) arranged to be manually actuated to hold the blade (16) in any position of extension outwardly of said housing assembly opening (22) and to release the blade from any such position in which it is held;

the blade (16) being formed so as to be capable of extending unsupported from the housing in an arcuate standout configuration having a horizontal linear length of standout measured as the horizontal distance between the said opening (22) and the distal end (20) of the blade (16);

characterised in that said elongated blade (16) has a width (F) in the flattened configuration thereof having a dimension within the range of 1.10" - 1.5" (approximately 2.8 to 3.8 cm), a height (H) in the concavo-convex configuration thereof having a dimension within the range of 0.25" - 0.40" (approximately 0.6 to 1.0 cm) and a thickness (T) in either configuration thereof having a dimension within the range of 0.0045" to 0.0063" (approximately 0.011 to 0.016 cm).

26. A retractable rule assembly comprising:

a housing assembly (12);

a reel (14) rotatably mounted in said housing assembly;

an elongate blade (16) formed of a ribbon of metal having one end connected to said reel and being arranged to extend from said reel outwardly through an opening (22) in said housing assembly for use;

a coil spring (32) formed of a ribbon of metal coupled between said housing assembly (12) and said reel (14) and arranged to rotate said reel in said housing assembly in a direction to wind up the elongate blade (16) onto said reel (14) for storage;

the blade (16) being formed so as to have a flattened cross-sectional configuration when wound on the reel and to have a concavo-convex cross-sectional configuration when extending outwardly of said housing assembly opening (22) in normal use, the concavo-convex cross-sectional configuration having a height measured as the perpendicular distance between the apex of the blade and a line joining the side edges of the blade; and

a blade holding assembly (124) arranged to be manually actuated to hold the blade (16) in any position of extension outwardly of said housing assembly opening (22) and to release the blade from any such position in which it is held;

the blade (16) being formed so as to be capable of extending unsupported from the housing in an arcuate standout configuration having a horizontal linear length of standout measured as the horizontal distance between the said opening (22) and the distal end (20) of the blade (16);

characterised in that the concavo-convex cross-sectional configuration of said blade (16) includes an arcuate central section (36) having a predetermined radius of curvature (R2) and integral arcuate end sections (38) each having the same radius of curvature (R1), the radius of curvature (R2) of said central section (36) being a dimension within the range of 0.30" to 0.60" (approximately 0.8 to 1.5 cm) and the radius of curvature (R1) of said end section (38) being a dimension within the range of 1.0" to 5.0" (approximately 2.5 to 12.7 cm).

Claims

1. A retractable rule assembly comprising
a housing assembly (12);
a reel (14) rotatably mounted in said housing assembly;
an elongated blade (16) formed of a ribbon of metal having one end connected to said reel constructed and arranged with respect to said housing assembly to extend from a position tangential to said reel outwardly through a spaced opening in said housing assembly;
a coil spring (32) formed of a ribbon of metal having a construction and arrangement between said housing assembly (12) and said reel (14) to rotate said reel in said housing assembly in a direction to wind up the elongated blade (16) when extending outwardly of said housing assembly opening in a normal concavo-convex cross-sectional configuration onto said reel in an abutting volute coil formation in a flat-

tened cross-sectional configuration; and
a blade holding assembly (124) constructed and arranged to be manually actuated to hold the blade (16) in any position of extension outwardly of said housing assembly opening (22) and to release the blade from any position in which it is held;
said blade (16) having a blade width (F), thickness (T) and height (H) of concavo-convex curvature sufficient to enable the blade to stand out arcuately a length measured along the blade of at least 10.5 feet (approximately 3.2 m) with a horizontal linear length of standout thereof being greater than 97% of the arcuate length of standout.

2. A retractable rule assembly according to claim 1, wherein the metal ribbon of said spring (32) has a width which is 95%-120% of the width of the metal ribbon of said blade (16) in its flattened configuration.

3. A retractable rule assembly according to claim 2, wherein the metal ribbon of said spring (32) is 100% - 110% of the width of the metal ribbon of the blade (16).

4. A retractable rule assembly according to any preceding claim ,wherein said housing assembly does not substantially exceed 3.65" (approximately 9.3 cm) in height.

5. A retractable rule assembly according to claim 5, wherein said housing assembly does not substantially exceed 3.25" (approximately 8.3 cm) in height.

6. A retractable rule assembly according to any preceding claim, wherein a free end portion of said blade (16) has a clear film of plastic material (158) adhered to a concave side thereof.

7. A retractable rule assembly as defined in any preceding claim wherein said blade (16) has an end hook member (34) on the free end (20) thereof, said end hook member (34) being formed of sheet metal of a predetermined thickness to include a concavo-convex mounting portion (150) having a U-shaped hook portion (152) bent at a generally right angle from an end thereof, said end hook member (34) being mounted on the free end of said blade (16) with the mounting portion thereof secured in limited sliding engagement with a concave side of the free end of said blade (16) so that said rule can be measured externally from an exterior surface of said U-shaped hook portion (152) or internally from an interior surface of said U-shaped hook portion, said U-shaped hook portion including a bight section (160) extending transversely from a convex side of the free end (20) of said blade (16) and spaced leg sections (162) extending beyond transversely spaced corners of the free end of said blade.

8. A retractable rule assembly as defined in any preceding claim wherein said housing assembly includes a pair of cooperating housing members (40, 42), each including an end wall (44, 46) having a peripheral wall (48, 50) extending from a periphery thereof and terminating in a free edge (52, 54), said housing members (40, 42) being fixed together with their free edges interengaged by a plurality of bolts (68) extending through one of said housing members and threadedly engaged in the other at spaced positions adjacent the peripheral walls thereof and by a fixed reel spindle (15) having a non-circular interengaging recess-projection connection at each end thereof with the central interior of the adjacent end wall, each end of said spindle being interiorly threaded to threadedly receive a bolt therein extending through a central hole (70, 72) in the adjacent end wall and the recess-projection connection between the central hole and threaded interior.

9. A retractable rule assembly as defined in any preceding claim wherein said housing assembly includes a fitment (118) defining a part of the housing assembly opening (22) adjacent a convex side of said blade (16), said fitment (118) having a plurality of tangentially extending transversely spaced elongated ridges (120) defining surfaces for engaging the convex side of said blade (16) extending tangentially from said reel (14) to said housing assembly opening (22).

10. A retractable rule assembly as defined in any preceding claim wherein said holding assembly (124) includes a holding member (126) mounted on said housing assembly (12) for arcuate movement in opposite directions between a normally inoperative position and a holding position, said holding member having (i) an interior free end (128) movable into wedging engagement with the tangentially extending portion of said blade (16) to hold the same against an interior holding surface (130) in the housing assembly when said holding member (126) is in said holding position and (ii) an exterior thumb engaging portion (132) configured to be moved digitally to move said holding member (126) from the normally operative position thereof to the holding position thereof, said interior free end portion (128) including a central recess of a width to operatively accommodate the width of said mounting portion of said hook member (34).

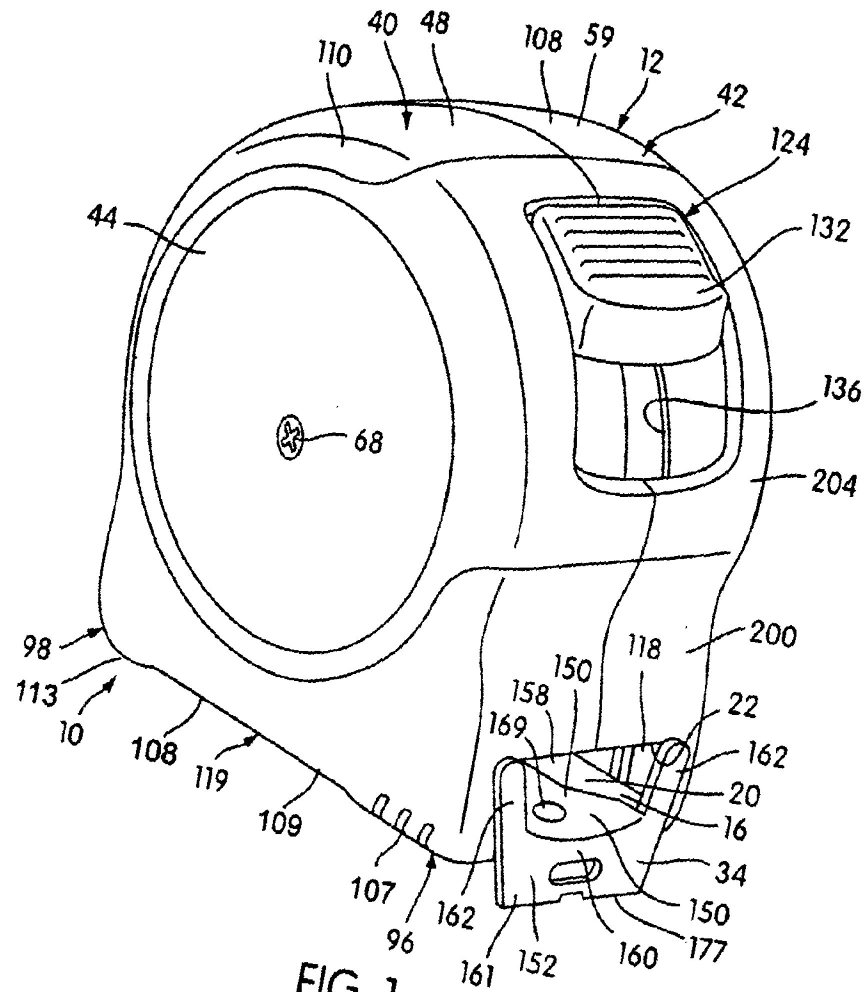
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FIG. 1

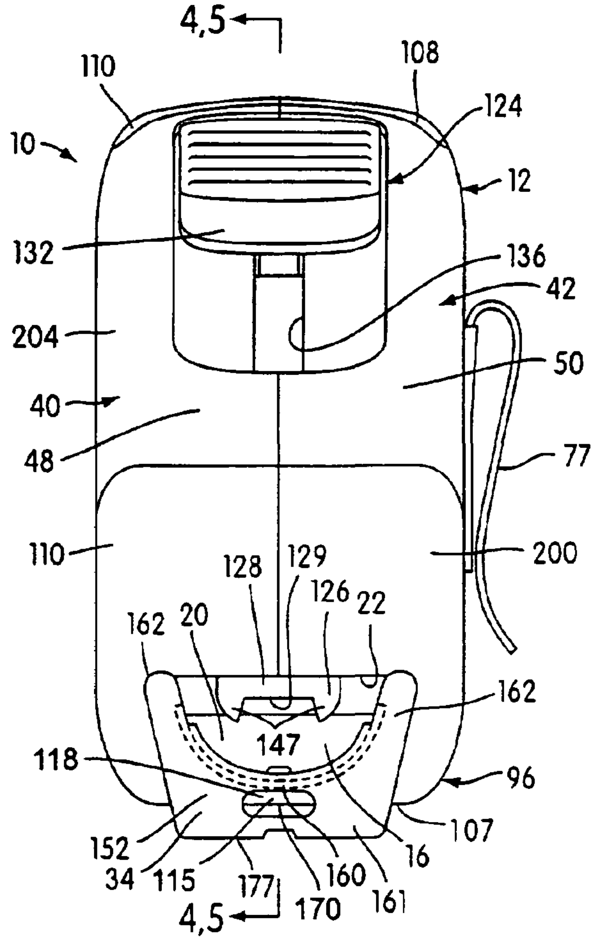
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FIG. 2

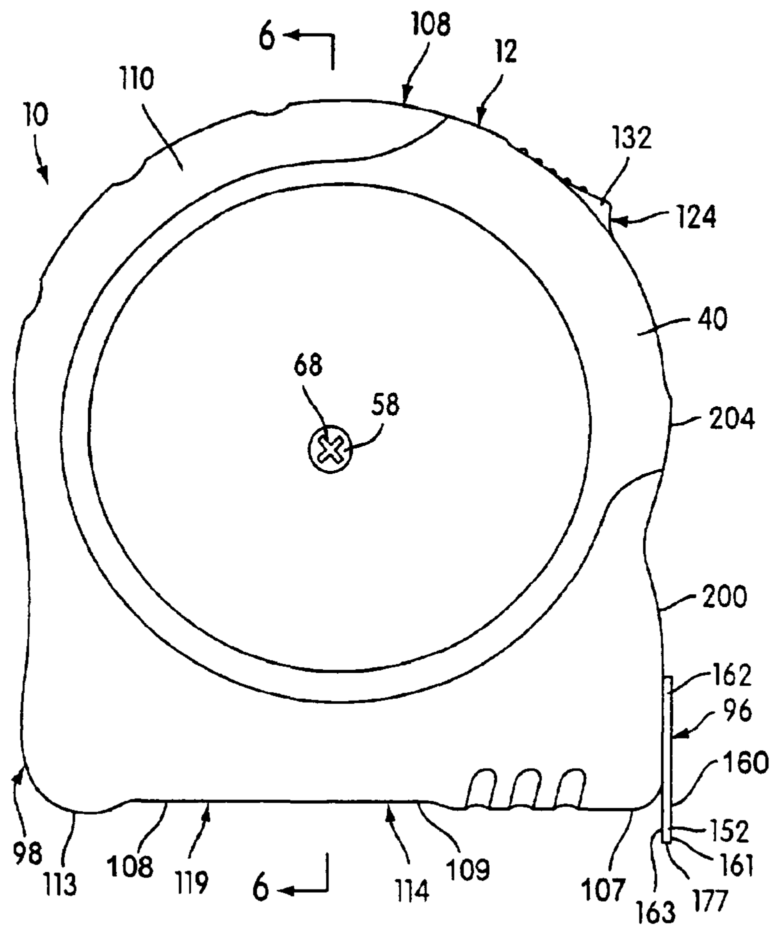
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FIG. 3

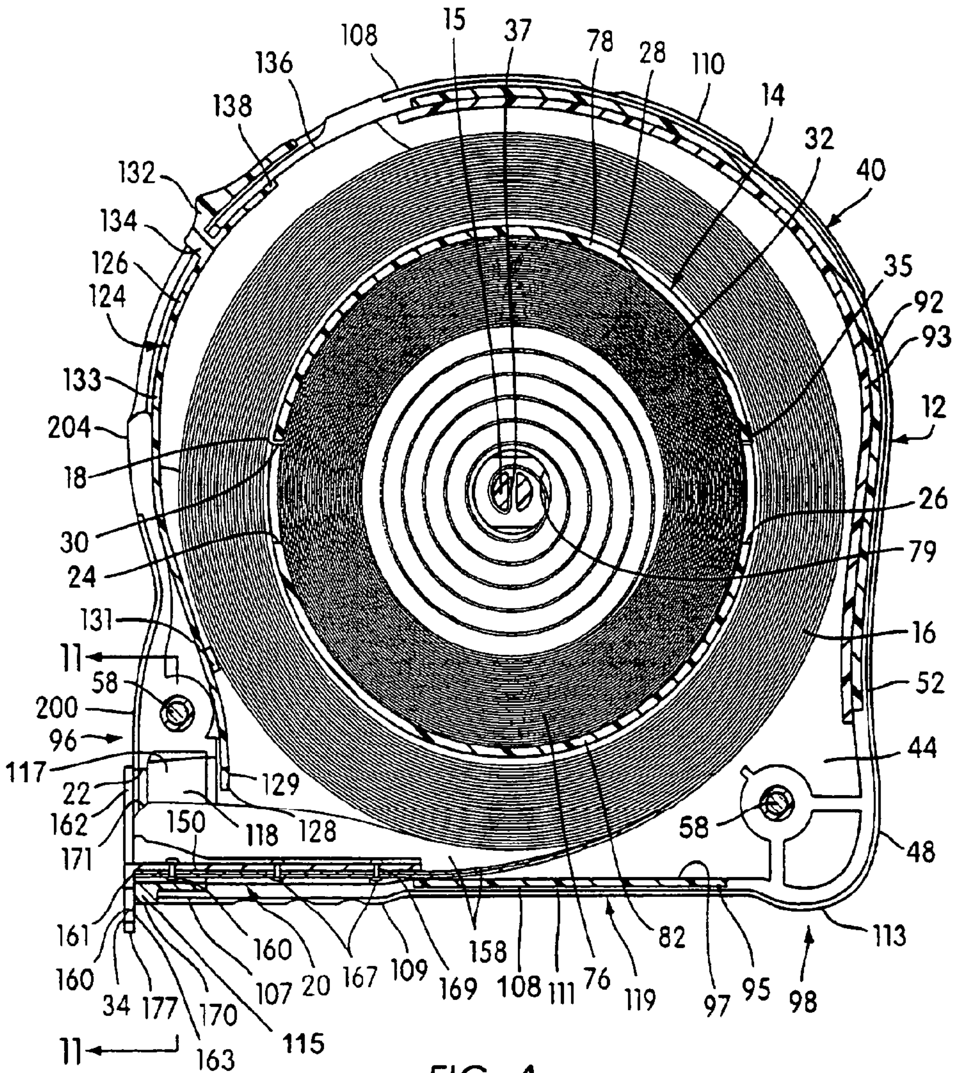
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FIG. 4

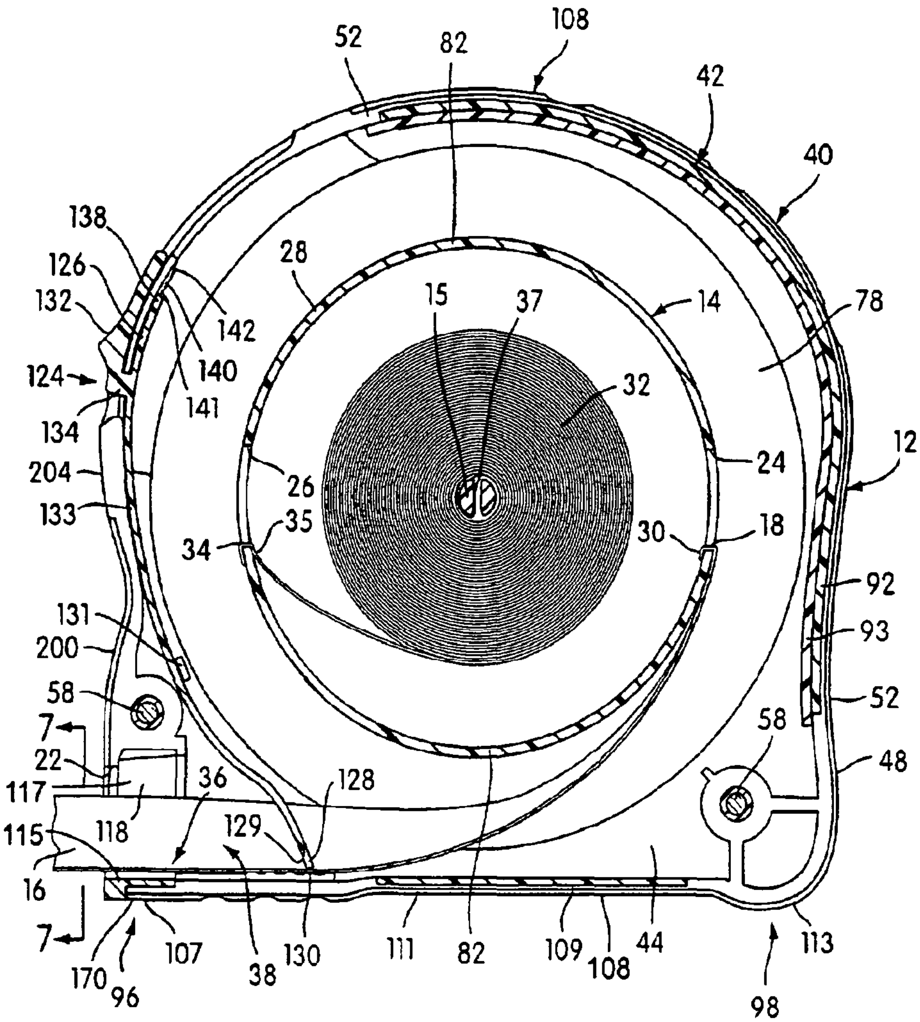
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FIG. 5

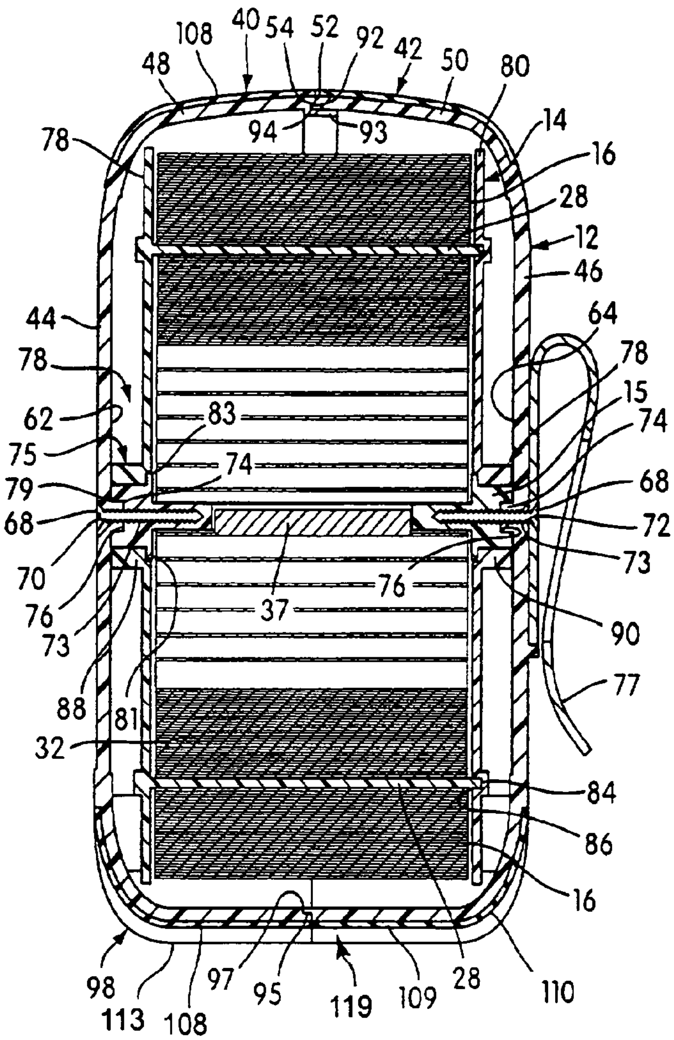
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FIG. 6

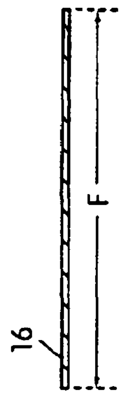

FIG. 8

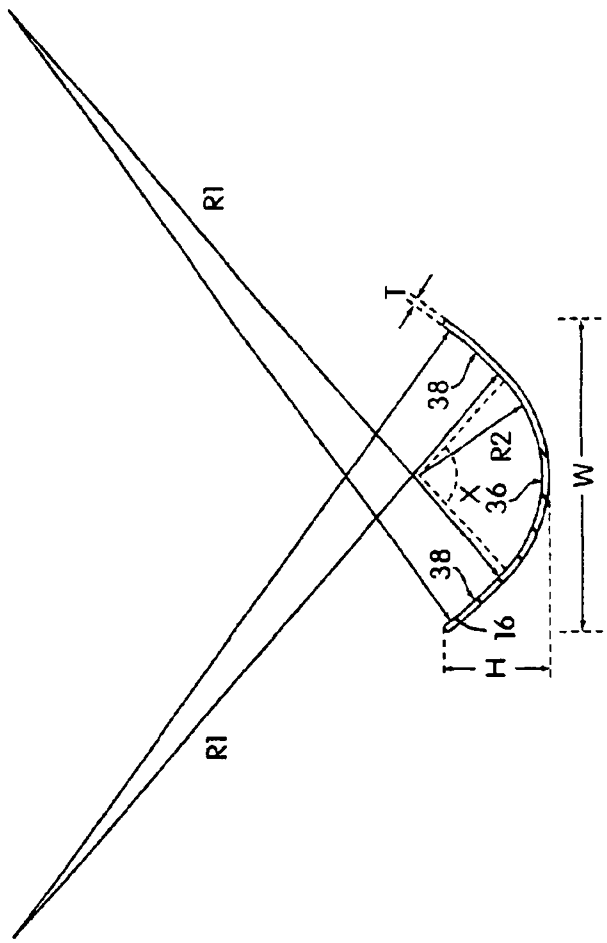

FIG. 7

PRIOR ART

*BLADE / SPRING WIDTH (IN)	*BLADE / SPRING THICKNESS (IN)	"ARCUATE" LENGTH-OUT "C" (IN / FT) (RANGE +/- 6 (IN))	***LINEAR LENGTH-OUT "B" (IN) (RANGE +/- 3%)	TAPE RULE REQUIRED HEIGHT TO ACHIEVE FULL BLADE EXTENSION "A" (IN) (RANGE +/- 3%)	PERCENT LINEAR TO ARCUATE LEGNTH-OUT	**** MAXIMUM TAPE RULE ROTATION ANGLE "D" AT FULL EXTENSION (DEGREES)
1.000 / 0.875	0.0045 / 0.0051	84 / 7 FT	79	23	94%	>45
1.000 / 0.875	0.0051 / 0.0056	84 / 7 FT	80	22	95%	>45
1.000 / 0.875	0.0051 / 0.0056	96 / 8 FT	86	40	90%	>45
1.000 / 0.875	0.0056 / 0.0060	84 / 7 FT	81	18	96%	>45
1.000 / 0.875	0.0056 / 0.0060	96 / 8 FT	91	31	95%	=/<35
1.000 / 0.875	0.0056 / 0.0060	108 / 9 FT	93	53	86%	=/<25
1.250 / 1.250	0.0051 / 0.0051	84 / 7 FT	83	5	99%	>45
1.250 / 1.250	0.0051 / 0.0051	96 / 8 FT	95	8	99%	>45
1.250 / 1.250	0.0051 / 0.0051	108 / 9 FT	107	17	99%	>45
1.250 / 1.250	0.0051 / 0.0051	120 / 10 FT	119	30	99%	>45
1.250 / 1.250	0.0051 / 0.0051	132 / 11 FT	129	38	98%	>45

* BLADE WIDTH MEASURED IN FLAT FORM OR ARCUATE PERIMETER OF THE CROSS SECTION
** RAW STEEL THICKNESS WITHOUT COATING(S)
*** ACTUAL UTILITY OF TAPE BLADE STANDOUT
**** ROTATION ANGLE REQUIRED WHEN MEASURING VERTICAL POINTS ABOVE HORIZONTAL PLANE OF BLADE TIP

FIG. 9

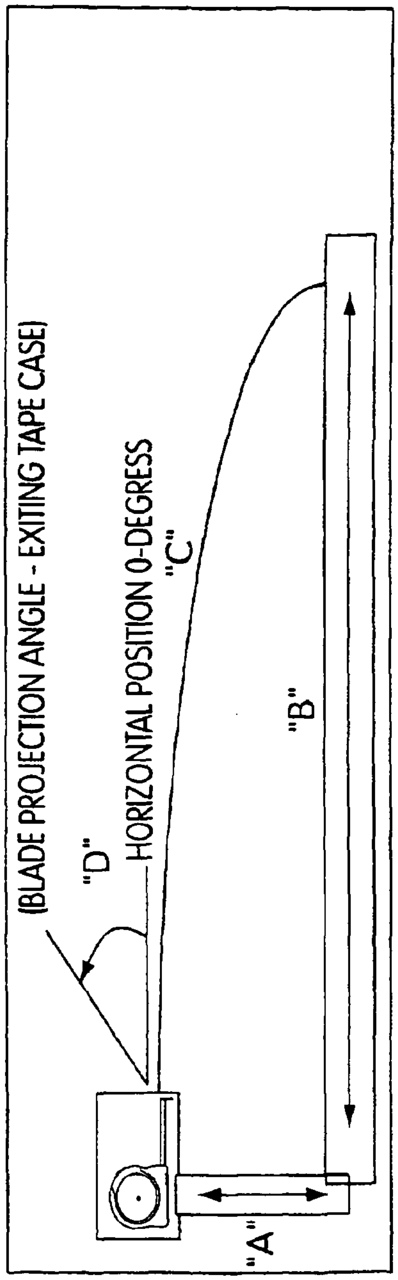
(BLADE PROJECTION ANGLE - EXITING TAPE CASE)
"D"
HORIZONTAL POSITION 0-DEGRESS
"C"
"B"
"A"

FIG. 10

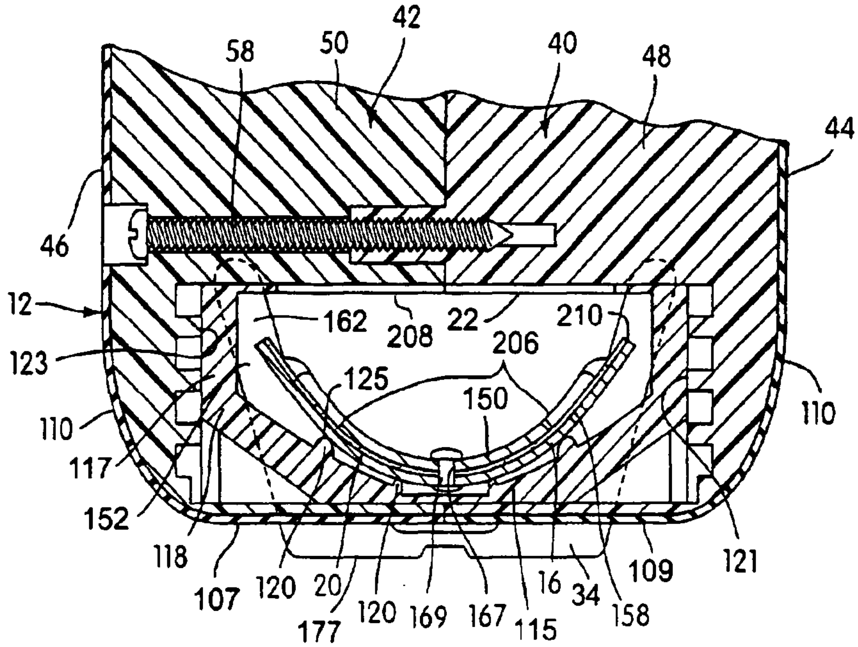
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FIG. 11

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 00 0362

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 4 429 462 A (RUTTY EDWARD C ET AL) 7 February 1984 (1984-02-07) * the whole document * -----	1-10	G01B3/10
A	US 1 964 248 A (WITCHGER EUGENE J ET AL) 26 June 1934 (1934-06-26) * the whole document * -----	1-10	
A	US 4 972 601 A (BICKFORD DUDLEY V ET AL) 27 November 1990 (1990-11-27) * column 3, line 12 - column 6, line 2 * -----	1-10	
A	DE 29 46 706 A (ROSSMANN CHRISTOPH) 27 May 1981 (1981-05-27) * pages 2-4; figures 1,2 * -----	1-10	
A	US 4 275 503 A (BERGKVIST LARS A) 30 June 1981 (1981-06-30) * column 1, line 62 - column 3, line 40; figures 1-5 * -----	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			G01B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	22 February 2006	Beyfuß, M

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CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 06 00 0362

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22-02-2006

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

(19) Europäisches Patentamt
European Patent Office
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(12) EUROPEAN PATENT APPLICATION

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G01B 3/10 *(2006.01)*

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Designated Extension States:
BA ME

(30) Priority: **28.01.2010 US 299224 P**
05.10.2010 US 898275

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(54) Tape rule and end hook therefor

(57) A rule assembly includes a housing, a reel rotatably mounted in the housing, and an elongated blade having an end hook member on a free end thereof. The elongated blade is arranged to be wound on the reel and to be extendable through an opening in the housing. The end hook member is formed of sheet metal to include a mounting portion and a hook portion bent at a generally right angle from an end of the mounting portion. The end hook member includes a pair of generally upwardly extending side edges, a generally laterally extending lower edge, and recessed edge portions disposed at corner portions at which the upwardly extending side edges and the laterally extending lower edge intersect.

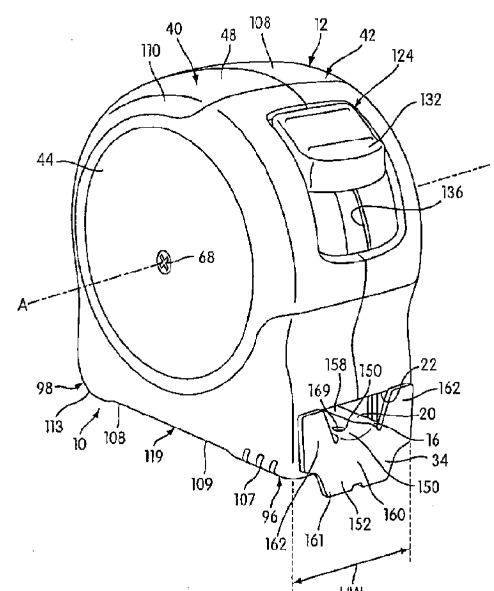


FIG. 1

EP 2 400 258 A1

Description

[0001] This application relies on the benefit of priority from U.S. Provisional Application No. 61/299,224, filed on January 28, 2010, which is incorporated herein by reference in its entirety.

[0002] The present invention relates to rule assemblies.

[0003] A typical tape rule assembly includes an elongated thin metal rule blade that is mounted on a reel rotatably disposed within a housing. The rule blade is retracted into the housing for storage by coiling it about the reel. To measure a work-piece, a length of the rule blade is pulled out of the housing to span the distance to be measured and the blade is held against the work-piece so that gradation lines and numbers printed on the blade can be read against a point on the work-piece. To measure a distance between two objects or surfaces, the blade hook at the free end of the blade may be temporarily secured or placed against an object or surface.

[0004] The present invention provides improvements over the prior art tape rules and blade hooks.

[0005] One aspect of the invention relates to a rule assembly that includes a housing, a reel rotatably mounted in the housing, and an elongated blade having an end hook member on a free end thereof. The end hook member includes a mounting portion and a generally hook portion extending from an end of the mounting portion. The end hook member comprises a pair of generally upwardly extending side edges, a generally laterally extending lower edge. The end hook member comprises recessed edge corner portions disposed between the upwardly extending side edges and the laterally extending lower edge.

[0006] Another aspect of the invention relates to a rule assembly that includes a housing, a reel rotatably mounted in the housing, an elongated blade arranged to be wound on the reel and to be extendable through an opening in the housing, the elongated blade having an end hook member on a free end thereof. The end hook member comprises a burred portion disposed on at least a portion of the end hook that is position above the elongated blade.

[0007] Another aspect of the invention relates to a rule assembly that includes a housing, a reel rotatably mounted in the housing, and an elongated blade having an end hook member on a free end thereof. The end hook member includes a mounting portion and a hook portion extending from an end of the mounting portion. The end hook member comprises a pair of generally upwardly extending side edges and a generally laterally extending lower edge. The end hook member comprises recessed edge corner portions disposed between the upwardly extending side edges and the laterally extending lower edge. Lower corner portions of the housing are constructed and arranged to extend beyond the recessed edge corner portions of the end hook member.

[0008] These and other aspects of the present invention, as well as the methods of operation and functions of the related elements of structure and the combination of parts and economies of manufacture, will become more apparent upon consideration of the following description and the appended claims with reference to the accompanying drawings, all of which form a part of this specification, wherein like reference numerals designate corresponding parts in the various figures. In one example of the invention, the structural components illustrated herein can be considered drawn to scale. It is to be expressly understood, however, that many other configurations are possible and that the drawings are for the purpose of example, illustration and description only and are not intended as a definition or to limit the scope of the invention. It shall also be appreciated that the features of one embodiment disclosed herein can be used in other embodiments disclosed herein. As used in the specification and in the claims, the singular form of "a", "an", and "the" include plural referents unless the context clearly dictates otherwise.

FIG. 1 shows a perspective view of a rule assembly in accordance with an embodiment of the present invention;

FIG. 2 shows a front of elevational view of the rule assembly in accordance with an embodiment of the present invention;

FIG. 3 shows a side of elevational view of the rule assembly in accordance with an embodiment of the present invention;

FIG. 4 shows a cross-sectional view of the tape rule assembly taken through the line 4--4 in FIG. 2 showing a blade thereof in a fully retracted configuration in accordance with an embodiment of the present invention;

FIG. 5 is a view similar to FIG. 4 except showing the blade in a fully extended configuration in accordance with an embodiment of the present invention;

FIG. 6 is a cross-sectional view taken through the line 6--6 in FIG. 3;

FIG. 7 shows a front view of an end hook in accordance with an embodiment of the present invention;

FIG. 8 shows a perspective view of the end hook in accordance with an embodiment of the present invention;

FIG. 9 shows another perspective view of the end hook in accordance with an embodiment of the present invention;

FIG. 10 shows a side perspective view of the end hook in accordance with an embodiment of the present invention;

FIG. 11 shows a top view of the end hook in accordance with an embodiment of the present invention;

FIG. 12 shows a rear perspective view of the end hook in accordance with an embodiment of the present invention;

FIGS. 13A-C show the procedures involved while the end hook engages with a work-piece having a large radius in accordance with an embodiment of the present invention;

FIG. 14 shows a front view of the end hook, where two-thirds of the mass of hook portion of the end hook lies outside a center section that comprises one-third of the hook portion's width in accordance with an embodiment of the present invention;

FIG. 15A shows a perspective view of the rule assembly prior to a corner impact in accordance with an embodiment of the present invention;

FIG. 15B shows a perspective view of the rule assembly, where lower corner portions of the housing extend beyond recessed surface portions of the hook portion in accordance with an embodiment of the present invention;

FIG. 16A-B shows a corner impact drop orientation and a side impact drop orientation for the rule assembly in accordance with an embodiment of the present invention;

FIG. 17 shows a bottom plan view of the rule assembly, where a gap is located behind upwardly extending side edges of the hook portion of the end hook in accordance with an embodiment of the present invention; and

FIGS. 18-22 show portions and dimensions of various parts of an exemplary end hook in accordance with an embodiment of the present invention.

FIGS. 1-4 show a rule assembly 10 in accordance with an embodiment of the present invention. The rule assembly 10 includes a housing 12, a reel 14 (as shown in FIGS. 4 and 5) rotatably mounted in the housing 12, and an elongated blade 16 having an end hook member 34 on a free end 20 thereof. The elongated blade 16 is

arranged to be wound on the reel 14 and to be extendable through an opening 22 in the housing 12.

[0009] In one embodiment, the housing 12 is constructed to easily and comfortably fit in a hand of the user because it optimizes the use of space within the housing 12 to house the blade 16, a coil spring 32 (as shown in FIGS. 4 and 5) and other cooperating components. The details of the internal structure of the housing 12 and the blade 16 mounted therein are shown in FIGS. 4-6. In one embodiment, the housing 12 and the reel 14 are constructed of, for example, a molded plastic material.

[0010] As can be clearly seen from FIG. 2, the housing 12 of the rule assembly 10 has an overall width dimension HW larger than a width dimension HW_1 of the housing near the opening 22 in the housing 12 from where the elongated blade 16 extends. For example, in one embodiment, the width of housing 12 is bit thinner near the opening 22 (towards a front lower portion of the housing) in comparison with the portion of the housing 12 at a central axis A that passes through the axis of rotation of the reel 14. An overall width dimension W of the hook portion 152 of the end hook 34 is greater than the width dimension HW_1 of the housing 12 near the opening 22 in the housing 12 from where the elongated blade 16 extends, and smaller than the overall width dimension HW.

[0011] As shown in FIG. 6, the housing 12 includes a pair of cooperating housing members 40, 42. In one embodiment, the housing members 40, 42 are made of, for example, a molded plastic material. Each housing member 40, 42 includes an end wall 44, 46, respectively, having a peripheral wall 48, 50, respectively, extending from a periphery thereof and terminating in a free edge 52, 54, respectively. The pair of cooperating housing members 40, 42 are movable toward one another in an axial direction into cooperating relation to define the housing 12 (where "axial direction" refers to the direction of the axis of rotation of the reel 14 defined by a reel spindle 15).

[0012] When the housing members 40, 42 are fixed together in the assembled rule assembly 10, the free edges 52, 54 are interengaged as shown in FIG. 6. It can be thus appreciated that the end walls 44, 46 can be considered the side walls of the assembled housing, the housing having side surfaces 393, a top surface 395, a front surface 397, a back surface 398, and bottom surface 399. A plurality of axially extending bolts 58 extend through one of the housing members 42 and threadedly engage the other housing member 40 at spaced positions adjacent the peripheral walls 48, 50. The housing members 40, 42 are also fixed together by the threaded engagement of bolts 68 with the fixed reel spindle 15. The axially extending spindle 15 is fixed at a central portion of the housing 12. In one embodiment, the fixed spindle 15 has a noncircular interengaging recess-projection connection (shown in FIG. 6 and described below) at each end thereof generally with a central interior region 62, 64, respectively, of the end walls 44, 46 of the housing 12. Each end of the fixed spindle 15 is interiorly threaded to threadedly receive the bolts 68 therein. The bolts 68 extend through central holes 70, 72 formed in the respective adjacent end walls 44, 46 of the housing 12 and threadedly engage internal threading 73 in each end of the spindle 15. Each bolt 68 extends through a recess-projection connection 75, when each bolt 68 is disposed in a respective central hole 70, 72 and threaded interior 73. A clip 77 is secured to one side of the housing 12 by one of the bolts 68. The clip 77 is generally used to attach the rule assembly 10 to the belt of a user, or other attachment point. In one embodiment, the belt clip 77 is made from, for example, a metal material.

[0013] In one embodiment, the spindle 15 is constructed of, for example, a molded plastic material or a nylon material. The construction of the recess-projection connections 75 between the ends of the spindle 15 and the walls 44, 46 is shown in cross-section in FIG. 6. Each recess-projection connection 75 is identical. In one embodiment, projections 74 having exterior noncircular cross-sections are integrally formed on the walls 44, 46 and are received within recesses 76 having complementary non-circular interior cross-sections formed on each end of the spindle 15. The noncircular interior and exterior cross-sections cooperate to prevent rotation of the spindle 15 with respect to the housing 12 when the ends of the spindle 15 are mounted on the projections 74 in the assembled rule assembly 10. Each end of the spindle 15 extends through a hole 79 of circular cross-section formed in opposite sides of the reel 14. The portions of the spindle 15 that extend through the holes 79 in the reel 14 have circular exterior cross sections. A flange 81 on the spindle 15 engages an annular groove 83 in the reel 14 surrounding the hole 79 to guide the rotation of the reel on the spindle. Thus, the reel 14 is rotatably mounted on the spindle 15 for bi-directional rotational movement of the reel with respect to the housing 12. As shown in FIGS. 4 and 6, the spindle 15 is internally slotted to receive the one longitudinal end 37 of the spring 32 to thereby secure the one end 37 of the spring 32 to the spindle 15.

[0014] The reel 14 includes two reel members 78, 80 (FIG. 6). In one embodiment, the reel 14 is made from, for example, a molded plastic material. The reel member 78 includes a integral cylindrical wall portion 28 about which the blade 16 is wound. In one embodiment, the reel member 80 is disk shaped. Each reel member 78, 80 includes an outwardly extending cylindrical wall portion 88, 90, respectively, formed around the hole 79. An annular edge portion 84 on the wall portion 82 is received within an annular groove 86 formed within the reel member 80 to help hold the reel 14 together. The abutting engagement of the wall portions 88, 90 on the reel 14 with the end walls 44, 46 of the housing 12 maintain the edge portion 84 within the groove 86 in the assembled rule assembly 10.

[0015] The housing members 40, 42 include portions along the abutting free edges thereof 52, 54, respectively, of tongue and groove construction (FIG. 6) to help secure the molded housing members 40, 42 of the assembled rule assembly 10 together. In one embodiment, at a top portion of the housing 12, a wall portion 92 formed on edge 54 is received within a groove 94 formed along a portion of the edge 52; and an integral wall portion 93 formed on edge 52 is disposed in underlying, abutting relation to wall portion 50 of the housing member 44. At a bottom portion of the housing 12, a wall portion 95 formed along a length of edge 54 is received within a recess 97 formed on a portion of the wall portion 48 of housing member 40.

[0016] When viewed from the side elevational view, the housing 12 includes only two corner portions (see FIG. 4, for example) 96, 98. One corner 96 is adjacent the housing opening 22 and the other corner portion 98 is at an opposite bottom end of the housing 12. The two bolts 58 are positioned in the two corner portions 96, 98, respectively, of the housing 12. Thus, it can be appreciated that the housing 12 is secured together using threaded fasteners in only three locations (from the point of view of one looking at the side elevational view of, for example, FIG. 4): at the opposite corners 96, 98 (bolts 58) at the bottom portion of the housing 12 and in the center of the housing 12 (bolts 68). This use of the bolts 68 on opposite ends of the reel spindle 15 allows the housing 12 to be secured together without using any bolts in a peripheral top portion or portions of the housing 12.

[0017] As shown in FIGS. 3-4, because the housing 12 does not require bolts in the upper periphery of the housing 12, the top portion 108 of the housing 12 can be made to have a relatively arcuate profile (FIG. 2, for example) that generally conforms to the profile of the reel 14, thus minimizing the footprint of the housing 12, eliminating corners in the upper portion of the housing 12 and providing a comfortable curved top surface to receive the palm of a user's hand. This arc-shaped upper surface of the housing 12 also increases impact resistance of the housing 12 in case the assembly 10 is dropped.

[0018] A peripheral portion of housing 12 is provided with a coating 110 around the gripped portion of the housing 12 to provide increased frictional engagement between the housing 12 and a user's hand and to provide a relatively soft comfortable surface for the user's hand. In one embodiment, the coating 110 is made from, for example, a rubber-like material.

[0019] The housing 12 includes a bottom wall 109 (FIGS. 4-5) having an exterior portion 107 at an end position adjacent the housing opening 22 which projects below an exterior surface portion 108 extending therefrom toward an opposite end 113 of the bottom wall 109 to provide a finger grip enhancing configuration 119 for a gripping hand of the user. In the illustrated embodiment, the bottom wall 109 (FIGS. 3-4) has the forward end portion 107 disposed adjacent the housing opening 22 and the rearward end portion 113 at the opposite end of the bottom wall 109. The portion 108 of the wall 109 therebetween is generally recessed to provide the finger grip enhancing configuration 119 for the gripping hand of the user. In one embodiment, this recessed area or gripping area 119 on the bottom of the housing 12 is covered with, for example, the overmolded rubber material or a rubber-like polymeric material. It can thus be appreciated that the housing 12 is constructed to be easily held in one hand of a user such that the user's fingers engage the finger grip enhancing portion 119 and the user's palm and thumb are generally in overlying relation with a top portion of the housing 12.

[0020] In one embodiment, a holding assembly 124 is constructed and arranged to be manually actuated to hold the blade 16 in any position of extension outwardly of the housing opening 22 and to release the blade 16 from any position in which it is held. The structure and operation of the holding assembly 124 is best appreciated from a comparison of FIGS. 4-5. The holding assembly 124 includes a holding member 126 mounted on the housing 12 for movement in opposite directions between a normally inoperative position (FIG. 4) and a holding position (FIG. 5). It can be appreciated that the blade holding member 126 is an arcuate member that is movable along an arcuate path between the two positions as aforesaid. The holding member 126 has an interior free end portion 128 that is movable into wedging engagement with the tangentially extending portion of the blade 16 to engage and hold the blade against an interior holding structure 130 (FIG. 5) on the housing 12 when the holding member 126 is in its holding position. The free end portion 128 includes a central recess 129 (FIG. 2, for example) that is described in detail below. The holding member 126 has an exterior thumb engaging portion 132 configured to be moved digitally to selectively move the holding member 126 from its normally inoperative position and its holding position. The exterior thumb engaging portion 132 is shown in FIGS. 1-2.

[0021] In one embodiment, the holding member 126 is an integral structure made of, for example, an appropriate durable flexible plastic material. The thumb engaging portion 132 is connected by an integral outwardly extending neck portion 134 to an elongated arcuate flexible body portion 133 that terminates in the interior free end 128. The outwardly extending portion 134 is slidably held within and guided by a slot 136 formed within a front part of housing 12 by the members 40, 42. The movement of a lower portion of the holding member 126 is guided by a pair of tabs 131 integrally formed on respective housing members 40, 42 (only one tab is shown in the figures). An integral locking structure 138 on the holding member 126 engages holding structure 140 (FIG. 5) integrally formed on the housing 12 to releasably lock the holding member 126 in the holding position in wedging engagement with the blade 16.

[0022] In one embodiment, to lock the blade 16 in a given position of extension, the user (while holding the blade 16 outwardly of the housing 12 against the spring force of the coil spring 32) slides the thumb engaging portion 132 downwardly with respective to the housing 12 causing the locking structure 138 to slide over a ramped surface 142 on the holding structure 140 and causing the free end 128 to move in a locking direction with respect to the blade 16. The flexible plastic locking structure 138 bends resiliently outwardly slightly as it passes over the holding structure 140. After the free end 128 contacts the blade 16, continued movement of the thumb engaging portion 132 in the locking (downward) direction thereafter wedges the free end 128 of the flexible body portion 133 against blade 16 to hold the blade 16 in place against the spring force of the coil spring 32 and moves the locking structure 138 into abutting engagement with a locking surface 141 on the holding structure 140. The holding member flexes slightly as the free end 128 is wedged against the blade 16. The abutting engagement between the locking structure 138 and the locking surface 141 locks the holding member 126 in its holding position. It can be understood from FIG. 5 that the blade 16 is held in an extended position (against the spring force of the coil spring 32) between the free end 128 of the body portion 133 and the interior holding structure 130 by the downward force exerted by the wedged body portion 133. The interior holding structure 130 (not visible in detail) is a series of longitudinally spaced, transversely extending ribs that are constructed and arranged to support the convex side of the blade 16. When viewed from the point of view of FIG. 5 (i.e., on a transversely directed line of sight), the top surfaces (not visible in the FIGS.) of the ribs cooperate to provide a generally downwardly sloped support (in a direction toward the opening 22) for the blade 16; and when viewed from the front, (i.e., on a longitudinally directed line of sight) the top surfaces (not visible in the figures) of each rib of the interior holding structure 130 are transversely spaced in a concave array to receive and support the convex side of the blade.

[0023] To release the blade 16, the user pulls upwardly on the thumb engaging portion 132 which causes the locking structure 138 on the plastic holding member 126 to move resiliently outwardly and past the locking surface 141 to release the holding member 126 from engagement with a blade 16. The holding member 126 resiliently returns to its normal arcuate shape. It can be appreciated from FIG. 2 that the recess 129 on the free end 128 of the holding member 126 defines two transversely spaced teeth 147 which have spaced arcuate side surfaces 144 sized to conform to the concave surface of the blade 16 to hold the same in locked position.

[0024] It can be understood that the use of the holding member 126 when a, measurement is being taken is optional. When taking a measurement, the user typically holds the housing 12 in one hand and manually pulls the blade 16 out of the housing 12 with the other hand. When a sufficient length of blade 16 has been withdrawn from the housing 12, the user can lock the blade 16 with respect to the housing 12 using the holding member 126 to prevent the blade 16 from retracting back into the housing 12 (under the spring force of spring 32) when the user releases the blade 12. When the measurement has been taken, the user simply releases the holding member 126 from holding engagement with the blade 16 by moving the free end 128 thereof out of wedging engagement with the blade 16 in the manner described above. If the holding member 126 is not used during the taking of a measurement, the user can simply hold the blade 16 with his other hand while the measurement is being taken or, alternatively, the hook member 34 can be placed in hooking engagement with the work-piece to hold the blade 16 outwardly of the housing 12 in a controlled and steady manner against the spring force of spring 32 while the measurement is being taken.

[0025] When the blade 16 is released after taking the measurement, the spring 32 rotates the reel 14 with respect to the housing 12 in a blade-winding direction to wind the blade 16 around the reel 14. A relatively short free end portion of the blade 16 has a clear film 158 of plastic material adhered to the concave side thereof (FIG. 11) to protect the blade 16 while the same is out of the housing 12 and while the blade 16 is being retracted under the spring force of the spring 32 back into the housing 12. In one embodiment, the film is made of polyurethane and is adhered to the blade by an acrylic adhesive. It is also contemplated to use polyester to construct the film. In one embodiment, the film has a thickness dimension of approximately 0.0005 inches. It is within the scope of the invention to apply this film to the blade of any known tape rule assembly.

[0026] The free end 20 of the blade 16 is frequently handled by the user and this handling can over time cause the numbering and markings on the concave side of the blade 16 to wear off or become difficult to read. The film 158 prevents this wear because it covers the numbering and markings on the free end of the blade and thereby protects the same from being worn off.

[0027] In one embodiment, the blade 16 is formed of a ribbon of metal (e.g., the metal being steel), and the top concave surface of the blade is printed with measuring lines and digits (not shown) for measuring lengths and distances. A first longitudinal end 18 of the blade 16 is connected to a first longitudinal end 35 of the coil spring 32 and the second longitudinal free end 20 of the blade 16 extends generally outwardly of the reel 14. The blade 16 is constructed and arranged with respect to the housing 12 to extend generally from a position tangential of the reel 14 outwardly through the opening 22 provided in the housing 12 (as shown, for example, in FIG. 4).

[0028] The reel 14 is mounted in the housing 12 by the reel spindle 15 that is secured within the housing 12. In one embodiment, the reel 14 is made of a molded plastic and is provided with a slot or an opening26 in a central cylindrical wall portion 28 thereof. The one end 18 of the blade 16 terminates in a hook-like structure 30 that engages the first longitudinal end 35 of the coil spring 32 to connect the end 18 of the blade 16 to the coil spring 32 (FIGS. 4, 5).

[0029] The coil spring 32 is constructed and arranged between the housing 12 and the reel 14 to rotate the reel 14 with respect to the housing 12 in a direction to wind the elongated blade 16 about the reel when the blade 16 is extending outwardly of the housing opening 22. The coil spring 32 is generally enclosed within the central wall portion 28 of the reel 14 (FIGS. 4-6). The first longitudinal end 35 of the coil spring 32 extends through the opening 26 and engages the first longitudinal end 18 of the blade 16, and a second longitudinal end 37 of the coil spring 32 hookingly engages the spindle 15. The spindle 15 is rigidly mounted to the housing 12 in a manner described above. In one embodiment, the spring 32 is a thin, flat ribbon of metal (e.g., the metal being steel).

[0030] The blade 16 is generally movable between a fully retracted position outwardly of the housing 12 to a fully extended position. The fully retracted position of the blade 16 is shown in FIG. 4 and the fully extended position of the blade is shown (in fragmentary view) in FIG. 5. It can be appreciated from a comparison of FIG. 4 and FIG. 5 that as the blade is unwound from the reel 14, the coil spring 32 is wound around the rigidly fixed spindle 15. This winding of the spring around the spindle stores energy in the spring to provide spring powered rewinding of the blade 16 around the reel 14 when the extended blade is released.

[0031] The blade 16 may be constructed of a ribbon of sheet metal that is shaped during the manufacturing to have a normal or memory configuration that has a generally arcuate or concavo-convex transverse cross-section. When a portion of the blade 16 is wound about the reel 14, the wound portion has a flat transverse cross-section and the wound layers of the coiled blade provide the wound blade with an abutting volute coil configuration. In other words, when the blade 16 is wound around the reel 14, it has the flat cross-section and when the blade 16 is withdrawn from the housing 12 to measure an object, it returns to the concavo-convex cross-section. Thus, the coil spring 32 is constructed and arranged between the housing 12 and the reel 14 to rotate the reel 14 about the spindle 15 with respect to the housing 12 in a direction to wind up the elongated blade 16 when extending outwardly of the housing opening 22 in a normal concavo-convex cross-sectional configuration onto the reel 14 in an abutting volute coil formation in a flattened cross-sectional configuration. The concavo-convex cross-section provides the extended blade with rigidity and maintains the blade essentially straight in the longitudinal direction.

[0032] The concavo-convex cross-section of the blade 16 generally provides the unsupported blade 16 with blade standout. The concavo-convex cross-section of the blade 16 generally includes an arcuate central section 36 and integral end sections 38. In various embodiments, the concavo-convex cross-sectional configuration of the blade 16 can be of the type described in commonly assigned U.S. Pat. No. 6,324,769, that is hereby incorporated by reference in its entirety.

[0033] FIGS. 7-12 show different views of the end hook member 34. As shown in FIGS. 7-12, the end hook member 34 includes a mounting portion 150 and a hook portion 152 bent at a generally right angle from an end of the mounting portion 150. In one embodiment, the end hook member 34 is formed of, for example, a sheet metal material of a predetermined thickness.

[0034] In one embodiment, the hook portion 152 has a generally U-shaped configuration. In one embodiment, the mounting portion 150 has a generally concavo-convex configuration. In another embodiment, the mounting portion 150 has a generally flat configuration.

[0035] As shown in FIGS. 1-4, the end hook member 34 is mounted on the free end 20 of the blade 16 with the mounting portion 150 thereof secured in engagement with a concave (upper) side of the free end 20 of the blade 16 and in overlying relation thereto.

[0036] In one embodiment, the connection between the free end 20 of the blade and the mounting portion 150 may permit limiting sliding movement therebetween.

[0037] Specifically, as shown in FIGS. 4, 9 and 11, the mounting portion 150 is provided with large holes 167 (FIGS. 4, 9 and 11) and a plurality of rivets 169 extend through the holes 167 to slidably mount the end hook member 34 to the blade 16 for limited longitudinal relative movement between the end hook member 34 and the blade 16 (i.e., the diameter of each hole 167 is greater than the diameter of the associated rivet 169 by an amount approximately equal to the desired amount of hook movement). The limited sliding engagement allows the blade 16 to be measured externally from an external surface 161 of the U-shaped hook portion 152 or internally from an internal surface 163 of the U-shaped hook portion 152. In other words, the sliding movement of the end hook member 34 allows an accurate measurement to be taken with either surface 161 or 163 in abutting relation with the work-piece; the hook member 34 slides longitudinally with respect to the blade 16 a distance approximately equal to the thickness of the hook portion 152 (where the thickness is measured from surface 161 to surface 163) so that a measurement taken with either surface 161 or 163 in abutting engagement with the work-piece will yield an accurate measurement.

[0038] In one embodiment, the distribution of the mass in the hook portion 152 is such that at least half of the mass of the hook portion 152 lies above an upper surface 380 (as shown in FIG. 7) of the elongated blade 16. In other words, in one embodiment, a larger portion of the mass of the hook portion 152 (and the mounting portion 150) is above an axis D-D (as shown in FIG. 7) passing through the upper surface 380 (as shown in FIG. 7) of the blade 16. In another embodiment, the distribution of the mass in the hook portion 152 is such that at least half of the mass of the hook portion 152 lies above the mounting portion 150 of the end hook member 34. These configurations of the end hook member 34 allows for increased top catching capability of the end hook member 34. In one embodiment, the top catching capability of the end hook member 34 generally refers to the ability of a portion the end hook 34 to hookingly engage with a work-piece to facilitate extension of the blade 16 and to temporarily secure the blade to the work-piece while a measurement is being taken. In such an embodiment, the portion of the end hook 34 may be a) located above the blade 16 and b) located above and to the side of the blade 16.

[0039] In one embodiment, the U-shaped hook portion 152 including a bight section 160 and spaced leg sections 162 extending upwardly from the bight section 160. In one embodiment, the bight section 160 of the U-shaped hook portion 152 is configured to extend downwardly, below a convex side of the free end 20 of the blade 16. The bight section 160 of the hook portion 152 of the hook member 34 provides an under-catch structure that can hookingly engage a work-piece to facilitate extension of the blade 16 and to temporarily secure the blade to the work-piece while a measurement is being taken.

[0040] In one embodiment, as shown in FIG. 7, the leg sections 162 extend laterally outwardly beyond the longitudinally extending edges of the blade 16 to provide a side catch surface on each side of the blade 16 that can be used to hook the blade 16 to an object or work-piece. The side catch structure provided by the legs 162 can function to secure the free end 20 of the blade 16 during a measurement. The side catch structure provided by the leg sections 162 also allow the blade 16 to be easily and steadily held in a position relative to a surface of the work-piece, thereby allowing a longitudinally extending edge of the blade 16 to be held against the work-piece. In one embodiment, when the convex side of the blade 16 is against the work-piece, the longitudinal edges are normally spaced from the surface because of the concavo-convex cross-section of the blade 16. The side catch provided by the legs 162 of the hook member 34 can be hooked over an edge of the work-piece to allow the user to hold steadily a longitudinal edge of the blade 16 very close to or directly against the work-piece when the convex side of the blade 16 is against the work-piece, which facilitates reading a measurement.

[0041] In one embodiment, as shown in FIG. 7, the leg sections 162 extend laterally beyond transversely spaced corners 171 of the free end 20 of the blade 16. In the illustrated embodiment, as shown in FIG. 7, the side surface 328 of leg sections 162 extend (at its laterally outermost point, when taking a vertical or plumb tangent line to the side surface 328 as shown) laterally beyond transversely spaced corners 171 of the free end 20 of the blade 16 by a distance of X (shown in FIG. 7). In one embodiment, the leg sections 162 extend laterally beyond transversely spaced corners 171 (as shown in FIG. 4) of the free end 20 of the blade 16 by at least a distance of 0.08 inches (i.e., by a distance equal to or greater than 0.08 inches). In one embodiment, as seen in FIG.4, the corners 171 at the front edge of the blade are chamfered or angled.

[0042] In one embodiment, as shown in FIG. 7, the upper portions of the leg sections 162 extend generally upwardly and outwardly above the concave side of the blade 16 to provide structure above the concave surface of the blade 16 to hookingly engage the work-piece to facilitate extension of the blade 16 and to hold the free end 20 of the blade 16 while a measurement is being read. For example, the blade 16 can be placed against a work-piece such that the concave side of the blade 16 is facing the work-piece and such that the opposite longitudinal edges of the blade 16 abut a surface on the work-piece at a point where they measurement is to be read. When the blade 16 is in this position, the upwardly extending portions of the legs 162 on the hook member 34 can be used to hold the free end 20 of the blade 16 against the work-piece.

[0043] In one embodiment, the leg sections 162 extend upwardly above both the mounting portion 150 and the spaced corners 171 of the free end 20 of the blade 16. In the illustrated embodiment, as shown in FIG. 7, the upper surface of leg sections 162 extend upwardly above transversely spaced corners 171 of the free end 20 of the blade 16 by a distance of Y, at a maximum height as shown. In one embodiment, the leg sections 162 extend upwardly above the spaced corners 171 of the free end 20 of the blade 16 by at least a distance of 0.08 inches (i.e., by a distance equal to or greater than 0.08 inches).

[0044] In one embodiment, with a substantial increase in the size and width of the end hook member 34, the end hook member 34 is to be protected from side and corner impacts.

[0045] FIG. 15A shows a front plan view of the rule assembly. As shown in FIG. 15A, at least a portion of forward lower corner portions 360 of the housing 12 are exposed (i.e., extended beyond the notched or recessed edge portions 342 at the lower, opposite ends of the hook portion 152). In one embodiment, the blade 16 (i.e., along the end hook 34 attached to the free end 20 thereof) of the rule assembly 10 is constructed and arranged to be movable from a first position (as shown in FIG. 15A) to a second position (as shown in FIG. 15B) to the end hook 34 upon impact (e.g., the tape rule housing being accidently dropped). In other words, as shown in FIG. 15B, sufficient clearance and/or movability of the blade and end hook 34 parts allows the end hook 34 to be pushed upwards (from its position as shown in FIG. 15A to the position in FIG 15B) to protect the end hook 34 from bring bent upon impact. In one embodiment, as shown in FIG. 15B, a large portion (i.e., in comparison with FIG. 15a) of the forward lower corner portions 360 of the housing 12 extend beyond the notched or recessed edge portions 342 at the lower, opposite ends of the hook portion 152 upon impact. In other words, in one embodiment, as shown in FIG. 15B, the notches 342 permit a sufficient portion of the forward lower corner portions 360 of the housing 12 to be exposed upon impact to prevent or at least reduce the likelihood of hook portion 152 from being bent/damaged upon impact. In one embodiment, when the rule assembly 10 is dropped in an orientation to have a corner impact (shown in FIG. 16A), the recessed edge portions 342 of the end hook member 34 are constructed and arranged to allow (or provide access to) the lower corner portions 360 of the housing 12 to receive the majority of the force upon a corner impact.

[0046] In one embodiment, when the rule assembly 10 is dropped in an orientation to have a side impact (shown in FIG. 16B), the housing 12 of the rule assembly 10 is constructed and arranged to first receive the impact. In one embodiment, during a side impact (shown in FIG. 16B) of the rule assembly 10, the end hook member 34 is protected because an overall width dimension HW (as shown in FIG. 2) of the housing 12 of the rule assembly 10 is wider than the width dimension W (as shown in FIG. 7) of the end hook member 34. In one embodiment, during the side impact (shown in FIG. 16B) of the rule assembly 10, the housing 12 of the rule assembly 10 is constructed and arranged to receive and absorb the impact in order to protect the end hook member 34 from bending due to the side impact (shown in FIG. 16B).

[0047] In one embodiment, the end hook member 34 may not contact the ground during a side impact. Specifically, when the rule assembly 10 is dropped in such an orientation (to have a side impact) that the end wall 44 or 46 (as shown in FIG. 6) of the rule assembly 10 generally lies parallel a surface (i.e., ground) on which it impacts (or the central axis A (as shown in FIG. 2) that passes through the axis of rotation of the reel 14 is generally perpendicular to the surface (i.e., ground) on which it impacts), then the end hook member 34 may not contact the ground during a side impact. This is at least in part because the thickness of the housing towards central portions thereof (e.g. along axis A), is such that the hook member 34 is signed and configured such that it will not contact an impact surface that is perpendicular to axis A.

[0048] In one embodiment, as shown in FIGS. 7-12, the end hook member 34 includes a pair of generally upwardly extending side edges 328, a generally laterally extending lower edge 330, and a generally laterally extending upper edge 332.

[0049] In one embodiment, as shown in FIGS. 7-12, the laterally extending lower edge 330 includes a pair of lowermost surfaces 334 lying along a common line or axis A-A and separated by an upwardly extending groove or notch portion 336. In another embodiment, the laterally extending lower edge 330 including the pair of lowermost surfaces 334 may lie along a curved line, such as a convex line (i.e., instead of the straight line).

[0050] In one embodiment, as shown in FIGS. 7-12, each of the upwardly extending side edges 328 extend along a line B-B that forms an angle that is between 85° and 100° with respect to the common line A-A along which the laterally extending lower edge 330 extends.

[0051] In one embodiment, as shown in FIGS. 7-12, the laterally extending upper edge 332 includes a pair of uppermost surfaces 338 lying along a common line or axis C-C and separated by an downwardly extending U-shaped portion 340. In another embodiment, the laterally extending upper edge 332 including the pair of uppermost surfaces 338 may lie along a curved line (i.e., instead of the straight line). In one embodiment, the U-shaped portion may include a pair of inwardly sloping edges 382 and 384, as shown in FIG. 7, and a connecting portion 386 constructed and arranged to join the two inwardly sloping edges 382 and 384. In one embodiment, the U-shaped portion 340 may include a pair of notch or groove portions 388 and 390 positioned at the area in which the connecting portion 386 join to the inwardly sloping edges 382 and 384.

[0052] In one embodiment, upper inner corners 392 and 394 at which the inwardly sloping edges 382 and 384 join with the laterally extending upper edge 332 are generally rounded or chamfered. In one embodiment, upper outer corners 396 and 398 at which the upwardly extending side edges 328 join with the laterally extending upper edge 332 are generally rounded or chamfered.

[0053] In one embodiment, as shown in FIGS. 7-12, the end hook member 34 includes recessed edge portions 342 disposed at corner portions at which the upwardly extending side edges 328 and the laterally extending lower edge 330 intersect. In one embodiment, the recessed edge portions 342 are constructed and arranged to protrude inwardly from a point 329 at which the upwardly extending side edges 328 and the laterally extending lower edge 330 intersect.

[0054] In one embodiment, as shown in FIGS. 7-12, the recessed edge portions 342 are constructed and arranged to extend between a first point 344 and a second point 346. In one embodiment, the first point 344 is at the end of the laterally extending lower edge 330 and the second point 346 is at the end of the upwardly extending side edge 328. In one embodiment, the linear distance between the first point 344 and the second point 346 is at least equal to 0.125 inches (i.e., is equal to or greater than 0.125 inches).

[0055] In one embodiment, the recessed corner portions 342 constructed and arranged to connect with the upwardly extending side edge 328 at the second point 346 and to connect with the laterally extending lower edge 330 at the first point 344. In one embodiment, corners that lie on the first point 344 and the second point 346 are generally rounded or chamfered.

[0056] As clearly shown in FIG. 12, in one embodiment, the end hook member 34 includes at least a burred portion (e.g., an area of roughness) 348 disposed on a portion of the end hook 34 that is positioned above the elongated blade 20. In one embodiment, the minimum height of the burred portion 348 is at least 0.003 inches from base to peak. In one embodiment, the height of burred portion 348 is between 0.010 to 0.015 inches.

[0057] In one embodiment, the burred portions 348 disposed (i.e., in multiple orientations) on the end hook 34 are constructed and arranged to hookingly engage the end hook 34 with the work-piece while a measurement is being read.

[0058] In one embodiment, the burred portions 348 disposed on the end hook member 34 are constructed and arranged to provide the end hook member 34 with an extra catching capability (i.e., when using the end hook member 34 to take measurements of a work-piece that is in an orientation other than directly below the blade 16). Also, in one embodiment, by having an end hook member 34 with burred portions 348 in multiple orientations accuracy is maintained.

[0059] In one embodiment, the burred portions 348 are disposed in multiple orientations on the end hook 34. In one embodiment, the burred portions 348 are disposed on the uppermost surfaces 338 of the leg sections 162. In one embodiment, the burred portions 348 are disposed on the upwardly extending side edges 328 of the end hook 34. In one embodiment, the burred portions 348 are disposed on the laterally extending lower edge 330 of the end hook 34. In one embodiment, the burred portions 348 are disposed on the portions of the end hook 34 beyond the curvature of the blade 16.

[0060] In one embodiment, as shown in FIG. 12, the burred portions 348 project inwardly towards the tape rule body (to the right in FIG. 12) from the peripheral edge portions of the end hook 34. For example, the burred portions 348 may extend from the top portions 351 of inner surface 349 of the hook member 34 (adjacent the uppermost edges or surfaces 338). In addition (or alternatively), the burred portions 348 may be adjacent side edges 328 and extend from portions of the inner surface 349 that are near or adjacent side edges 328 of the end hook 34. Furthermore, the burred portions may alternatively or additionally be formed adjacent the bottom or lower edge 330 of the hook member 34 and extend inwardly toward the tape rule housing side of the hook member 34 (to the right in FIG. 12 as shown). In one embodiment, these burred portions (e.g., an area of roughness) 348 are formed during a stamping operation of the end hook 34.In other words, after the stamping operation, the peripheral edges of the end hook member 34 are not de-burred, leaving burrs 348 intact to provide a gripping attribute to the edges of the hook member 34.

[0061] In one embodiment, the recessed edge portions 342 are constructed and arranged, as shown in FIG. 13C, such that when the end hook member 34 hookingly engages with a work-piece with a large radius, the recessed edge portions 342 are constructed and arranged to engage with curved surface portions 350 of the work-piece 352.

[0062] FIGS. 13A-C show the end hook member 34 of the extended blade 16 engaging with a work-piece 352 having two perpendicular, planar surface portions 353 and 355 with a curved (i.e., with a large radius) surface portion 350 at an interface therebetween. As shown in FIG. 13A, first the burred portions 348 disposed on the inner surface 349 adjacent the side edge 328 of the end hook member 34 are brought into contact with the planar surface portion 353 of the work-piece 352. As shown in FIGS. 13A and 13B, when the side burred portions 348 disposed on the inner surface 349 adjacent the side edge 328 of the end hook member 34 come in contact with the planar surface portion 353 of the work-piece 352, the end hook member 34 is constructed and arranged to rotate (as the blade 16 twists slightly) until the corner point (or the first point) 344 disposed at the intersection of the laterally extending lower edge 330 and the curved or recess edge portion 342 contacts the curved surface 350 or planar surface 355 of the work-piece 352, thus, stabilizing the end hook member 34. FIG. 13C shows the end hook member 34 in a stable configuration, where the recessed edge portions 342 of the end hook member 34 engage with the curved surface portion 350 of the work-piece 352, while the second point 346 (at the intersection between the curved or recess edge portion 342 and the side edge 328) disposed at the end of the upwardly extending side edge 328 is still in contact with the planar surface portion 353 of the work-piece 352. Thus, the second point 346 contacts the first planar surface 353, while curved edge 342 of the end hook 34 lies adjacent to the curved surface 350 of the work piece, and the first point 344 contacts a portion of the curved surface 350 or planar surface 355. During this operation, the lower portion of the end hook 34 is disposed slightly more closely to the tape rule housing (the hook member 34 is disposed at a slight angle)

[0063] In one embodiment, as shown in FIGS. 7 and

10, the mounting portion 150 has a length dimension L, and the hook portion 152 has a width dimension W. In one embodiment, to increase side catching capability of the end hook 34 while limiting weight of the end hook 34, the width dimension W of the hook portion 152 (i.e., face of the end hook 34) is larger than the length L of the mounting portion 150 (i.e., shank of the end hook 34). That is, in one embodiment, a ratio of the width dimension W of the hook portion 152 to the length dimension L of the mounting portion 150 is greater than or equal to 1.

[0064] In one embodiment, as shown in FIGS. 7 and 11, the mounting portion 150 has a top surface area TA, and the hook portion 152 has a front surface area FA. In one embodiment, to increase side catching capability of the end hook 34 while limiting weight of the end hook 34, the front surface area FA of the hook portion 152 (i.e., face of the end hook 34) is made larger than top surface area TA of the mounting portion 150 (i.e., shank of the end hook 34). That is, in one embodiment, a ratio of the front surface area FA of the hook portion 152 to the top surface area TA of the mounting portion 150 is greater than or equal to 1.1. Also, because the thickness of the metal is approximately uniform, the ratio of the weight of the hook portion 152 to the mounting portion 150 is similarly greater than or equal to 1.1.

[0065] As noted above, the mass of the mounting portion 150 (i.e., shank) of the end hook 34 is limited by having a ratio of the front surface area FA of the hook portion 152 to the top surface area TA of the mounting portion 150 is greater than or equal to 1.1 and/or a ratio of the width dimension W of the hook portion 152 to the length dimension L of the mounting portion 150 is greater than or equal to 1.

[0066] In one embodiment, as shown in FIG. 14, if the hook portion's width W is divided into three equal length sections 354, 356, and 358, at least two-thirds of the mass of the hook portion 152 lies outside a center section 356 that comprises one third of the hook portion's width. More specifically, in one embodiment, as shown in FIG. 14, the hook portion 152 may include a central section 356, and opposing side sections 354 and 358 on opposite sides of the central section. The sections 354, 356 and 358 each include a width dimension that is equal to one-third of the width dimension W of the hook portion 152. In one embodiment, at least two-thirds of the mass of the hook portion 152 lies outside the central one third of the width of the hook portion 152 (i.e., face) of the end hook 34.

[0067] In one embodiment, by moving additional mass of the end hook 34 outboard of the central axis of the end hook 34, the end hook 34 acts as a stabilizer. This construction of the end hook 34 (i.e., where two-thirds of the mass of the hook portion 152 lies outside the center section 356) reduces roll of the blade 16 when the blade 16 is extended from the housing 12. This is achieved because the moment of rotational inertia of the end hook 34 is increased. In one embodiment, the moment of inertia of the end hook 34 is taken with respect to a plane in which the hook portion 152 of the end hook 34 lies. By increasing the overall inertia of the end hook 34, in relation to the axis of rotation that runs parallel to the blade length, the rule assembly 10 is stabilized. This gives the user a more stable rule assembly 10 and more opportunity to "recover and adjust" if the blade 16 begins to roll.

[0068] When the blade 16 is fully retracted into the housing 12 (as shown in FIGS. 1, 3 and 4), the blade 16 may be extracted by pulling the hook member 36 from behind the lower edge 330 (i.e., below the blade 16) of the hook member 34. In one embodiment, the end hook 34 gives the user access to extract the hook member 34 from behind the side edges 328 as well. For example, in one embodiment, when the blade 16 is fully retracted into the housing 12 (as shown in FIGS. 1, 3 and 4), a gap G (as shown in FIG. 17) is located behind the upwardly extending side edges 328 of the end hook 34. In other words, in one embodiment, when the end hook member 34 rests against the housing 12, the rear portions of the end hook member 34 immediately behind side edges 328 are free and do not rest or abut against the housing 12. This gap G (as shown in FIG. 17) located behind the upwardly extending side edges 328 of the hook portion 152 of the end hook 34 allows the user to extract the blade 16 along the side edges 328 of the hook member 34. In such embodiment, the blade 16 may be extracted by the user by inserting a finger in the gap G (as shown in FIG. 17) located behind the upwardly extending side edges 328 of the hook portion 152 of the end hook member 34.

[0069] As can be appreciated from FIG. 17, the housing tapers, so as to have a tapered region 391, as it transitions from the side surfaces 393 to the front surface 397 at a region near the opening in the housing that receives the tape rule blade. The tapered region 391 narrows the width of the housing as it approaches the opening 22 in the housing so that the hook is wider than the housing at a region where the hook portion abuts the housing and/or near the opening. As shown, the housing may be wider than the end hook 34 at regions spaced from the opening 22. This is one possible construction for forming the gap G, but other configurations are also possible.

[0070] In one embodiment, the end hook may be formed from various types of steel material. For example, in one embodiment, the end hook is formed from high carbon steels.

[0071] FIGS. 18-22 show portions and dimensions of various parts of the end hook in accordance with an embodiment of the present invention. The portions and dimensions of various parts of the end hook shown in FIGS. 18-22 are intended to be merely exemplary and not limiting in any way. The various parts of the end hook shown in FIGS. 18-22 are drawn to scale in accordance with one embodiment, although other scales and shapes may be used in other embodiments. The dimensions of various parts of the end hook as shown in FIGS. 18-22 are measured in inches unless indicated otherwise. In one embodiment, the dimensions of various parts of the end hook, as shown in FIGS. 18-22, are up to 10 percent greater than or up to 10 percent less than those illustrated. In another embodiment, the dimensions of various parts of the end hook, as shown in FIGS. 18-22, are up to 5 percent greater than or up to 5 percent less than those illustrated. FIG. 21 illustrates a radius R of the recessed edge portions 342. In one embodiment, a non-limiting range for the radius R of the recessed edge portions 342 is between 0.03 to 0.4 inches.

[0072] The aspects described above of the end hook including the extra top catch and side catch capabilities, burrs in multiple orientations, recessed edge portions, a ratio of the front surface area of the hook portion to the top surface area of the mounting portion is greater than or equal to 1.1, a ratio of the width dimension of the hook portion to the length dimension of the mounting portion is greater than or equal to 1, two-thirds of the mass of the hook portion lies outside a center section that comprises one third of the hook portion's width, at least half of the mass of the hook portion lies above the elongated blade, and/or an overall width dimension of the hook portion of the end hook is greater than the width dimension of the housing near the opening in the housing from where the elongated blade extends can be used separately or in combination with one another.

[0073] Similarly, the general teachings of the dimensions and/or construction of the housing, for example, lower corner portions of the housing are constructed and arranged to extend beyond the recessed edge portions of the end hook member can be used separately or in combination with any other aspect.

[0074] One skilled in the art will understand that the embodiment of the rule assembly 10 shown in the figures and described above is exemplary only and not intended to be limiting. It is within the scope of the invention to provide any known rule assembly with any or all of the features of the present invention. For example, the end hook constructed according to the principles of the present invention can be applied to any known rule assembly.

[0075] Although the invention has been described in detail for the purpose of illustration, it is to be understood that such detail is solely for that purpose and that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover modifications and equivalent arrangements that are within the spirit and scope of the appended claims. In addition, it is to be understood that the present invention contemplates that, to the extent possible, one or more features of any embodiment can be combined with one or more features of any other embodiment.

Claims

1. A rule assembly comprising:

   a housing;
   a reel rotatably mounted in the housing;
   an elongated blade arranged to be wound on the reel and to be extendable through an opening in the housing, the elongated blade having an end hook member on a free end thereof;
   the end hook member including a mounting portion and a hook portion extending from an end of the mounting portion,
   the end hook member comprising a pair of generally upwardly extending side edges and a generally laterally extending lower edge,
   wherein the end hook member comprises recessed edge corner portions disposed between the upwardly extending side edges and the laterally extending lower edge.

2. The rule assembly of claim 1, wherein the recessed edge corner portions are constructed and arranged to extend between a first point and a second point, the first point being at the end of the laterally extending lower edge and the second point being at the end of the upwardly extending side edge.

3. The rule assembly of claim 2, wherein distance between the first point and the second point is at least equal to 0.125 inches.

4. The rule assembly of claim 1, wherein the laterally extending lower edge comprises a pair of lower most surfaces lying along a common line and separated by an upwardly extending groove or notch portion.

5. The rule assembly of claim 4, wherein the upwardly extending side edges extend along a line that forms an angle that is between 85° and 100° with respect to the common line along which the laterally extending lower edge extends.

6. The rule assembly of claim 1, wherein the hook portion is bent at a generally right angle from an end of the mounting portion and has a generally U-shaped configuration.

7. The rule assembly of claim 1, wherein the mounting portion has a generally concavo-convex configuration.

8. The rule assembly of claim 1, wherein the hook portion including a bight section and spaced leg sections extending upwardly from the bight section, the leg sections extending laterally beyond transversely spaced corners of the free end of the blade by at least a distance of 0.08 inches.

9. The rule assembly of claim 1, wherein the hook portion including a bight section and spaced leg sections extending upwardly from the bight section, the leg

sections extending upwardly above both the mounting portion and the recessed edge spaced corners of the free end of the blade by at least a distance of 0.08 inches.

10. The rule assembly of claim 1, wherein lower corner portions of the housing are constructed and arranged to extend beyond the recessed edge corner portions of the end hook member.

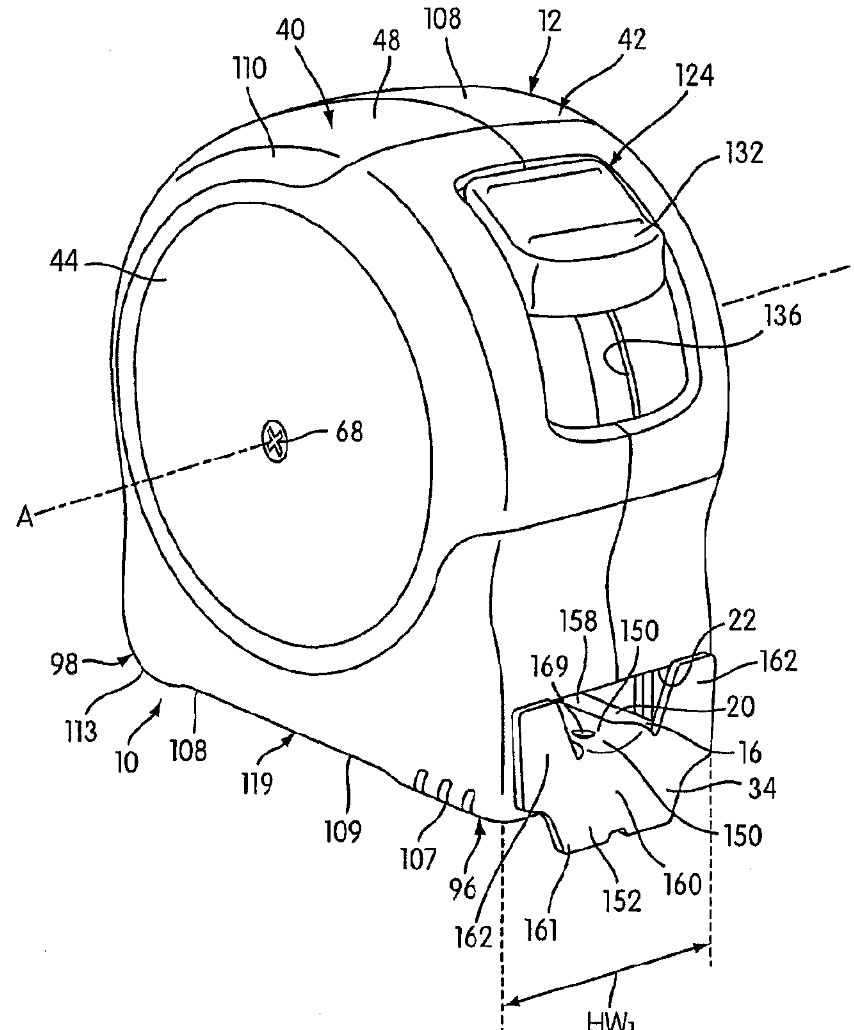
11. The rule assembly of claim 1, wherein the end hook member comprises a burred portion disposed on at least a portion of the end hook that is positioned above the elongated blade.

12. The rule assembly of claim 11, wherein the burred portion comprises a plurality of burrs, wherein each burr has a height at least 0.003 inches.

13. The rule assembly of claim 11, wherein the burred portion extends inwardly towards the housing from a portion of an inner surface of the end hook adjacent a generally upwardly extending side edge of the end hook.

14. The rule assembly of claim 11, wherein the burred portion extends inwardly towards the housing from a portion of an inner surface of the end hook adjacent an uppermost surface of a leg section of the hook portion.

15. The rule assembly of claim 11, wherein the burred portion extends inwardly towards the housing from a portion of an inner surface of the end hook adjacent a generally laterally extending lower edge of the end hook.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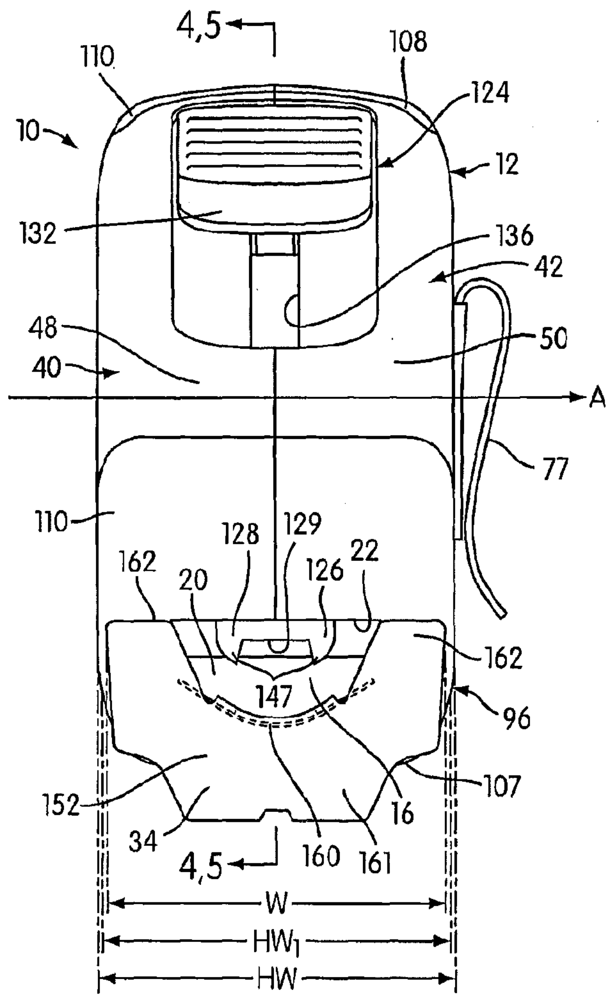
HW1

FIG. 1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HW_1
HW

FIG. 2

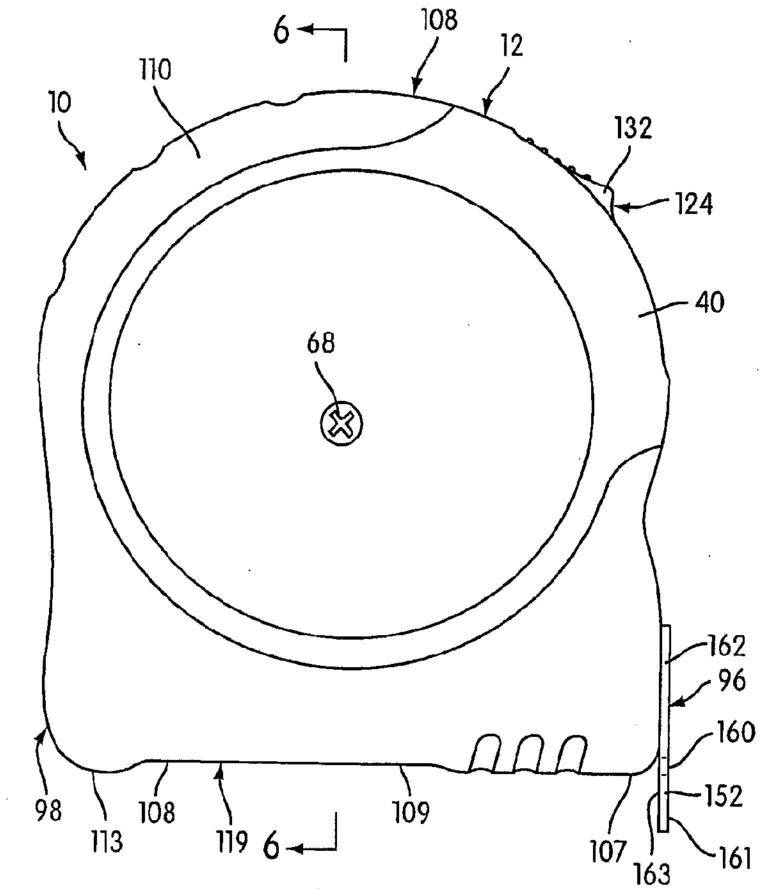
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FIG. 3

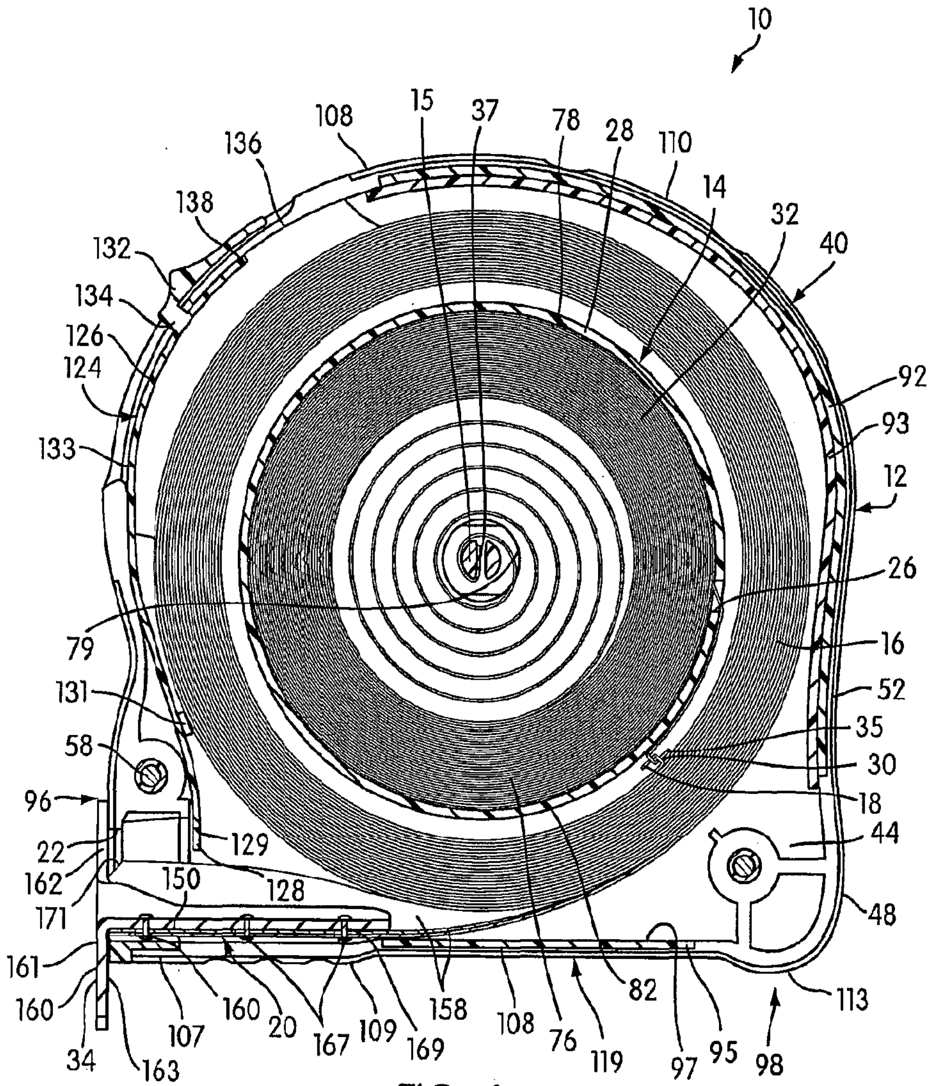
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FIG. 4

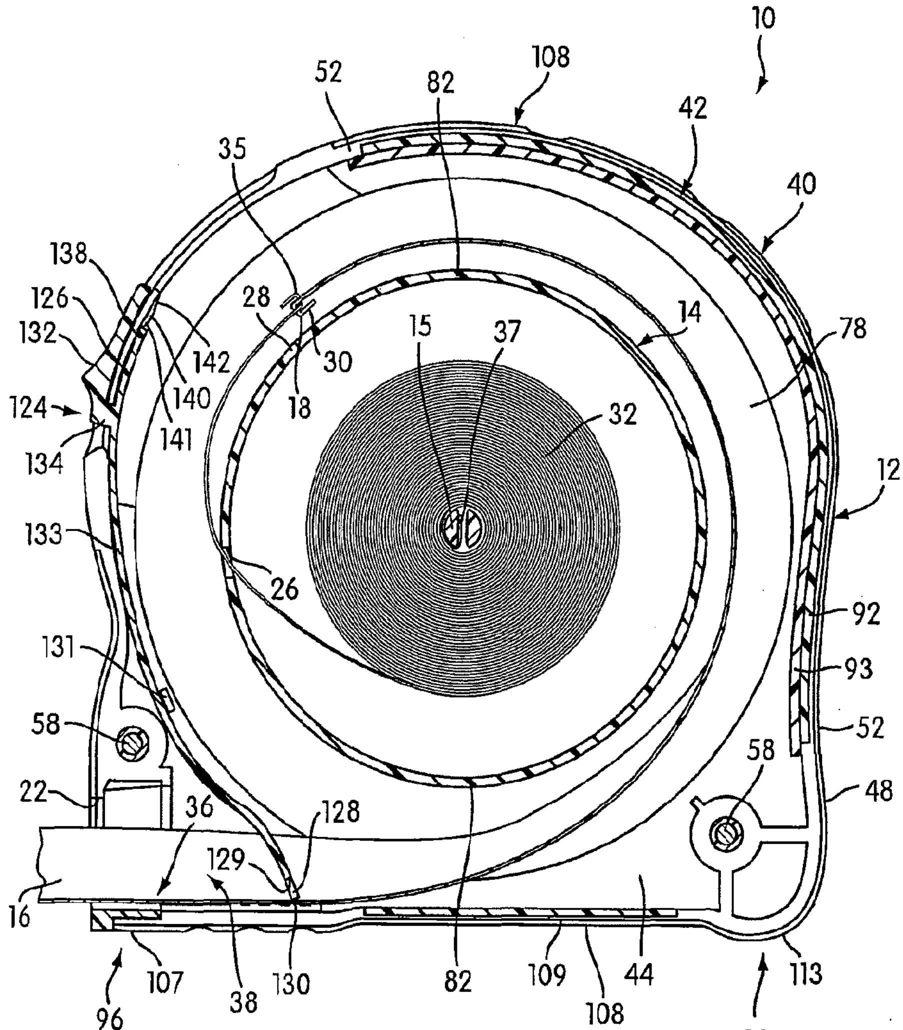
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FIG. 5

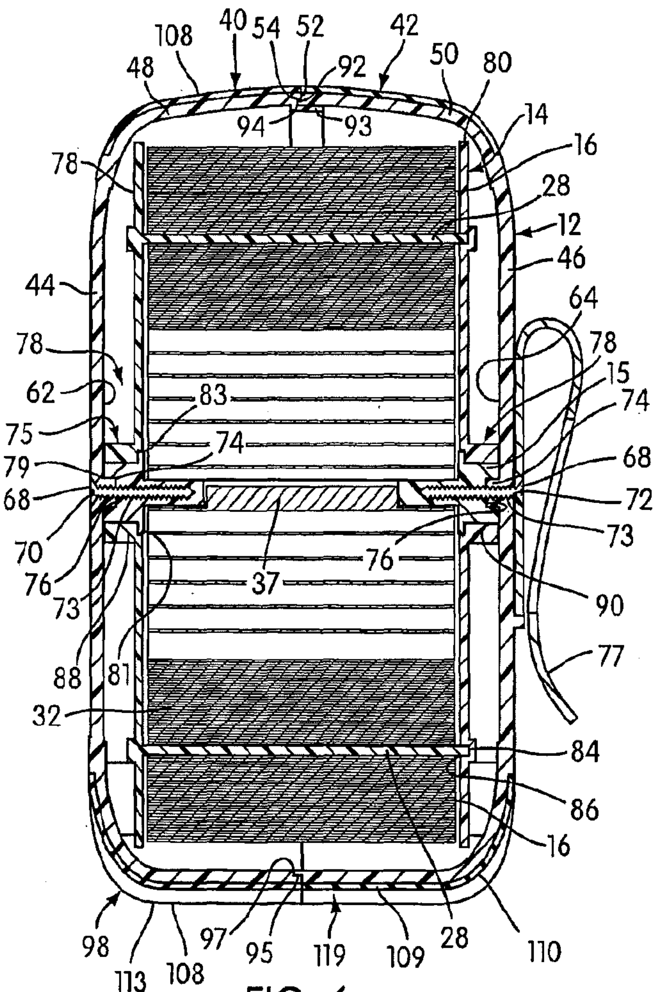
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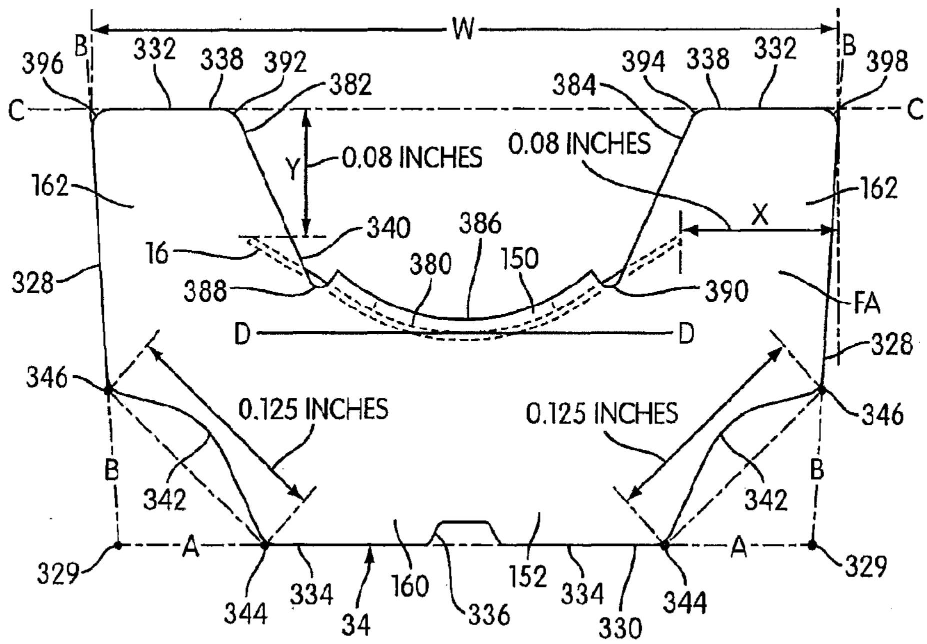
FIG. 6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386
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FA
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346
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0.125 INCHES
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FIG. 7

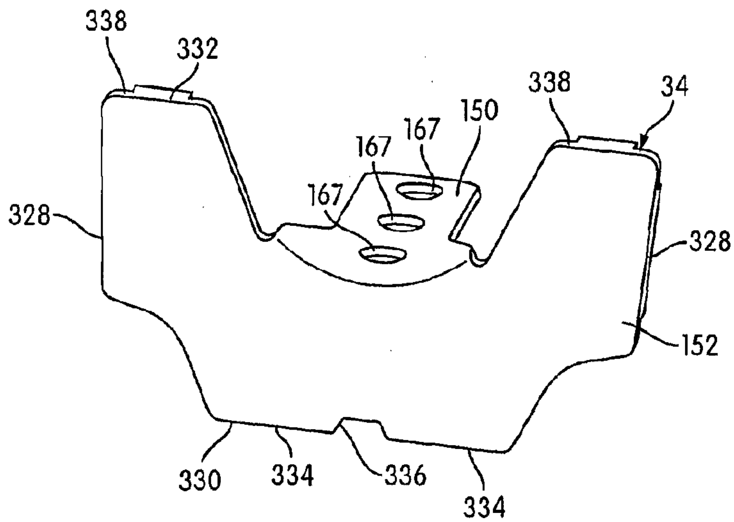
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FIG. 8

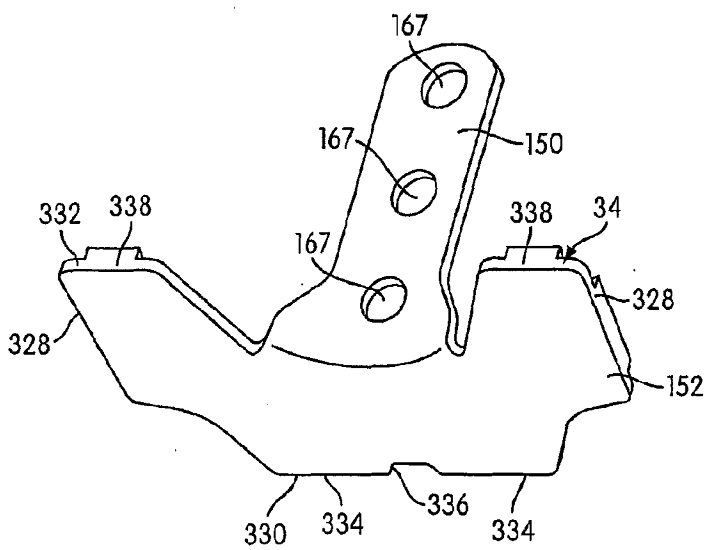
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FIG. 9

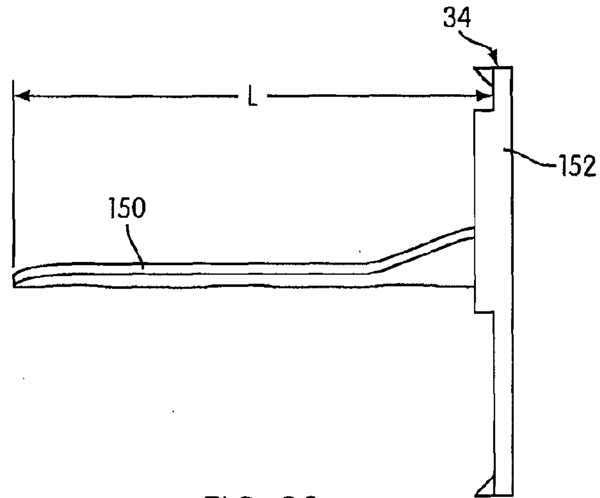

FIG. 10

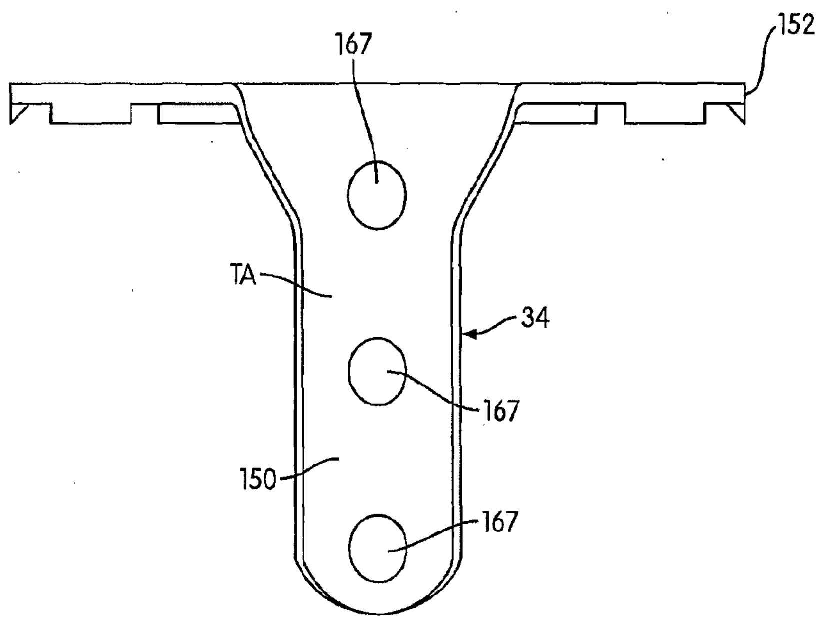

FIG. 11

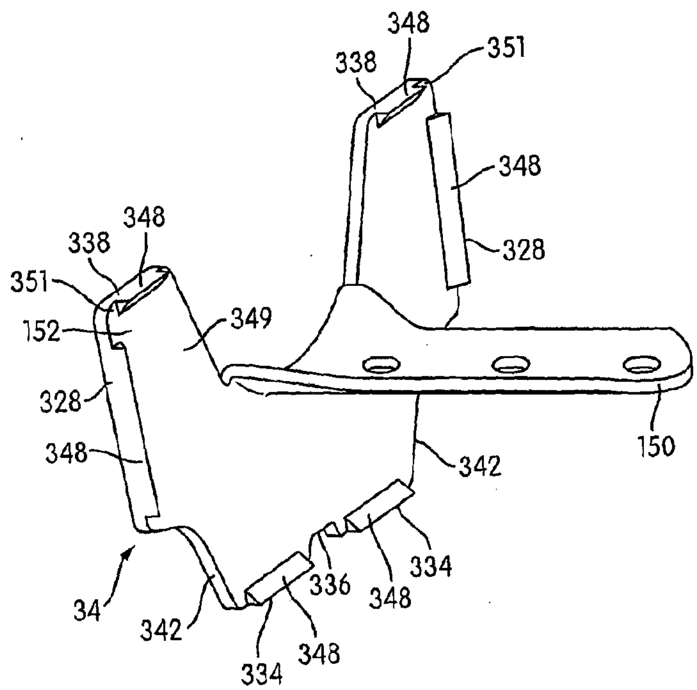
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FIG. 12

FIG. 13A

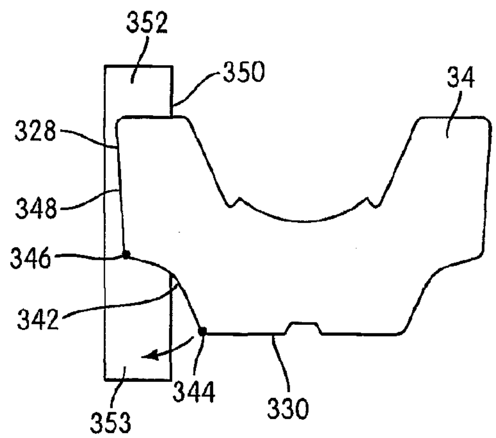


FIG. 13B

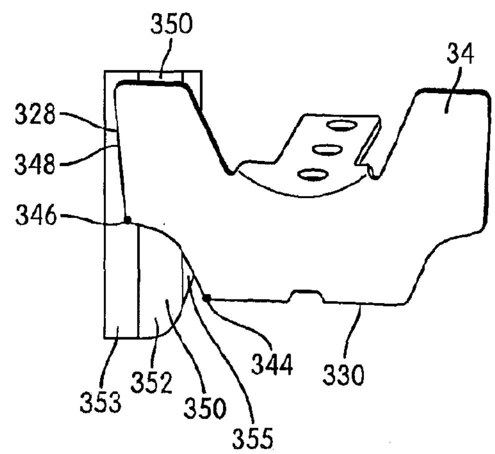
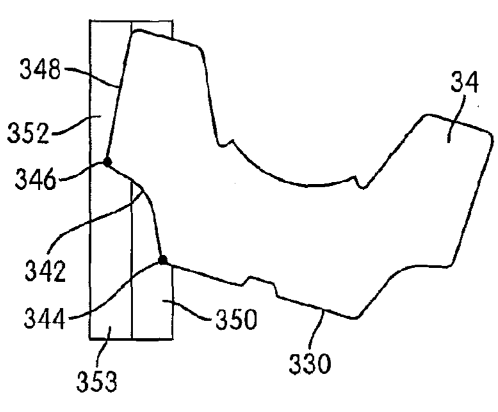


FIG. 13C



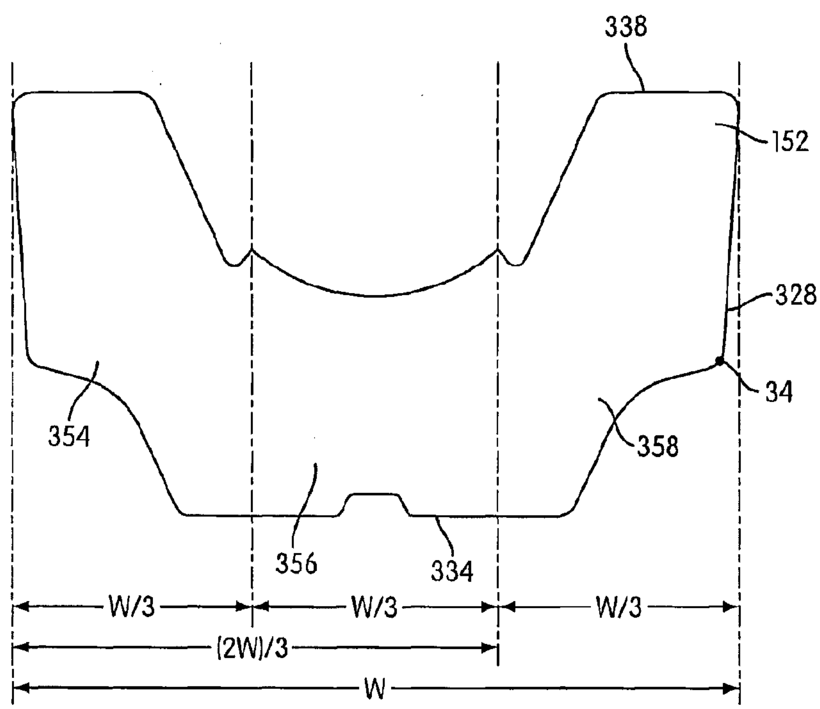


FIG. 14

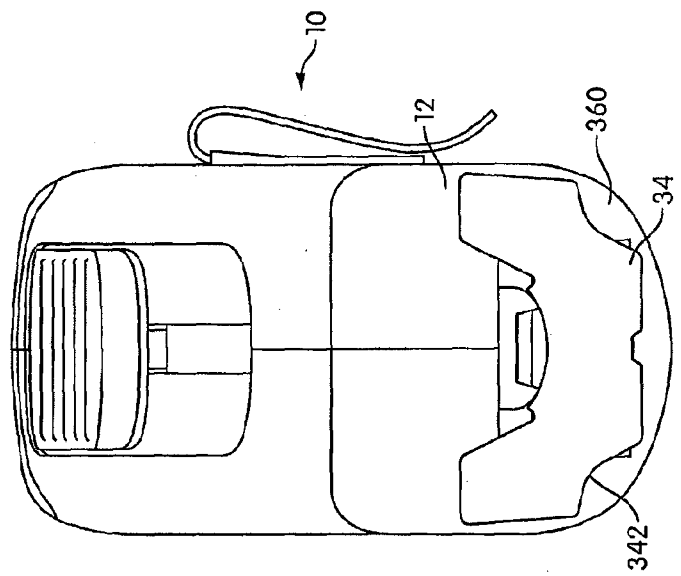


FIG. 15B

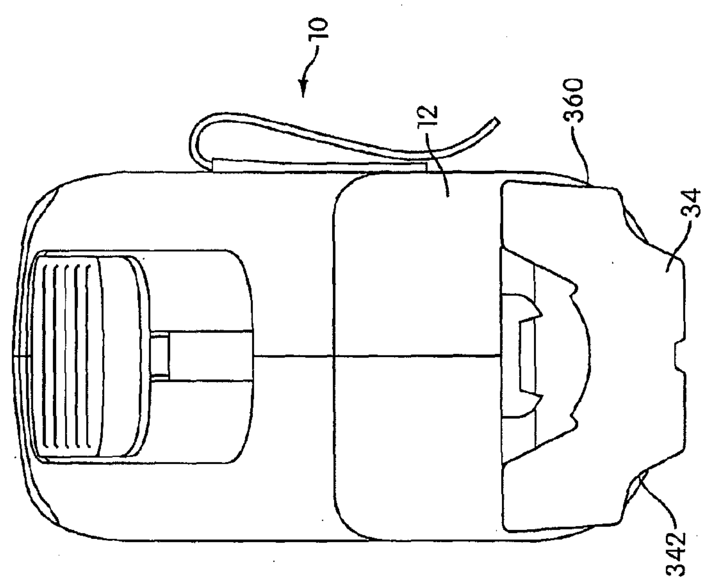


FIG. 15A

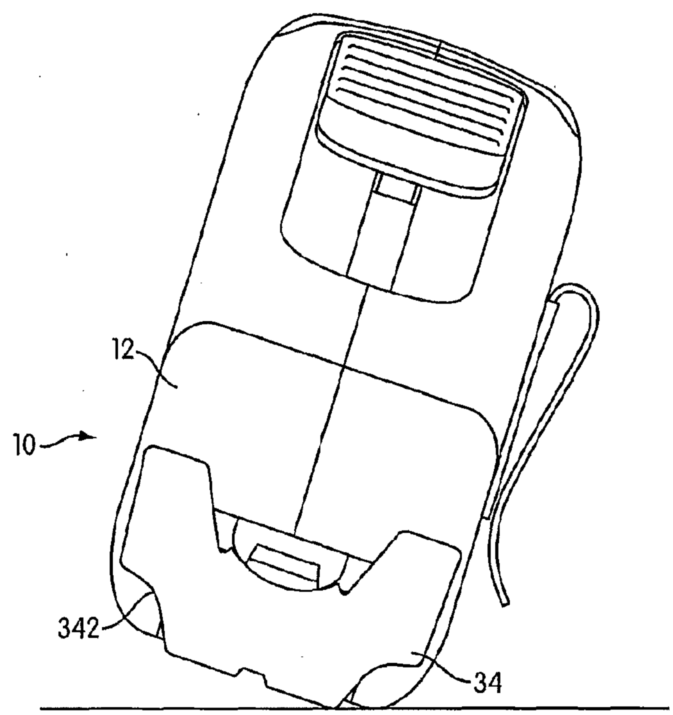


FIG. 16A

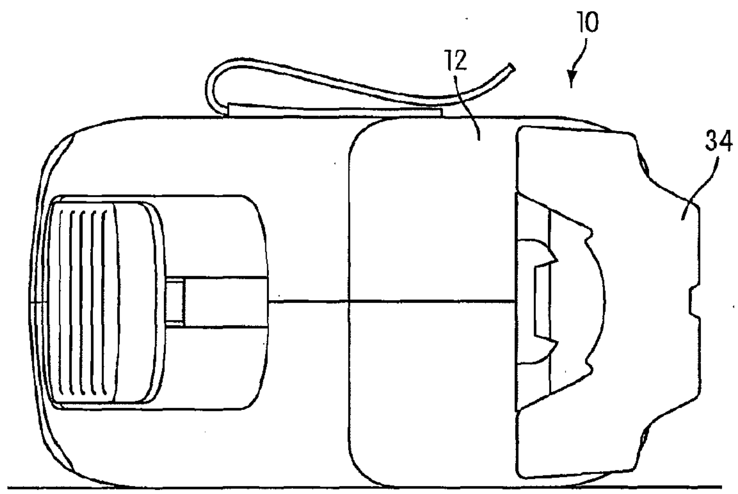


FIG. 16B

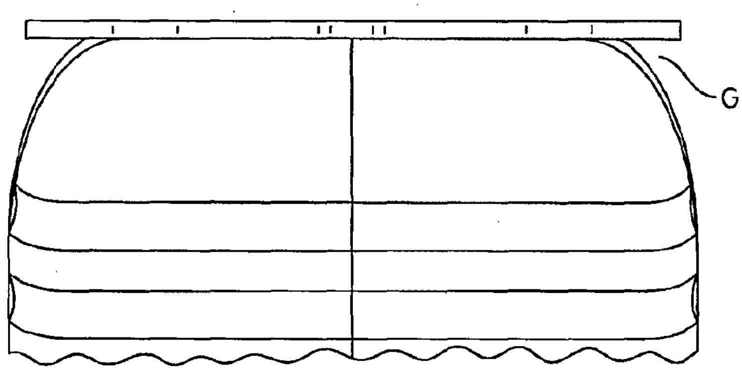


FIG. 17

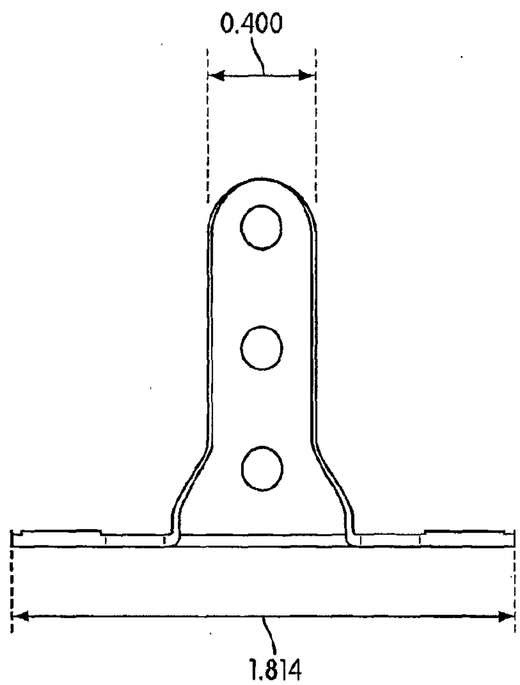


FIG. 18

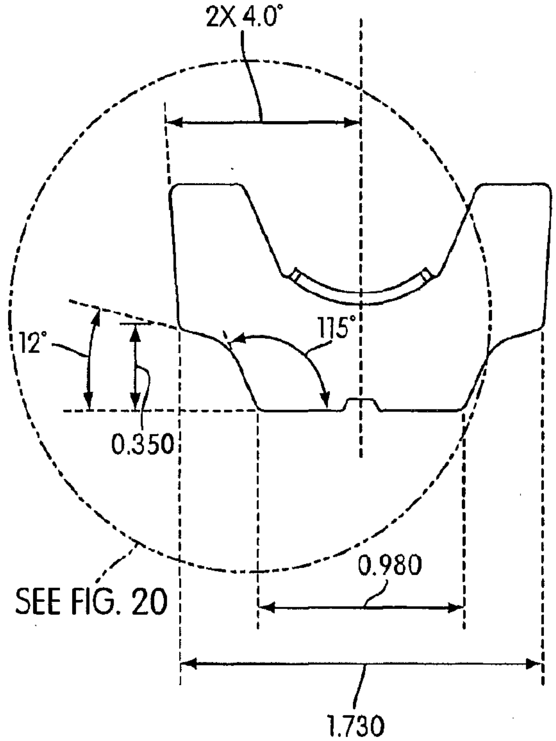


FIG. 19

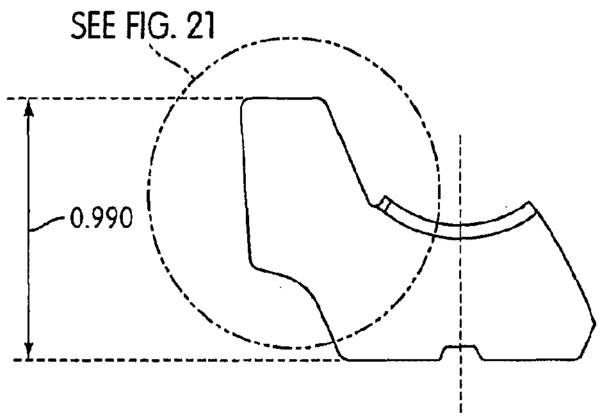


FIG. 20

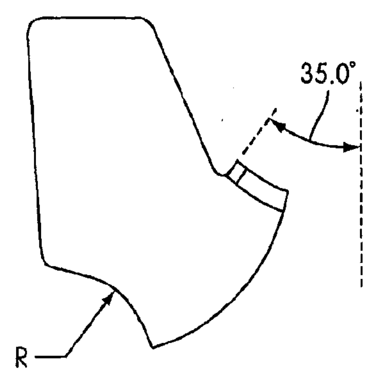


FIG. 21

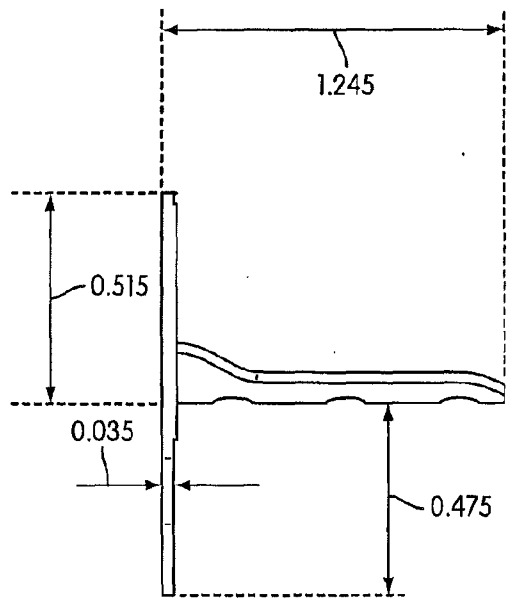


FIG. 22

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 10 19 6447

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2006/107546 A1 (PRITCHARD GARY [US]) 25 May 2006 (2006-05-25) * paragraph [0021] - paragraph [0040]; figures 1-6 *	1-5	INV. G01B3/10
X	US 2005/028396 A1 (STAUFFER GENE [US] ET AL) 10 February 2005 (2005-02-10) * paragraph [0021] - paragraph [0024]; figures 1-3,5A,5B *	1-15	
X	US 6 442 863 B1 (POINEAU DONALD [US] ET AL) 3 September 2002 (2002-09-03) * column 1, line 8 - column 1, line 28 * * column 3, line 9 - column 4, line 7; figures 1-3 * * claims 5-11 *	1-15	
X	US 5 894 677 A (HOFFMAN WILLIAM W [US]) 20 April 1999 (1999-04-20) * column 4, line 61 - column 5, line 14; figure 5 * * column 6, line 4 - column 6, line 9; figure 8 *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			G01B

The present search report has been drawn up for all claims

3

Place of search	Date of completion of the search	Examiner
Munich	14 February 2011	Beyfuß, Martin

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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D : document cited in the application
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EPO FORM 1503 03.82 (P04C01)

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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14-02-2011

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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
25 July 2002 (25.07.2002)

PCT

(10) International Publication Number
WO 02/057710 A2

(51) International Patent Classification[7]: G01B 3/00

(21) International Application Number: PCT/US01/50117

(22) International Filing Date: 21 December 2001 (21.12.2001)

(25) Filing Language: English

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(30) Priority Data:
09/761,081 16 January 2001 (16.01.2001) US

(71) Applicant: 3M INNOVATIVE PROPERTIES COMPANY [US/US]; 3M Center, Post Office Box 33427, Saint Paul, MN 55133-3427 (US).

(72) Inventor: PEDERSON, Jeffrey, C.; Post Office Box 33427, Saint Paul, MN 55133-3427 (US).

(74) Agents: CHRISTOFF, James, D. et al.; Office of Intellectual Property Counsel, Post Office Box 33427, Saint Paul, MN 55133-3427 (US).

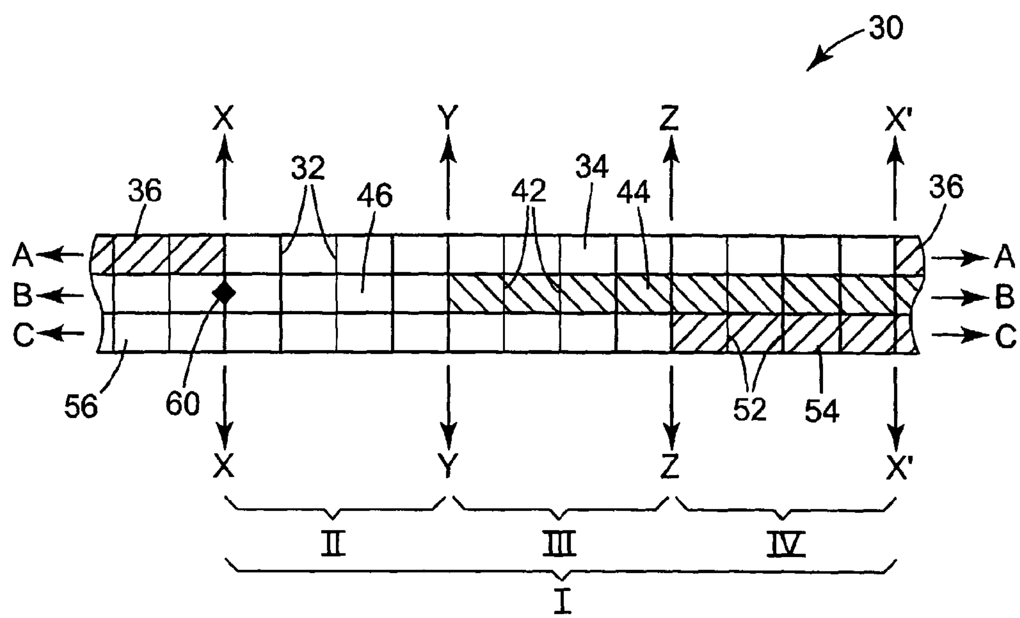
(81) Designated States (*national*): AE, AG, AL, AM, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ (utility model), DE (utility model), DK (utility model), DM, DZ, EC, EE (utility model), ES, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK (utility model), SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *without international search report and to be republished upon receipt of that report*

[Continued on next page]

(54) Title: ADHESIVE MEASURING TAPE



(57) Abstract: An adhesive backed measuring tape is disclosed that can provide customized, printed measurement scales on a single flexible backing that has a positionable or repositionable adhesive for contact with flat surfaces, single curved surfaces, or compound curved surfaces. In a preferred embodiment, the measuring tape has multiple scales printed thereon. The combination of linear sections and transverse axes defined by intervals can permit a variety of repeating scales on a single tape, minimizing waste of tape unrolled from a dispenser.

WO 02/057710 A2

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

ADHESIVE MEASURING TAPE

Field of the Invention

This invention relates to an adhesive-backed measuring tape, in one embodiment having multiple scales thereon.

Background of the Invention

The variety of industries and crafts require accurate measurement of flat surfaces, simple curved surfaces, or compound curved surfaces. In the construction industry, retractable metal tape measures are common because of the reuse and adjustability of the tape measures. These tape measures do not have to be associated in direct contact with a substrate over the course of measurement in order to be useful.

The art has developed a variety of measuring tapes which require periodic or continuous contact with the substrate being measured in order to be useful. To distinguish from "tape measures", i.e., the mechanical, retractable, metallic variety, these "measuring tapes" are typically polymeric, paper or other flexible substrate having an adhesive on the major surface opposing the measuring scale, in order for that adhesive to contract the substrate either periodically or continuously over the course of measurement. Representative examples of such measuring tapes are disclosed in the U.S. Patent No.4,149,320 (Troyer et al.); U.S. Patent No. 5,012,590 (Wagner et al.); and U.S. Patent No. 4,845,858 (Thomas).

Each of the measuring tapes disclosed in the above-identified patents share some common features. All of the measuring tapes which have adhesive-backed surface for contacting the substrate periodically or continuously. All are directed for use in association with the building construction industry, and particularly that industry which includes concerns framing of wooden structures which have lumber studs at critical locations, e.g., 16 inch separation, 24 inch separation, and /or 48 inch separation.

The measuring tapes of the above-identified patents differ in the features which such inventors thought valuable for the building construction industry. For example, Troyer et al. emphasizes a code for identification of specific distances superimposed on a single scale measuring tape, either an English scale, a metric scale, or both. By contrast, the stud locating tape of Thomas is based on different center stud distances and colored in a code which relates to the different stud distances. This stud locating tape does not otherwise include numerical scales nor usefulness other than in the building construction trade based on specific distances between building structural components.

The disposable layout tape of Wagner et al. discloses a multitude of coded indications for use in positioning building materials, wherein the tape is intended to be left in place within the building upon completion. Again, a code is employed to indicate specific distances, but a numerical scale was deemed not necessary.

Each of the measuring tapes of the patents disclosed above have deficiencies which limit their versatility to use in the building trades. Moreover, none of the three measuring tapes disclosed in the these patents are concerned with how much a measuring tape one must use for smaller dimensioned constructions because all three are concerned with building materials locations which inevitably require many inches or centimeters of measuring tape for each usage. Nor are they concerned about adhesive qualities or characteristics of removability of the measuring tape from a surface after usage.

Summary of the Invention

The art needs an adhesive backed measuring tape that is removable from finished surfaces without harm to the finished surface.

The art also needs an adhesive backed measuring tape that is positionable or repositionable to permit adjustment of the measurement position prior to taking the actual measurement.

As used herein, "positionable" means an adhesive or pressure sensitive adhesive surface can be placed against a substrate surface and easily slid over the surface into proper position without preadhering to the substrate; pressure is generally required to adhere the adhesive article to the substrate.

As used herein, "repositionable" means an adhesive or pressure sensitive adhesive surface can be applied and adhered to a substrate and then removed (generally within 24 hours) and reapplied without distorting, defacing, or destroying the backing, adhesive, or substrate; repositionable adhesives need not be positionable or vice versa.

The art also needs an adhesive backed measuring tape which minimizes waste and maximizes the applicable starting point for measurement

Further, the art needs an adhesive backed measuring tape which provides both numerical and color for multiple measurement usage within the same length of measuring tape.

One aspect of the present invention is an adhesive backed measuring tape, comprising (a) a flexible backing having two major surfaces, wherein one major surface has a measurement layer printed or contacted thereon and (b) a positionable or repositionable adhesive layer adhered to the other major surface of the flexible backing or to the measurement layer.

Another aspect of the invention is a method of using an adhesive backed measuring tape identified above, comprising the steps of (a) dispensing the measuring tape from a roll; (b) applying the measuring tape to a substrate; and (c) removing the measuring tape from the substrate.

A third aspect of the invention is an adhesive backed measuring tape, comprising (a) a backing having two major surfaces, wherein one major surface has a measurement layer printed or contacted thereon, wherein the measurement layer has a multiple of linear axes and a multiple of transverse axes, wherein each linear axis represents a linear segment of the measuring tape which is a function of the number transverse axes, and (b) an adhesive layer adhered to the other major surface of the backing or to the measurement layer.

A feature of the invention is the use of commercially useful positionable or repositionable adhesives on flexible substrates to permit adjustment to measurements or repeatable measurements without harm to the underlying substrate.

Another feature of the invention, in a preferred embodiment, is the use of linear axes along the same measuring tape to provide differing information.

Another feature of the invention, in a preferred embodiment, is the use of a multiple numerical scales and colored indications which can be customized for use in particular industries or crafts based on key measurements that are common to that industry or craft.

An advantage of the present invention is the use of positionable or repositionable adhesives on flexible substrates to minimize harm to a sensitive finished substrate, such as a silk garment being measured for a person.

Another advantage of the present invention, in a preferred embodiment, is a multi-scale measuring tape such that waste of a disposable measuring tape is minimized because the starting point for use of the measuring tape can exist at any linear axis employed along the measuring tape.

Another advantage of the invention is the ability to use convenient printing techniques during manufacture of the measuring tape to provide customized measuring tapes for particular businesses within given industries or crafts to publicize and promote that business within the industry or craft.

Further details of the invention are defined in the features of the claims.

Brief Description of the Drawings

Fig.1 is a cross-sectional view of one measuring tape of the present invention having an adhesive backing on a major surface opposite the major surface of the measuring scale.

Fig.2 is another embodiment of the present invention where adhesive is placed in contact with the scale to permit adhesion of the measuring tape on a transparent or translucent surface for measuring on the opposing side of that transparent or translucent surface.

Fig.3 is a measuring tape of a preferred embodiment of the present invention having multiple scales along linear axes of the measuring tape.

Embodiments of the Invention

For purposes of the present invention, an adhesive is repositionable if it passes the following test:

Tape samples are applied to a white bond 20 pound (9 kg) xerographic quality paper. For testing the paper was applied to a metal surface with double-sided adhesive. Tape samples are applied to the paper substrate using a 5 lb (2.3 kg), 3.25 inch (27 cm) diameter, rubber coated roller, rolled over the tape once. The tape is then removed using a 90 degree pull at a rate of 90 inches (2.3 m) per minute. The test is pass/fail based on damage to the paper substrate or tape substrate. Damage is defined by the inability to reapply the tape to the substrate, that is, paper fiber left on the tape prevents it from being re-applied. If able to apply a second time, second peel of re-applied tape gives 50% or less of initial peel force. If tape backing is torn, ripped etc. the test is also considered a failure.

Measuring tapes of the present invention are particularly advantageous, because they allow for easy, hands-free measuring on any surface condition by a single person. Because the tape will conform to surfaces of any shape, including curved surfaces, accurate measurement may be accomplished with great ease.

Due to the ease of use of the present invention, measuring tapes as described herein find beneficial use for home consumer in such diverse projects as hanging pictures, home remodeling projects, craft projects, hobby projects (e.g. model building), and school/science projects. Additionally, the present measuring tape is desirable for professional use as well, such as as a layout tool for picture framers, sign makers, woodworkers, graphic designers and the like. Further, the present measuring tape finds use as a measuring tool for drafting, architectural drawings and maps. Additional uses comprise as a measurement device that may be applied for selectively long term uses such as on tabletops, workbenchs, notebooks and equipment scales.

The present masking tape further provides an inexpensive courtesy item for use in stores, such as for fabric, clothing, hardware, furniture, and appliance stores. Additionally, the present masking tape may be included in do-it-yourself kits, e.g., closet storage kits.

Because the measuring tapes of the present invention are repositionable, they leave no marks on finished surfaces and will not damage sensitive surfaces. Additionally, repositionable measuring tapes of the present invention are re-usable, thereby enhancing the ease of use of the present product by allowing replacement in the event of error in placement in the first instance. Reusability also enhances the economy of the present invention.

<u>Measuring Tape Construction</u>

Fig. 1 and Fig. 2 are alternate embodiments of a measuring tape of the present invention distinguished by the location of the functional layers of the measuring tape. Tape 10 in Fig. 1 has a polymeric tape backing 12 having two major opposing surfaces, one of which has a measurement scale layer 14 printed or contacting backing 12 and the other having a layer 16 of pressure sensitive adhesive. Depending on the composition and properties of the measurement layer 14, adhesive layer 16 may need an optional release liner (not shown) in order to protect the adhesive prior to use and especially when tape is rolled upon itself. Preferably, printed layer 14 has sufficient properties to permit release of adhesive layer 16 if tape 10 is stored in a rolled fashion, more preferably in a dispenser suitable for conveniently unrolling tape 10 along the substrate to be measured.

Fig. 2 is another embodiment of the present invention where tape 20 is composed of a backing 22 having two opposing major surfaces, wherein one of the major opposing surfaces has both a layer of measurement scale 24 and, on top of layer 24, a layer 26 of pressure sensitive adhesive. Tape 20 is particularly suitable for measurement of translucent or transparent materials where it is desired to have the measurement device on the opposite side from the location where measurement is desired. For example, in the manufacture of backlit signage, the assembly of colored pieces of translucent films onto a transparent or translucent surface may not permit the measuring tape to be adhered at the same location as the placement of the pieces of colored film. Use of a tape 20, conveniently called a "second surface" measuring tape, permits measurement to be employed without interruption of the assembly of the backlit signage phase.

For either embodiment seen in Figs. 1 and 2, a possible additional feature is a series of perforations to aid in removal of a specific length of tape, e.g., perforations at 36 inch (0.9 m) intervals in a manner to simulate a conventional English Scale Yard Stick.

Tape Backing

Backing 12 or 22 as seen in Fig. 1 or Fig.2 can be any material having a relatively high tensile modulus (Young's modulus or flexural modulus) and relative insensitivity to temperature or humidity conditions and a relatively dimensionally stable structure. Nonlimiting examples of tape backing can include those materials which are, in any combination:

transparent, translucent, or opaque;

singularly colored, multiply colored, or white or black;

glossy, matte, metallic, reflective, retroreflective, or luminescent in appearance; and

susceptible to printing, embossing, or other means of delivery of the measurement scales to layers 14 or 24 .

Additionally, the surface (after printing of initial information) could be receptive to pen and pencil markings as desired by the user of the tape 10 or 20.

The tensile modulus of the backing 12 or 22 can typically range from about 1.0 X 10^3 lbs./in^2 (7.0 x10^5 kg/m^2) to about 5.0 X 10^7 lbs./in^2 (3.5 x 10^{10} kg/m^2) and preferably from 6.0 X 10^4 lbs./in^2 (4.2 x 10^7 kg/m^2) to about 1.0 X 10^6 lbs./in^2 (7.0 x 10^8 kg/m^2).

Backing 12 or 22 preferably is a polyester having a thickness of from about 0.05 millimeters (2 mil) to about 0.10 millimeters (4 mil).

The backing should withstand temperatures ranging from about -45°C to about 65°C, and preferably from about -17°C to about 52°C.

The tape should be relatively insensitive to humidity ranging from about 0% R.H. to about 100 % R.H.

Dimensional stability for backing 12 to 22 (described in terms of % change in sheet dimension) should range from about 0% to about 0.15 % and preferably from about 0% to about 0.1%.

Nonlimiting examples of materials from which backing 12 and 22 can be constructed include polymers having the physical properties described above which are exemplified by polyesters (PET), high density polyethylene (HDPE), polyvinylidene fluoride, polyvinyl chloride, nylon, and some sturdy paper products. Such backings may be integrally dimensionally stable (with or without tensile orientation) or can include reinforcements such as nylon filaments to achieve dimensional stability.

Measurement Layer

Measurement layer 14 or 24 in Fig. 1 or 2 is a functional means of printing or otherwise delivering a measurement scale to such layers 14 and 24. If a composition of backing 12 or 22 is unsuitable for a particular method of creating the measurement scales on layers 14 and 24, then such layers 14 and 24 need to have coating or other surface treatments to enable accurate printing of a measurement scale on such layer 14 and 24. For example, in case of a backing composed of paper, a surface treatment may not be needed.

Nonlimiting examples of surface treatments for layers 14 and 24 include corona treatment, coatings (such as disclosed in U.S. Patent Nos. 5,747,148 (Warner); and the like.

Nonlimiting examples of method of creating multiple scales on layers 14 and 24 include electrostatic printing, inkjet printing, thermo transfers, offset, flexographic printing, and the like. Of these methods, flexographic printing is presently preferred.

Particularly preferred for the creation of layers 14 and 24 are 4-color printing systems using the subtractive colors of cyan, magenta, yellow, and black ("CMYK" colors) to permit one skilled in the art of printing to create as many as 256 different colors or more according to the industry requirements or preferences.

Colorant used for creating layers 14 and 24 can range from pigmented particles such as included in inkjet inks, electrostatic toners used in electrographic printing dye based inks, offset web printing inks, and the like.

Surface embossing techniques can also be employed to mark physically the surface of the backing in order to provide a tactile differentiation for measurement use.

One factor for consideration by those skilled in the art is the size of the printing job for a particular tape 10 or 20 and the ability to customize such tapes depending on use of printing software such as GraphicMaker™ software commercially available from Minnesota Mining and Manufacturing Company through its Commercial Graphics Division. Large format printers can print a multitude of different types of measurement scales on tapes 10 or 20 with suitable cutting or slitting of such sheets into multiple, narrower tapes, rolled or unrolled.

<u>Adhesives</u>

Pressure sensitive adhesive layer 16 or 26 can be any pressure sensitive adhesive such as those known to those skilled in the art and disclosed in the <u>Handbook of Pressure Sensitive Adhesives, Second Edition,</u> Satas, Ed., (Van Nostrand, 1989). Of the various pressure sensitive adhesives tapes so disclosed, acrylic pressure sensitive adhesive tapes are preferred, such as those commercially available from Minnesota Mining and Manufacturing Company of St. Paul, Minnesota from a variety of its operating divisions and generally described in U.S. Patent Nos. 3,922,464; 3,691,140; 5,141,790; 5,194,299; 4,605,592; 5,045,386; 5,296,277; and 5,229,207 and EPO Patent Publication EP 0 570 515 B1 (Steelman et al.). Another suitable adhesive is disclosed in PCT Patent Publication WO98/29516 and its related copending, coassigned, United States Patent Application Serial No. 08/775,844 (Sher et al.).

As described in these documents, both positionability and repositionability of measuring tapes of the present invention are desirable because of the construction of the adhesive layers physically and compositionally.

For example, positionable adhesives are disclosed in EPO Patent Publication EP 0 570 515 that have high shear strength. More particularly, the aqueous adhesive composition is capable of displaying positionability; when applied as a layer to a substrate; while maintaining elevated shear strength and peel adhesion. The composition comprises an aqueous blend of: (a) an aqueous suspension of hollow; polymeric; infusible; inherently tacky elastomeric microspheres; wherein the microspheres are comprised of at least 85 parts by weight of at least one alkyl acrylate or methacrylate ester and up to 15 parts by weight of at least one polar monomer; and wherein a majority of the microspheres have a central cavity than is at least 10% of the diameter of the microspheres; and (b) an aqueous film-forming pressure sensitive adhesive latex comprising at least one long chain alkyl acrylate having from 4 to 12 carbon atoms; wherein the weight ratio of the microspheres to the latex; on a solids basis; is from 12 to 1 to 39 to 1. Use of this adhesive is preferred because one can position and reposition a measuring tape backed with this adhesive with minimal harm to the substrate being measured.

Another desirable adhesive is disclosed in U.S. Patent No. 5,141,790 (Calhoun et al.). This pressure-sensitive adhesive tape or sheet is reliably repositionable by having a plurality of spaced clumps of particles uniformly distributed over at least one surface of the pressure-sensitive adhesive layer with the tips of the clumps of particles being substantially free from adhesive, which particles are smaller than the thickness of the pressure-sensitive adhesive layer. Preferred particles are glass beads which may be from 5 to 15 mm in diameter when the thickness of the pressure-sensitive adhesive layer is about 25 mm. Each clump preferably contains from 5 to about 100 particles. The pressure-sensitive adhesive layer can be covered with a carrier web which has a low adhesion surface that is formed with depressions that protect the clumps of particles.

Yet another useful adhesive is disclosed in U.S. Patent No. 5,296,277 (Wilson et al.), where the adhesive layer has at least one topologically microstructured surface comprising a plurality of pegs, optionally containing one or more beads, substantially uniformly distributed and protruding outwardly from the adhesive layer, wherein the pegs have essentially flat tops that comprise less than 25% of the total surface contact area of the adhesive layer, and have a height of at least 15 mm. This adhesive composition is both positionable and repositionable.

A particularly suitable adhesive on a transfer tape is commercially available from Minnesota Mining and Manufacturing Company (3M) of St. Paul, Minnesota, USA under the brand 3M™ Double-Coated Repositionable Film Tape 9415PC. This transfer tape permits transfer of the repositionable adhesive to a flexible backing, printed or unprinted.

If a release liner is desired, release liners are also well known and commercially available from a number of sources. Nonlimiting examples of release liners include silicone coated Kraft paper, silicone coated polyethylene coated paper, silicone coated or non-coated polymeric materials such as polyethylene or polypropylene, as well as the aforementioned base materials coated with polymeric release agents such as silicone urea, urethanes, and long chain alkyl acrylates, such as defined in U.S. Patent No. 3,957,724; 4,567,073; 4,313,988; 3,997,702; 4,614,667; 5,202,190; and 5,290,615 and those liners commercially available as Polyslik brand liners from Rexam Release of Oakbrook, IL, USA and EXHERE brand liners from P.H. Glatfelter Company of Spring Grove, PA, USA.

One distinguishing characteristic of adhesive 26 from adhesive 16 is that adhesive 26 should be transparent to permit the measurement layer 24 to be seen in the configuration of tape 20 in its second surface placement. Nonlimiting examples of transparent adhesives with transparent backings are marketed by Minnesota Mining and Manufacturing Company of St. Paul, MN under the brand Scotchcal™ V6089 films.

Especially preferred among the adhesives disclosed-identified patents are those adhesives which are aggressive, removable, positionable or repositionable or both, and have low tack; all depending on the particular industry and the sensitive of the substrate at the time of adhesive placement and adhesive removable of tapes 10 and 20 from the substrate being measured. For example, in the fabric industry, the fabric may be considerably expensive and sensitive to placement of adhesives thereon, which militates towards a low tack adhesive. In contrast, a rough building material such as concrete block may require an aggressive adhesive without regard to the difficulty of removal because of the need for assurance of the adhesion during measurement. It is an advantage of the present invention that a variety of adhesives can be selected to be use with a variety of methods of printing of the measurement scale on a variety of backings, such that one those skilled in the art can tailor a particular type of tape 10 for use with particular industry.

Tapes 10 and 20 can be either placed in suitable lengths along a release liner or rolled for dispensing from a compact dispenser. As stated above, in respect of tape 10, the surface of measurement layer 14 needs to accommodate a low-adhesion backsize property to permit a suitable surface for the rolling of tape 10 as intended with layer 16 on the opposite side from layer 14. For tape 20, the opposing major surface 28 of backing 22 must have such low-adhesion backsize properties for unrolling from the adhesive layer 26 when tape 20 is stored in a rolled condition. Suitable low-adhesion backsize compositions are well known to those skilled in the art including those disclosed in U.S. Patent Nos. 4,825,763 (Truskolaski et al.); 4,873,140 (McIntyre); and 4,587,156 (Wu).

Printing of a tape 10 or tape 20 can be conveniently arranged to have alternating background color at given intervals, such as at 12 inch lengths, preferably with a perforation at a second interval, such as at 36 inch lengths. With the surface of backing 12 suitable for various types of printing, one skilled in the art is able to customize any type of combination of scales and backgrounds according to the desires of the market.

Fig. 3 discloses one preferred embodiment of the present invention having a multiple scale on layer 14 or layer 24 of tapes 10 or 20. Viewed from above, Fig.3 shows a tape 30 having a multiple of linear axes A-A; B-B; and C-C and a multiple of transverse axes X-X; Y-Y; and Z-Z. Tape 30 is merely exemplary of one embodiment of the invention in that it shows three linear axes and three transverse axes, but the invention is not limited to a plurality of three. Indeed, tape 30 of the present invention can have any number of multiple scales from about 2 to about 20, and preferably from 3 to 5.

The number of linear axes equals the number of transverse axes because each linear axis represents a linear segment of tape 30 which is a function of the number of transverse axes on tape 30. As seen in Fig. 3, the linear segments represented by axes A-A; B-B; and C-C are equally spaced, although one skilled in the art can vary the width of the segments according to particular needs or particular industry. The distance between axes X-X and its repetition X'-X' is represented by I, the distance of which is determined according to the needs of the particular industry. After having established the initial interval I, then one skilled in the art can determine the appropriate interval II which represents the distance between transverse axis X-X and transverse axis Y-Y. Moreover, the interval between transverse axis Y-Y and transverse axis Z-Z is represented by III in Fig.3. Finally, Interval IV represents the interval between transverse axis Z-Z and transverse axis X'-X'.

Interval I also represents the distance from transverse axis Y-Y to transverse axis Y'-Y' (not shown) and axis Z-Z- to axis Z'-Z' (also not shown). Thus, the configuration of intervals I, II, III, and IV are such that once the Interval I is determined, then Intervals II, III, and IV are integral fractions of Interval I and their sum equals the length of Interval I. Preferably, Intervals II, III and IV are the same integral fractional number, although they can be different according to the needs of the one skilled in the art. For example, the Interval I can be 12 inches (30.5 cm) with the Intervals II, III and IV each being four inches (10.2 cm).

Alternatively, the distance of Interval I can be unique to the distance between transverse axis X-X and X'-X' with no relationship to the distance between transverse axis Y-Y and Y'-Y' and/or the distance between axis Z-Z and axis Z'-Z', so that one skilled in the art would recognize that the use of tape 30 can be utilized in the alternative different scales represented by linear segments A-A, B-B and C-C without regard to the relationship among linear segments A-A, B-B, and C-C. Each of the transverse axes becomes a repeating scale, which can be the same or different depending on the Intervals I chosen. In one embodiment, with Interval I at 12 inches (30.5 cm) and Intervals II, III, and IV at four inches (10.2 cm), no use of tape 30 is more than four inches (10.2 cm) from the beginning of a foot-long scale. That configuration minimizes waste of tape 30 during usage because one can rotate among the closest zero point that begins an Interval I to begin adhered measurement of a surface. Alternatively, one can use one segment scale for one type of measurement on a surface and a second segment scale for a second type of measurement on that same surface. Use of different colors for lines 32, 42, and 52 within each segment A-A; B-B; and C-C assists such discernable usage. In other words, the measurement layer can have multiple scales of different systems of measurement.

For example, linear segment A-A beginning at transverse axis X-X can be a 12 inch (30.5 cm) linear scale with linear segment B-B being a logarithmic scale beginning at transverse axis Y-Y with linear segment C-C being a metric scale beginning at transverse axis Z-Z. While such a combination is possible, one skilled in the art may find such combination of single tape 30 unduly complicated, but the possibility that industries may have such needs and the ability of measuring tapes of the present invention to be configured in such manner is an unexpected advantage of tapes of the present invention.

On the assumption that tape 30 represented in Fig.3 is comprised of three linear segments A-A; B-B; and C-C, where each linear segment is a represents 12 inch (30.5 cm) scale from each respective transverse axis, then an appreciation of how the scales may be so configured can occur. Transverse axis X-X can be the zero line for linear segment A-A as distinguished by periodic markings 32 such as inch segments or fractions of inch segments between axis X-X and axis X'-X', which begins a repeating scale. The indications of such periodic lines 32 can be a contrasting color on a white surface, a contrasting color on a black surface, or some combination of white and black according to visually perceptible needs of the person skilled in the art. For example, background color 34 can be white for the segment A-A between axes X-X and X'-X' with a second background color 36 indicating the Interval I between transverse and X'-X' and X"-X" (not shown but see the Interval I ending at axis X-X). In that manner, the Interval I can be easily identified within segment A-A by the background color of each Interval I preferably alternating between two distinguishing background colors 34 and 36 upon which periodic lines 32 are superimposed.

Continuing with segment B-B, such scale begins at axis Y-Y and terminates at axis Y'-Y'. Periodic lines 42 can be the same or different in scale from that of periodic lines 32 in segment A-A. Interval I is indicated by a background color 44 as distinguished from a background color 46. More than two background colors can be used according to the needs of one skilled in the art to further distinguish segment B-B from segment A-A of the scales on tape 30. The distance between the zero point of the scale of segment A-A and the scale of segment B-B is Interval II as seen in Fig.3.

Referring now to segment C-C of tape 30, the zero point can be at axis Z-Z having periodic lines 52 superimposed on a background color 54 within the first interval I and a background color 56 in an alternating or sequential fashion for further Intervals I.

Fig.3 demonstrates that within such described mathematical principles of the present invention, one can combine multiple scales onto a single measuring tape where use of periodic lines 32, 42 and 52 as distinguished by background colors 34 and 36; 44 and 46; and 54 and 56 can provide a multitude of customize multiple scale measurements for customized use in a particular industry. For example, it may be significant to provide certain dimensions for such industries as building construction, painting and wall papering, copy and crafts, fabric and clothing, furniture and appliance, signage and automobile detailing, and other industries. With the ability to use personal computers and consumer or office printing equipment, desktop publishing of measuring tapes is easily performed. Moreover, because the tape 10, 20, or 30 can be conformed to single or compound curved surfaces hands-free measuring of such curved surfaces is possible.

Optionally, one can add unique symbols notable to a given industry at specific locations on any or all of sections A-A; B-B; and C-C. For example, one can add 16 inch (40.6 cm) stud location markings or one can add promotional or other branding indicia on tape (generally represented by item 60) during the course of the printing process of making tape 30. Preferably, one skilled in the art will learn what customized indicia are desired and add such markings into the printing process as needed.

While a number of embodiments have been disclosed, the invention is not so limited. The claims follow.

What is claimed is:

1. An adhesive backed measuring tape, comprising

(a) a flexible backing having two major surfaces, wherein one major surface has a measurement layer printed or contacted thereon, and

(b) a repositionable adhesive layer adhered to the other major surface of the flexible backing or to the measurement layer.

2. The tape of Claim 1, wherein the adhesive layer also is positionable.

3. The tape of Claim 1, wherein the adhesive layer is adhered to the other major surface of the flexible backing.

4. The tape of Claim 1, wherein the adhesive layer is adhered to the measurement layer.

5. The tape of Claim 3, further comprising a low-adhesion backsize property on the measurement layer.

6. The tape of Claim 4, further comprising a low-adhesion backsize property on the other major surface of the backing.

7. The tape of Claim 1, wherein the measurement layer has alternating background colors at given intervals.

8. The tape of Claim 1, wherein the tape has perforations at given intervals according to the measurement layer.

9. The tape of Claim 1, wherein the measurement layer has a multiple of linear axes and a multiple of transverse axes, wherein each linear axis represents a linear segment of the measuring tape which is a function of the number of transverse axes.

10. The tape of Claim 1, wherein the backing is selected from the group consisting of transparent materials, translucent materials, and opaque materials;

wherein the backing is selected from the group consisting of singularly colored materials, multiply colored materials, white materials, and black materials;

wherein the backing is selected from the group consisting of glossy materials, matte materials, metallic materials, reflective materials, retroreflective materials, and luminescent materials; and

optionally having a surface receptive to pen and pencil markings.

11. The tape of Claim 1, wherein the adhesive layer is composed of an acrylic pressure sensitive adhesive material.

12. The tape of Claim 1, further comprising a symbol printed on the measurement layer, wherein the symbol is selected from the group consisting of a stud location marking, a promotional symbol, a branding indicium, and combinations thereof.

13. A method of using an adhesive backed measuring tape of Claim 1, comprising the steps of:

(a) dispensing the measuring tape from a roll;

(b) applying the measuring tape to a substrate; and

(c) removing the measuring tape from the substrate.

14. An adhesive backed measuring tape, comprising:

a backing having two major surfaces,

wherein one major surface has a measurement layer printed or contacted thereon, wherein the measurement layer has a multiple of linear axes and a multiple of transverse axes, wherein each linear axis represents a linear segment of the measuring tape which is a function of the number of transverse axes, and

(b) a repositionable adhesive layer adhered to the other major surface of the backing or to the measurement layer.

15. The tape of Claim 14, wherein the number of linear axes ranges from about 2 to about 20 measurement scales.

16. The tape of Claim 14, wherein each linear segment is equally spaced.

17. The tape of Claim 14, wherein background color on the measurement layer of each linear segment of a linear axis has a different color from another linear segment of the linear axis.

18. The tape of Claim 17, wherein background color of the measurement layer of each linear axis has a different color from another linear axis.

19. The tape of Claim 14, further comprising a symbol printed on the measurement layer, wherein the symbol is selected from the group consisting of a stud location marking, a promotional symbol, a branding indicium, and combinations thereof.

20. The tape of Claim 14, wherein the measurement layer has multiple scales of different systems of measurement.

21. The tape of Claim 14, wherein the backing is flexible and the adhesive layer is adhered to the other major surface of the flexible backing.

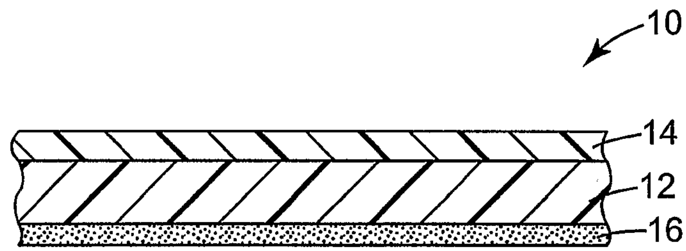


Fig. 1

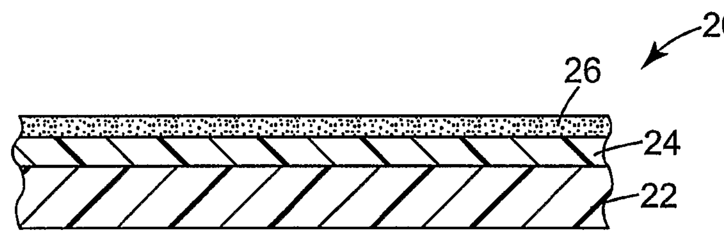


Fig. 2

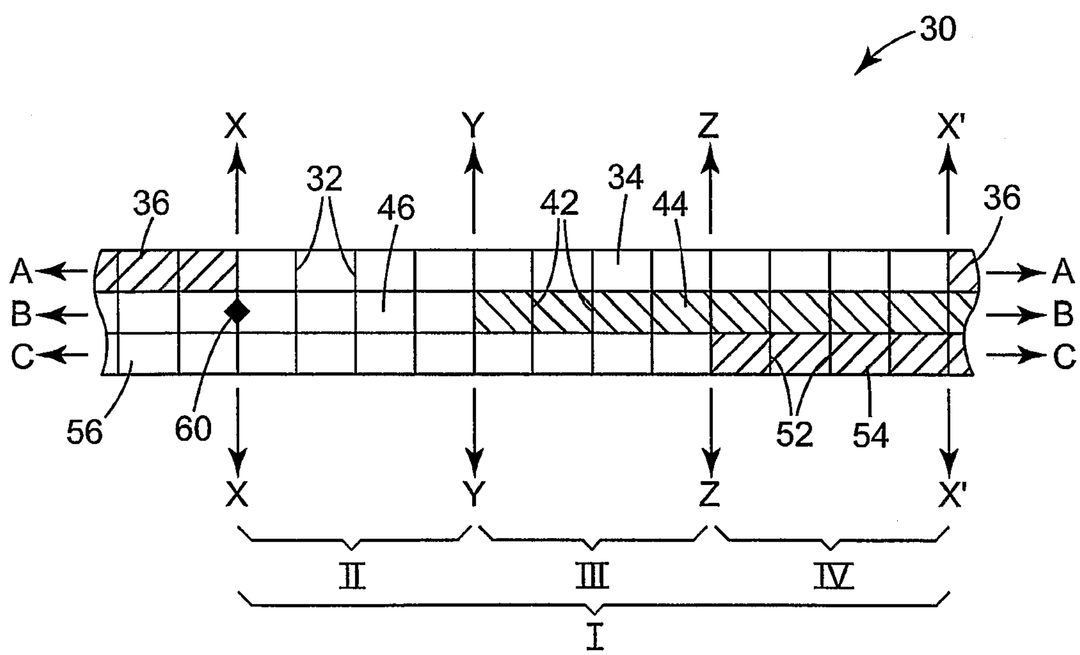


Fig. 3

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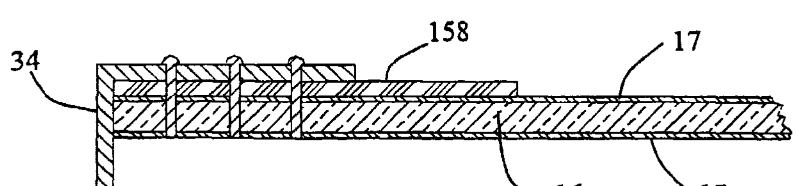

(57) Abstract: A retractable rule assembly (10) includes a housing assembly (12) and a reel (14) in the housing assembly (12). An elongated blade (16) formed of a ribbon of metal having one end connected to reel (14) is able to extend outwardly through a space opening (22) in the housing assembly (12). A coil spring (37) is arranged within the housing assembly opening (22) and to release the blade (16) when extending from the housing (12). A blade holding assembly (126) is actuatable to hold the blade (16) outwardly of the housing assembly opening (22) and to release the blade (16) from any position in which it is held. A relatively short free end portion of the blade (16) has a film (158) of plastic material adhered to a convex or a concave side thereof. The clear film (158) of plastic material protects the covered portion of the blade (16) from cracking or tearing and protects any indicia on the end of the blade (16) from wear.

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RULE ASSEMBLY WITH PROTECTIVE FILM

This application claims priority from U.S. application No. 09/973,955, filed October 11, 2001, which iis a continuation-in-part of co-pending U.S. patent application number 09/366,782, filed August 4, 1999, herein incorporated by reference.

This invention is generally related to retractable tape rule assemblies and more particularly to rule assemblies of the spring retractable type.

BACKGROUND OF THE INVENTION

A typical retractable tape rule assembly includes an elongated thin metal rule blade that is mounted on a reel rotatably disposed within a housing assembly. The rule blade is retracted into the housing assembly for storage by coiling it about the reel. A coil spring is mounted between the reel and housing assembly to provide spring powered rewinding of the blade about the reel to the fully retracted position of the blade after the measurement has been taken. Repeated extension and retraction is stressful on the blade, however. It has been found that the first several inches of the free end of the blade are particularly susceptible to damage and wear over the life of the tape assembly. The leading end of the blade is frequently handled, for example, by the tape assembly user to pull the tape out of the housing assembly or to hold the free end of the tape on the workpiece. This repeated handling of the free end of the tape exposes the numbering and graduation lines on the face of the tape to wear and over time can wear these markings off. Spring powered retraction of the blade may cause fairly rapid rewinding of the blade into the housing assembly, causing the last several inches of the rewinding tape (i.e., the several inches on the free end of the tape) to "whip" or hit against the portions of the housing assembly that define the housing assembly opening. Over time, this hitting action of the tape against the housing assembly opening leads to cracks or tears in the tape and eventual tape breakage. Most breaks in the tapes of tape assemblies in commercial use occur in the first six inches of the blade.

Although tape breakage could be reduced by increasing the thickness of the metal of the blade, this is undesirable for several reasons. A thick blade increases tape assembly size, weight and material cost. A uniformly thick blade may have a detrimental effect on blade standout by increasing the weight of the extended portion of the blade. Furthermore, experience has shown that thickening or reinforcement of the entire blade length is not necessary to maximize service life of a rule assembly because most breaks and most blade wear occur in the several leading inches of the blade.

A need exists for a low cost, lightweight, durable material to cover and reinforce a selected length of a retractable tape blade that is easy to apply, highly durable and that can be used on any known tape rule product.

BRIEF DESCRIPTION OF THE INVENTION

A retractable rule assembly comprising a housing assembly; a reel rotatably mounted in said housing assembly; an elongated blade formed of a ribbon of metal having one end connected to said reel, said blade extendable from a position tangential to said reel outwardly through a spaced opening in said housing assembly, said elongated blade housing a concavo-convex configuration when extended from said housing assembly, said elongated blade having measuring indicia formed on the concave side thereof, and a clear, protective coating provided on both said concave and convex side of said blade throughout the length of the blade for inhibiting wear of said measuring indicia; a coil spring formed of a ribbon of metal constructed to rotate said reel in said housing assembly in a direction to wind up the elongated blade when extending outwardly of said housing assembly opening in said concavo-convex cross-sectional configuration onto said reel in an abutting volute coil formation in a flattened cross-sectional configuration; and a blade holding assembly constructed to hold the blade in any position of extension outwardly of said housing assembly opening and to release the blade from any position in which it is held; a relatively short free end portion of said blade having a film of plastic material overlying said protective coating on at least one of the convex and concave side of the blade, said film of plastic material having a thickness greater than a thickness of said protective coating.

The thin film may be any flexible or semiflexible plastic such as thermoset, thermoplastic, thermoplastic elastomer or rubber materials. Preferably, the film is made of polyurethane and is adhered to the blade by an acrylic adhesive. Alternatively, a polyester, silicone, polyimides, polyethylene, fluoropolymers, Nylon® or Mylar® film could be used to cover the blade. Preferably, the film has a thickness dimension within a range of about 0.006" to about 0.014".

In one preferred embodiment the retractable rule assembly further includes an end hook member formed of sheet metal of a predetermined thickness to include a concavo-convex mounting portion and a U-shaped hook portion that is bent at a generally right angle from an end of the mounting portion. The end hook member is mounted on the free end of the blade with the mounting portion of the hook member being secured for limited movement with respect to the free end of the blade so that the rule can be measured externally from an exterior surface of the U-shaped hook portion or internally from an interior surface of the U-shaped hook portion. When the hook member is included, preferably the film is adhered to the concave side of the blade from the free end thereof a length that is within a range of from approximately 2" to approximately 12" so that one end portion of the film is disposed between the concave side of the blade and the mounting portion of the end hook member so that the portion of the tape on which the hook member is movably mounted is covered by tape.

The film of material provides localized strengthening and slight thickening of the blade to provide localized protection against cracking and breaking of the blade. The thin film also provides a transparent covering that can be used to cover the numbering and graduation lines on sections of the blade that are frequently handled. Because the thin film is very lightweight, it has no appreciable adverse effect on blade standout, even when it is applied on the first few inches of the blade.

It is contemplated to provide a wide range of tape assembly embodiments that include at least one section of the blade covered by a protective film as described above. More particularly, in the more specific aspects of the present invention, it is a further object to provide a retractable rule assembly having a blade that includes a protective film to provide the localized blade strengthening and protection previously described with any combination of the following additional features:

1. The blade has a blade width, thickness and height of concavo-convex curvature sufficient to enable the blade to stand out arcuately a length measured along the blade of approximately 11 feet with a horizontal linear length of standout thereof greater than 97% of the arcuate length of standout.

2. A retractable rule assembly wherein the elongated blade has a width in the flattened configuration thereof having a dimension within the range of 1.10" - 1.5", a height in the concavo-convex configuration thereof having a dimension within the range of 0.25" - 0.40" and a thickness in either configuration thereof having a dimension within the range of 0.0045" to 0.0063".

3. A retractable rule assembly wherein the concavo-convex cross-sectional configuration of the blade includes an arcuate central section having a predetermined radius of curvature and integral arcuate end sections each having the same radius of curvature, the radius of curvature of the central section being a dimension within the range of 0.35" to 0.60" and the radius of curvature of each end section being a dimension within the range of 1.0" to 5.0".

4. A retractable rule assembly wherein the metal ribbon of the spring has a width which is 95%-120% of the width of the metal ribbon of the blade.

5. A retractable rule assembly wherein the blade has an end hook member on the free end thereof, the end hook member being formed of sheet metal of a predetermined thickness to include a concavo-convex mounting portion having a U-shaped hook portion bent at a generally right angle from an end thereof, the end hook member being mounted on the free end of the blade with the mounting portion thereof secured in limited sliding engagement with a concave side of the free end of the blade so that the rule can be measured externally from an exterior surface of the U-shaped hook portion or internally from an interior surface of the U-shaped hook portion, the U-shaped hook portion including a bight section extending transversely from a convex side of the free end of the blade and spaced leg sections extending beyond transversely spaced corners of the free end of the blade.

6. A retractable rule assembly wherein the housing assembly includes a pair of cooperating housing members, each including an end wall having a peripheral wall extending from a periphery thereof and terminating in a free edge, the housing members being fixed together with their free edges interengaged by a plurality of bolts extending through one of the housing members and threadedly engaged in the other at spaced positions adjacent the peripheral walls thereof and by a fixed reel spindle having a non-circular interengaging recess-projection connection at each end thereof with the central interior of the adjacent end wall, each end of the spindle being interiorly threaded to threadedly receive a bolt therein extending through a central hole in the adjacent end wall and the recess-projection connection between the central hole and threaded interior.

7. A retractable rule assembly wherein the housing assembly includes a fitment defining a part of the housing assembly opening adjacent a convex side of the blade, the fitment having a plurality of tangentially extending transversely spaced elongated ridges defining surfaces for engaging the convex side of the blade extending tangentially from the reel to said housing assembly opening.

8. The housing assembly includes a bottom wall having an exterior portion at an end position adjacent the housing assembly opening which projects below the exterior surface portion extending therefrom toward an opposite end to provide a finger grip enhancing configuration.

9. The housing opening has a height dimension which exceeds the height dimension of the blade an amount that is at least approximately equal to the amount the hook portion extends below the bottom end surface of the housing assembly at the housing opening.

In the broadest aspects of the present invention, it is an object to provide any known tape rule product with a protective film along at least a portion of the blade as previously described.

These and other objectives, features, and advantages of the present invention will become apparent from the following detailed description, the accompanying drawings, and the appended claims.

DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a prospective few of a tape rule assembly constructed according to the principles of the present invention;

FIG. 2 shows a front of elevational view of the tape rule assembly;

FIG. 3 shows a side of elevational view of the tape rule assembly;

FIG. 4 shows a cross-sectional view of the tape rule assembly taken through the line 4-4 in FIG. 2 showing a blade thereof in a fully retracted configuration;

FIG. 5 is a view similar to FIG. 4 except showing the blade in a fully extended configuration;

FIGS. 5a-b show two cross sections of configurations of the blade with a film of plastic material on the concave and convex sides, respectively.

FIG. 6 is a cross-sectional view taken through the line 6-6 in FIG. 3;

FIG. 7 is a transverse cross-sectional view taken through a portion of the extended blade;

FIG. 8 is a transverse cross-sectional view taken through a portion of the blade when the blade is in a flattened configuration;

FIG. 9 is a table showing a comparison of the construction and standout characteristics of a plurality of exemplary prior art tape rule assemblies with an embodiment of the tape rule assembly constructed according to the principles of the present invention;

FIG. 10 is a schematic representation of an extended tape blade extending from a housing assembly to illustrate the linear length-out, arcuate length-out of the blade and the rotational angle of the housing assembly; and

FIG. 11 is a cross-sectional view of a fragment of the tape rule assembly taken through the line 11-11 of FIG. 4.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. 1-3 show an exterior view of a retractable rule assembly that is generally designated 10 and is constructed according to the principles of the present invention. The rule assembly 10 includes a housing assembly 12 and a reel 14 that is rotatably mounted inside the housing assembly 12 (best seen in the cross-sectional views of FIGS. 4-6). The reel 14 is mounted in the housing assembly 12 by a reel spindle 15 that is secured within the housing assembly 12 (FIGS. 4-6). An elongated tape rule blade 16 is mounted on the reel 14.

The blade 16 is formed of a ribbon of metal, the preferred metal being steel, and the top concave surface of the blade is printed with measuring lines and digits (not shown) for measuring lengths and distances. One longitudinal end 18 of the blade 16 is connected to the reel 14 and a second longitudinal free end 20 of the blade 16 extends generally outwardly of the reel 14. The blade 16 is constructed and arranged with respect to the housing assembly 12 to extend generally from a position tangential of the reel 14 outwardly through a spaced opening 22 provided in the housing assembly 12 (as shown, for example, in FIG. 4).

Preferably the reel 14 is made of a molded plastic and is provided with slots or openings 24, 26 in a central cylindrical wall portion 28 thereof. The one end 18 of the blade terminates in a hook-like structure 30 that hookingly engages an edge of the wall portion 28 of the reel 14 at opening 24 to connect the end 18 of the blade 16 to the reel 14 (FIGS. 4, 5).

A coil spring 32 has a construction and arrangement between the housing assembly 12 and the reel 14 to rotate the reel 14 with respect to the housing assembly 12 in a direction to wind the elongated blade 16 about the reel when the blade 16 is extending outwardly of the housing assembly opening 22. The coil spring 32 is generally enclosed within the central wall portion 28 of the reel 14 (FIGS. 4-6). One longitudinal end 35 of the coil spring 32 hookingly engages an edge of the wall portion 28 of the reel 14 that defines the opening 26; a second longitudinal end 37 of the blade 16 hookingly engages the spindle 15. The spindle 15 is rigidly mounted to the housing assembly 12 in a manner considered in detail below. Preferably the spring 32 is a thin, flat ribbon of metal, the preferred metal being steel.

The blade 16 is generally movable between a fully retracted position outwardly of the housing assembly 12 to a fully extended position. The fully retracted position of the blade 16 is shown in FIG. 4 and the fully extended position of the blade is shown (in fragmentary view) in FIG. 5. It can be appreciated from a comparison of FIG. 4 and FIG. 5 that as the blade is unwound from the reel 14, the coil spring 32 is wound around the rigidly fixed spindle 15. This winding of the spring around the spindle stores energy in the spring to provide spring powered rewinding of the blade 16 around the reel 14 when the extended blade is released.

The blade 16 is constructed of a ribbon of sheet metal that is shaped during the manufacturing to have a normal or memory configuration that has a generally arcuate or concavo-convex transverse cross-section. The blade 16 has a layer of paint on both sides thereof, with the paint on the concave side of the blade 16 providing measuring indicia. The paint layer on each side of the blade preferably has a thickness of about .0006" - .0014", and more preferably between .0008" -.0012." A water-based paint or solvent-based paint is preferred. In order to reduce damage to the paint layer from rust, corrosion and wear, the paint layer on both sides of the entire blade length is preferably coated with a thin, clear plastic protective coating 17 as shown in Figure 5a and as described in U.S. Patent 3,121,957, herein incorporated by reference. The thin plastic coating 17 is preferably provided throughout the length of the blade and on both sides of the blade, with each side of the blade having a coating thickness of less than .0035", and even more preferably between about .0005" and about .001". Any appropriate flexible or semi-flexible material may be used, but Mylar, Polyester, Nylon, Lacquer or Acrylic are most preferred. In addition, an appropriate thermoset, rubber, thermoplastic, thermoplastic elastomer, polyamide, polyvinyl, silicone, polyimide, polyethylene, fluoropolymer or polyethylene terephthalate may be also used, for example. The coating 17 provides a war-resistant layer that reduces or inhibits wear of the indicia on the blade. It also preferably provides a sealing function to inhibit rust formation on the blade. If the plastic coating 17 is omitted, it is preferable to use a wear resistant paint to provide the measuring indicia.

When a portion of the blade 16 is wound about the reel 14, the wound portion has a flat transverse cross-section (FIGS. 6 and 8) and the wound layers of the coiled blade provide the wound blade with an abutting volute coil configuration. A representative transverse cross-section of the extended blade 16 showing its concavo-convex configuration is illustrated in FIG. 7. It can therefore be understood from a comparison of FIGS. 4-5 (and from a comparison of FIGS. 7-8) that when the blade 16 is wound around the reel 14, it has the flat cross-section of FIG. 8 and when the blade 16 is withdrawn from the housing assembly 12 to measure an object, it returns to the concavo-convex cross-section shown in FIG. 7. Thus, the coil spring 32 is constructed and arranged between the housing assembly 12 and the reel 14 to rotate the reel 14 about the spindle with respect to the housing assembly 12 in a direction to wind up the elongated blade 16 when extending outwardly of the housing assembly opening 22 in a normal concavo-convex cross-sectional configuration onto the reel 14 in an abutting volute coil formation in a flattened cross-sectional configuration. The concavo-convex cross-section provides the extended blade with rigidity and maintains the blade essentially straight in the longitudinal direction.

The concavo-convex cross-section of the blade generally provides the unsupported blade 16 with blade standout. As described in greater detail below, the blade 16 has a blade width, thickness and height of concavo-convex curvature sufficient to enable the blade 16 to standout arcuately a length measured along the blade of at least 10.5 feet with a horizontal linear length of standout thereof that is greater than 97 percent of the arcuate length of standout. As also described in greater detail below, the concavo-convex transverse cross-section of the blade 16 is provided with a geometry that also improves blade standout.

Generally, one skilled in the art will understand that the length of blade standout depends on many factors, including (but not limited to) blade width (i.e. the transverse width of the blade measured when the blade is in its flattened condition shown, for example, in FIG. 8 and designated F); the height of the blade 16 in the concavo-convex configuration (designated H in FIG. 7); blade thickness (designated T in FIG. 7); and the geometry of the blade transverse cross-section when the same is in its normal concavo-convex than configuration. Preferably, the blade 12 has a width in the flattened condition thereof having a dimension within the broad range of from approximately 1.10 inches to approximately 1.5 inches; a height H in the concavo-convex configuration thereof having a dimension within the broad range of approximately 0.25 inch to approximately 0.40 inch; and a thickness in either configuration thereof having a dimension within the broad range of approximately 0.0045 inch to approximately 0.0063 inch. More preferably, the blade 12 has a width in the flattened condition thereof having a dimension within the narrower range of from approximately 1.25 inches to approximately 1.39 inches; a height H in the concavo-convex configuration thereof having a dimension within the narrower range of approximately 0.30 inch to approximately 0.35 inch; and a thickness in either configuration thereof having a dimension within the narrower range of approximately 0.005 inch to approximately 0.0056 inch. Most preferably the blade 16 width is approximately 1.25 inch, the blade height H is approximately 0.32 inch and the blade thickness T is approximately 0.0051 inch. A blade constructed according to these principles has a blade standout of up to approximately 13 feet. More specifically, a blade construction having dimensions within the broadest ranges identified immediately above for the width F, height H and thickness T can have a blade standout in the preferred broad range of at least 10.5 feet to approximately 13 feet; a blade construction having dimensions within the more preferred narrower ranges identified immediately above for the width F, height H and thickness T can have a blade standout in the range of at least 10.5 feet to approximately 12.5 feet; and a blade construction having the most preferred dimensions identified immediately above for the width F, height H and thickness T has a blade standout of approximately 11 feet.

The concavo-convex cross-section of the blade 16 has a unique geometry (shown in FIG. 7) that increases its standout ability. The concavo-convex cross-sectional configuration of the blade 16 includes an arcuate central section 36 and integral arcuate end sections 38. Each arcuate end section 38 has the same radius of curvature (indicated for one of the two end sections 38 in FIG. 7 by the line designated R1). The central section 36 has a radius of curvature designated R2 (FIG. 7). The radii of curvature R1 for the two end sections 38 are greater than the radius of curvature R2 of the central section 36. The central section having a radius R2 extends through an angular extent designated X in FIG. 7. Preferably angle X is approximately 84 degrees.

Preferably the arcuate central section 36 has a radius of curvature R2 that is a dimension within the broad range of approximately 0.30" to approximately 0.60"; and the radius of curvature R1 of each end section 38 is a dimension within the broad range of approximately 1.0" to approximately 5.0". More preferably the arcuate central section 36 has a radius of curvature R2 that is a dimension within the narrower range of approximately 0.40" to approximately 0.50" and the radius of curvature R1 of each end section 38 is a dimension within the narrower range of approximately 2.0" to approximately 4.0". Most preferably, the arcuate central section 36 has a radius of curvature R2 of approximately 0.46" and the radius of curvature of each end section R1 is approximately 3.0".

The transverse cross-sections of prior art tape blades are either constant curves (i.e., constant radius of curvature) or are constant curves in the center of the blade with straight (i.e. flat) sections at each transverse end of the cross-section when the blade is extended. Blades constructed to have either these basic cross-sections are less stable during blade standout and show a greater tendency to buckle than blades having cross-sections constructed according to the present invention.

FIG. 9 shows a comparison of the construction and standout capabilities of three prior art rule assemblies (shown in the first six rows of the table and indicated with a bracket) with a preferred embodiment of the rule assembly 10 constructed according to the principal of the present invention (shown in the last five rows of the table). As the first column of FIG. 9 indicates, typical prior art rule blades did not exceed one inch in width (measured in the flattened, coiled configuration of the blade). The second column indicates that prior art blade thickness for a one inch blade ranged from 0.0045 inch to 0.0056 inch and produced blade having a standout length of from approximately 7 feet to approximately 9 feet as indicated in FIG. 9, the third column.

The embodiment of the rule assembly constructed according to the principles of the present invention shown in FIG. 9 has a blade width of 1.250 inches (in the flat configuration) and a blade thickness of 0.0051 inch. Preferably, the blade described in FIG. 9 has a concavo-convex cross-section in the extended configuration as described above and as shown in FIG. 8.

The last five columns in FIG. 9 compare the standout characteristics of the three prior art tape assemblies with the tape assembly 10 constructed according to the principles of the invention. The standout characteristics of the blade of a given tape assembly are best understood by comparing the arcuate (i.e., actual) length-out measured along the surface of the blade with the linear length-out of the blade. These two characteristics are often expressed as a percentage of linear length-out to arcuate length-out. FIG. 10 shows a schematic diagram that illustrates what is meant by arcuate length-out and linear length-out.

Arcuate length-out is represented by arcuate line C in FIG. 10 and is a measure of the total length of the extended portion of the blade. Linear length-out is designated B in FIG. 10 and is a measure of the linear length of the projection of the extended blade on an imaginary horizontal surface below the tape assembly 10. Line A designates the height the housing assembly 10 is required to be above the horizontal surface when the housing assembly 12 is angularly oriented with respect to the surface at an angle D to position the arcuately extending blade so that the free end thereof just touches the surface. Thus, angle D generally represents the degree of tape rule housing assembly rotation (with respect to the horizontally extending surface) required to achieve maximum standout for a given length of extended tape.

The comparison of the prior art and the present invention given in FIG. 9 indicates that the maximum prior art arcuate length-out that could be achieved with a one inch wide blade was approximately nine feet. Because of the relatively shallow (relative to the present invention) cross-sectional blade height H of approximately 0.21 inch (not shown in FIG. 9) typically used in prior art one inch blades and because of the relatively high thickness of the metal of the prior art blades (which thickness is required for the arcuate length-out to be achieved), however, the linear length-out B was approximately 93 inches. This results in a percent of linear to arcuate length-out of approximately 86 percent. It can be appreciated that the third embodiment of the prior art shown in the fourth through the sixth rows of FIG. 9 shows relatively little bending for seven feet of standout (96% linear to arcuate length-out), but that this embodiment bends a very large degree when two additional feet of the blade are extended. This high degree of arcuate bending of the 1 inch blade at standout lengths approaching 9 feet makes the task of measuring a large distance difficult for a single person using the prior art tape rule assembly. As indicated in FIG. 9, the present invention provides a rule assembly that can achieves seven feet to approximately 11 feet of arcuate length-out while maintaining the percent of linear to arcuate length-out in the approximate range of 99 percent to 98 percent. This greatly facilitates the task of measuring a length for the tape assembly user. Greater degrees of standout with a comparable percentage of linear to arcuate length-out can be achieved by making the blade wider. It is, for example, within the scope of the present invention to provide a blade width of 1.5 inches or greater.

It can be understood by one skilled in the art that the 1.25 inch blade width of a preferred embodiment of the assembly 10 allows the blade height H to be increased without increasing the overall blade curvature to a degree that would make reading the gradations and lettering printed on the concave surface of the blade 16 difficult. This construction results in a blade with relatively high height H that is also easy to read. (In contrast, one inch blades having a curve height of the extended blade of over 0.21 become very difficult to read and are thus not commercially practical.) Increasing the blade width of the blade of the present invention also allows the printing on the blade to be made larger, thus making measurements easier by making the blade easier to read. When the preferred 1.25 inch blade (flat width F) is in its concavo-convex cross-sectional configuration (FIG. 7), the height H thereof, as mentioned above, is approximately 0.32 inch and the curved or arcuate width W is approximately 1.018 inches. This relatively wide width W of the extended blade also facilitates reading a measurement from the blade 16.

The blade of the rule assembly 10 is thus able to achieve the approximately 11 feet of standout while improving the percent of linear to arcuate length-out relative to the prior art. This length of standout is achieved while the bottom surface of the housing is angled approximately 45 degrees with respect to the horizontal surface S (as indicated in the right most column of FIG. 9) which is comparable to the three prior art rule assembly embodiments shown in FIG. 9.

One skilled in the art will appreciate that when the rule assembly 10 is provided with a 33 foot long blade, a coil spring 32 must be provided to accommodate outward movement of the blade 16 to its fully extended position. It can be appreciated that it is desirable to construct a rule assembly 10 so that the housing assembly 12 is small enough and compact enough to fit easily in one hand of a user. Because the rule assembly 10 has a wide blade, the width of the housing assembly 12 is comparably wide. It is desirable to construct a retractable rule assembly 10 so that the height and length of the housing assembly 12 (also called the "footprint" of the housing assembly 12) are as small as possible. Because both the spring 32 and the blade 16 can be quite long in some embodiments of the invention (up to approximately 33 feet of blade length, for example), the spring 32 must be carefully constructed so that it provides sufficient spring forced to retract the fully extended blade and yet fits within a housing assembly 12 having a footprint that is dimensioned to easily fit in a user's hand.

The coil spring is constructed of a coiled ribbon of metal (typically steel). The spring force provided by the spring is approximately directly proportional to the spring width and the spring thickness. A thick spring undesirably increases the height and length of the housing assembly 12, however. It has been found that the most desirable construction of a rule assembly constructed according to the principles of the present invention has a coil spring that is relatively thin and relatively wide compared to prior art springs. Preferably the spring 32 of the rule assembly 10 has a width that is approximately 95 percent to approximately 120 percent of the width of the blade (for a given blade width in the broad range set forth above for the flattened blade). More preferably, the spring has a width that is approximately 100 percent to approximately 110 percent of the width of the metal ribbon of the blade, and is most preferably 100% of (i.e., equal to) the blade width (as shown in FIG. 9). Because the spring width is relatively great, the spring can be made the same thickness as or thinner than the blade 16. The reduction in the spring thickness relative to blade thickness (as compared to the prior art) allows the housing assembly 12 to be constructed so that it has a minimal footprint to provide a housing assembly 12 that can be easily gripped in one hand.

Typical springs used with prior art one-inch blades have a width that is less than the width of the blade, usually in the range of 0.8 to 0.89 inch. FIG. 9 shows a typical value of 0.875-inch for the spring width for all three embodiments of the one-inch blades described in the figure. Prior art spring thickness ranges from about 0.0051 to about 0.0060 inch. Generally, prior art spring thickness is approximately 0.0003-0.0006 greater than the blade thickness. Thus, prior art construction uses springs that are thicker and significantly narrower than the blade. It can be appreciated that although it is possible to use this prior art construction and the present invention, it is undesirable because the relatively thick spring of the prior art would result in a housing assembly footprint that too large to fit comfortably within the average user's hand. Thus there is a need for a new spring construction that can be used with the blade 16 that will allow the footprint of the housing assembly to be made small to be comfortably gripped using one hand.

It can thus the understood that the relatively wide spring allows the thickness of the spring to remain relatively small and this allows the footprint of the housing assembly to be small enough to be easily gripped in a single hand of the most users. More specifically, preferably, when the spring width is approximately equal to the blade width, the spring 32 of the present invention is 0 percent to 10 percent thinner than the blade 16. As another example, if the spring 32 is made one hundred twenty percent the width of the blade 16, the spring 32 is preferably 0 percent to 25 percent of thinner than the blade. In terms of actual measurement, this means that typically the spring thickness is up to 0.0005 inch thinner than the thickness of the blade. Furthermore, because the spring of the present invention is made wide relative to the width of the blade, the overall length of the spring can be made shorter relative to the length of prior art springs for comparable measuring blade 16 lengths. For example, a typical one inch wide, 25 foot long prior art blade has a spring that is approximately 240 inches in length; the length of a wide spring 32 constructed according to the principles of the present invention for the rule assembly 10 having a 25 foot blade is approximately 230 inches.

By increasing the spring width of the spring 16, the thickness of the spring can be decreased and the length decreased while still providing sufficient spring force to retract the blade without increasing the footprint of the housing assembly to an undesirable degree. Examples of specific housing assembly 12 heights for particular blade lengths will be considered below after other structural details of the construction of the rule assembly 10 are considered.

The housing assembly 12 is further constructed to easily and comfortably fit in a hand of the user because it optimizes the use of space within the housing assembly 12 to house the blade 16, coil spring and other cooperating components. The details of the internal structure of the housing assembly 12 and the blade 16 mounted therein are shown in FIGS. 4-6 and 11. Preferably the housing assembly 12 and the reel 14 are constructed of a molded plastic. As best appreciated from FIG. 6, the housing assembly 12 includes a pair of cooperating molded plastic housing members 40, 42. Each housing member 40, 42 includes an end wall 44, 46, respectively, having a peripheral wall 48, 50, respectively, extending from a periphery thereof and terminating in a free edge 52, 54, respectively. The pair of cooperating housing members 40, 42 are movable toward one another in an axial direction into cooperating relation to define the housing assembly (where "axial direction" refers to the direction of the axis of rotation of the reel defined by the spindle).

When the housing members 40, 42 are fixed together in the assembled rule assembly 10, the free edges 52, 54 are interengaged as shown in FIG. 6. A plurality of axially extending bolts 58 extend through one of the housing members 42 and threadedly engage the other housing member 40 (FIG. 11) at spaced positions adjacent the peripheral walls 48, 50. The housing members 40, 42 are also fixed together by the threaded engagement of bolts 68 with the fixed reel spindle 15. The axially extending spindle 15 is fix at a central portion of the housing assembly 12. Specifically, the fixed spindle 15 has a noncircular interengaging recess-projection connection (shown in FIG. 6 and described below) at each end thereof generally with a central interior region 62, 64, respectively, of the end walls 44, 46 of the housing assembly 12. Each end of the fixed spindle 15 is interiorly threaded to threadedly receive the bolts 68 therein. The bolts 68 extend through central holes 70, 72 formed in the respective adjacent end walls 44, 46 of the housing assembly and threadedly engage internal threading 73 in each end of the spindle 15. Each bolt 68 extends through a recess-projection connection, generally designated 75, when each bolt 68 is disposed in a respective central hole 70, 72 and threaded interior 73. A metal clip 77 is secured to one side of the housing assembly by one of the bolts 68.

Preferably the fixed spindle 15 is constructed of a molded plastic or nylon. The construction of the recess-projection connections 75 between the ends of the spindle 15 and the walls 44, 46 is shown in cross-section in FIG. 6. Each recess-projection connection 75 is identical. Specifically, projections 74 having exterior noncircular cross-sections are integrally formed on the walls 44, 46 and are received within recesses 76 having complementary non-circular interior cross-sections formed on each end of the spindle 15. The noncircular interior and exterior cross-sections cooperate to prevent rotation of the spindle 15 with respect to the housing assembly 12 when the ends of the spindle 15 are mounted on the projections 74 in the assembled rule assembly 10. Each end of the spindle 15 extends through a hole 79 of circular cross-section formed in opposite sides of the reel 14. The portions of the spindle 15 that extend through the holes 79 in the reel 14 have circular exterior cross sections. A flange 81 on the spindle 15 engages an annular groove 83 in the reel 14 surrounding the hole 79 to guide the rotation of the reel on the spindle. Thus, the reel 14 is rotatably mounted on the spindle 15 for bi-directional rotational movement of the reel with respect to the housing assembly 12. As can best be appreciated from FIGS. 4 and 6, the spindle 15 is internally slotted to receive the one longitudinal end 37 of the spring 32 to thereby secure the one end 37 of the spring to the spindle.

The molded plastic reel 14 includes two reel members 78, 80 (FIG. 6). Reel member 78 includes the integral cylindrical wall portion 28 about which the blade 12 is wound. Reel member 80 is essentially disk shaped. Each reel member 78, 80 includes an outwardly extending cylindrical wall portion 88, 90, respectively, formed around the hole 79. An annular edge portion 84 on the wall portion 82 is received within an annular groove 86 formed within reel member 80 to help hold the reel 14 together. The abutting engagement of the wall portions 88, 90 on the reel with the end walls 44, 46 of the housing assembly 12 maintain the edge portion 84 within the groove 86 in the assembled rule assembly.

The housing members 40, 42 include portions along the abutting free edges thereof 52, 54, respectively, of tongue and groove construction (FIG. 6) to help secure the molded housing members 40, 42 of the assembled rule assembly 10 together. Specifically, at a top portion of the housing assembly 12, a wall portion 92 formed on edge 54 is received within a groove 94 formed along a portion of the edge 52; and an integral wall portion 93 formed on edge 52 is disposed in underlying, abutting relation to wall portion 50 of the housing member 44. At a bottom portion of the housing assembly 12, a wall portion 95 formed along a length of edge 54 is received within a recess 97 formed on a portion of the wall portion 48 of housing member 40.

When viewed from the side elevational view, the housing assembly 12 includes only two corner portions (see FIG. 4, for example), generally designated 96, 98. One corner 96 is adjacent the housing assembly opening 22 and the other corner portion 98 is at an opposite bottom end of the housing assembly 12. The two bolts 58 are positioned in the only two corner portions 96, 98, respectively, of the housing assembly 12. Thus, it can be appreciated that the housing assembly 12 is secured together using threaded fasteners in only three locations (from the point of view of one looking at the side elevational view of, for example, FIG. 4): at the opposite corners 96, 98 (bolts 58) at the bottom portion of the housing assembly 12 and in the center of the housing assembly 12 (bolts 68). This use of the bolts 68 on opposite ends of the reel spindle 15 allows the housing assembly 12 to be secured together without using any bolts in a peripheral top portion or portions of the housing assembly 12.

This arrangement of the bolts helps reduce the size of the footprint of the housing assembly 12 to allow the housing assembly 12 for a 33-foot long blade constructed according to the principles of the invention to have up to 13 feet of blade standout, for example, to easily fit in a hand of a user. Specifically, it is within the scope of the invention to provide tape assemblies constructed according to the principles taught herein wherein the height (and length) of the housing assembly does not substantially exceed 3.65 inches for a blade length that is at most approximately 33 feet; wherein the height (and length) of the housing assembly does not substantially exceed 3.45 inches for a blade length that is at most approximately 30 feet; and wherein the height (and length) of the housing assembly does not substantially exceed 3.25 inches for a blade length that is at most approximately 8 meters.

As best appreciated from FIGS. 3-4, because the housing assembly does not require bolts in the upper periphery of the housing assembly 12, the top portion 108 of the housing assembly 12 can be made to have a relatively arcuate profile (FIG. 2, for example) that generally conforms to the profile of the reel, thus minimizing the footprint of the housing assembly 12, eliminating corners in the upper portion of the housing assembly and providing a comfortable curved top surface to receive the palm of a user's hand. This arc-shaped upper surface of the housing assembly 12 also increases impact resistance of the housing assembly 12 in case the assembly 10 is dropped.

A peripheral portion of housing assembly 12 is provided with a rubber-like coating 110 around the gripped portion of the housing assembly 12 to provide increased frictional engagement between the housing assembly and a user's hand and to provide a relatively soft comfortable surface for the user's hand.

The housing assembly 12 includes a bottom wall 109 (FIGS. 4-5) having an exterior portion 107 at an end position adjacent the housing assembly opening 22 which projects below an exterior surface portion 108 extending therefrom toward an opposite end 113 of the bottom wall 109 to provide a finger grip enhancing configuration, generally designated 119 for a gripping hand of the user. More specifically, the bottom wall 109 (FIGS. 3-4) has a forward end portion 107 adjacent the housing assembly opening 22 and a rearward end portion 113 at the opposite end of the bottom wall 109; the portion 108 of the wall 109 therebetween is generally recessed to provide the finger grip enhancing configuration 119 for the gripping hand of the user. This recessed area or gripping area 119 on the bottom of the housing assembly 12 is preferably completely covered with the overmolded rubber or rubber-like polymeric material. It can thus be appreciated that the housing assembly 12 is constructed to be easily held in one hand of a user such that the user's fingers engage the finger grip enhancing portion 119 and the user's palm and thumb are generally in overlying relation with a top portion of the housing assembly.

The housing assembly includes a fitment 118 (FIG. 11) which forms a part of the housing assembly opening 22 adjacent a convex side of the blade 16. The fitment 118 is an essentially U-shaped structure having a transversely extending cross member 115 and two upstanding arms 117 extending upwardly from opposite sides of the cross member 115. The cross member 115 defines the lower edge of the housing opening; a bottom surface 170 of the cross member 115 is flush with the adjacent surface portion 107 of the bottom wall 109 so that a bottom surface portion 170 of the fitment 118 forms part of the bottom surface of the housing assembly 12 adjacent the opening 22. The fitment 118 is preferably an integral molded plastic structure. The fitment 118 is held within appropriately sized opposing recesses 121, 123 (FIG. 11) formed in the respective housing members 40, 42 and which recesses are disposed on opposite sides of the opening 22 when the housing members 40, 42 are secured together. The cross member 115 of the fitment 118 has a plurality of tangentially extending, transversely spaced elongated ridges 120 which define surfaces 125 along the bottom of the opening 22 for engaging and supporting the convex side of the blade 16 extending tangentially from the reel 14 of the housing assembly opening 22. Thus, the ridges 120 slidably engage the convex side of the blade 16 and provide a low friction engagement between the housing assembly 12 and blade 16.

A holding assembly, generally designated to 124, is constructed and arranged to be manually actuated to hold the blade 16 in any position of extension outwardly of the housing assembly opening 22 and to release the blade 16 from any position in which it is held. The structure and operation of the holding assembly 124 is best appreciated from a comparison of FIGS. 4-5. The holding assembly 124 includes a holding member 126 mounted on the housing assembly 12 for movement in opposite directions between a normally inoperative position (FIG. 4) and a holding position (FIG. 5). It can be appreciated that the blade holding member 126 is an arcuate member that is movable along an arcuate path between the two positions as aforesaid. The holding member 126 has an interior free end portion 128 that is movable into wedging engagement with the tangentially extending portion of the blade 16 to engage and hold the blade against an interior holding structure 130 (FIG. 5) on the housing assembly 12 when the holding member 126 is in its holding position. The free end portion 128 includes a central recess 129 (FIG. 2, for example) that is described in detail below. The holding member 126 has an exterior thumb engaging portion 132 configured to be moved digitally to selectively move the holding member 126 from its normally inoperative position and its holding position. The exterior thumb engaging portion 132 is best seen in FIGS. 1-2.

Preferably the holding member 126 is an integral structure made of an appropriate durable flexible plastic. The thumb engaging portion 132 is connected by an integral outwardly extending neck portion 134 to an elongated arcuate flexible body portion 133 that terminates in the interior free end 128. The outwardly extending portion 134 is slidably held within and guided by a slot 136 formed within a front part of housing assembly 12 by the members 40, 42. The movement of a lower portion of the holding member 126 is guided by a pair of tabs 131 integrally formed on respective housing members 40, 42 (only one tab is shown in the figures). An integral locking structure 138 on the holding member 126 engages holding structure 140 (FIG. 5) integrally formed on the housing assembly 12 to releasably lock the holding member 126 in the holding position in wedging engagement with the blade 16.

More specifically, to lock the blade 16 in a given position of extension, the user (while holding the blade 16 outwardly of the housing assembly 12 against the spring force of the coil spring 32) slides the thumb engaging portion 132 downwardly with respective to the housing assembly 12 causing the locking structure 138 to slide over a ramped surface 142 on the holding structure 140 and causing the free end 128 to move in a locking direction with respect to the blade 16. The flexible plastic locking structure 138 bends resiliently outwardly slightly as it passes over the holding structure 140. After the free end 128 contacts the blade 16, continued movement of the thumb engaging portion 132 in the locking (downward) direction thereafter wedges the free end 128 of the flexible body portion 133 against blade 16 to hold the blade 16 in place against the spring force of the coil spring 32 and moves the locking structure 138 into abutting engagement with a locking surface 141 on the holding structure 140. The holding member flexes slightly as the free end 128 is wedged against the blade 16. The abutting engagement between the locking structure 138 and the locking surface 141 locks the holding member 126 in its holding position. It can be understood from FIG. 5 that the blade 16 is held in an extended position (against the spring force of the coil spring 32) between the free end 128 of the body portion 133 and the interior holding structure 130 by the downward force exerted by the wedged body portion 133. The interior holding structure 130 (not visible in detail) is a series of longitudinally spaced, transversely extending ribs that are constructed and arranged to support the convex side of the blade 16. When viewed from the point of view of FIG. 5 (i.e., on a transversely directed line of sight), the top surfaces (not visible in the FIGS.) of the ribs cooperate to provide a generally downwardly sloped support (in a direction toward the opening 22) for the blade 16; and when viewed from the front, (i.e., on a longitudinally directed line of sight) the top surfaces (not visible in the figures) of each rib of the interior holding structure 130 are transversely spaced in a concave array to receive and support the convex side of the blade.

To release the blade 16, the user pulls upwardly on the thumb engaging portion 132 which causes the locking structure 138 on the plastic holding member 126 to move resiliently outwardly and past the locking surface 141 to release the holding member 126 from engagement with a blade 16. The holding member 126 resiliently returns to its normal arcuate shape. It can be appreciated from FIG. 2 that the recess 129 on the free end

128 of the holding member 126 defines two transversely spaced teeth 147 which have spaced arcuate side surfaces 144 sized to conform to the concave surface of the blade 16 to hold the same in locked position.

It can be understood that the use of the holding member 126 when a measurement is being taken is optional. When taking a measurement, the user typically holds the housing assembly 12 in one hand and manually pulls the blade 16 out of the housing assembly 12 with the other hand. When a sufficient length of blade 16 has been withdrawn from the housing assembly 12, the user can lock the blade 16 with respect to the housing assembly 12 using the holding member 126 to prevent the blade 16 from retracting back into the housing assembly 12 (under the spring force of spring 32) when the user releases the blade 16. When the measurement has been taken, the user simply releases the holding member 126 from holding engagement with the blade 16 by moving the free end 128 thereof out of wedging engagement with the blade 16 in the manner described above. If the holding member 126 is not used during the taking of a measurement, the user can simply hold the blade 16 with his other hand while the measurement is being taken or, alternatively, the hook member 34 can be placed in hooking engagement with the workpiece to hold the blade 16 outwardly of the housing assembly 12 in a controlled and steady manner against the spring force of spring 32 while the measurement is being taken.

When the blade 16 is released after taking the measurement, the spring 32 rotates the reel 14 with respect to the housing assembly 12 in a blade-winding direction to wind the blade 16 around the reel 14. A relatively short free end portion of the blade 16 has a film 158 of plastic material adhered to the concave and/or to the convex side thereof (FIG. 11) to protect the blade 16 while the same is out of the housing assembly 12 and while the blade 16 is being retracted under the spring force of the spring 32 back into the housing assembly 12. Though the film 158 may be clear to permit reading of measuring indicia beneath the film, it may also be opaque, particularly in the case where it is on the convex side of the blade 16 as shown in Figure 5b. Moreover, if an opaque film 158 is used on the concave side of the blade, it may itself contain the measuring indicia for that portion of the blade, so that even if the film obscures printed indicia on the blade 16, the device can still be readily used. Preferably the film 158 is made of polyurethane and is adhered to the blade (i.e., over the paint layer), or, in the case that the blade includes a protective plastic coating 17, to the coating 17, by an acrylic adhesive. Adhesive may not be necessary if the plastic coating is made of the same material as the film, since the two components can chemically bond, for example under heat treatment, obviating the need for adhesive. It is also contemplated to use Mylar® or Nylon® to construct the film. The film 158 has a thickness dimension that is larger than the thickness dimension of the thin plastic coating 17, if coating 17 is provided. The film 158 preferably has a thickness within the range of approximately 0.006 inches to approximately 0.014 inches. It is within the scope of the invention to apply this film to the blade of any known tape rule assembly.

Preferably the film 158 is self-adhering and is placed over several leading inches (preferably within a broad range of approximately 2 inches to approximately 12 inches) of the free end 20 of the blade 16, including the portion of the blade on which the hook member 34 is disposed so that preferably the film goes under the hook member 34 all the way to the free end 20 of the blade 16. More preferably, the film 158 is applied along a length from the free end 20 of the blade 16 that is less than 10.5 inches; and most preferably, the length of the blade 16 from the free end thereof that is covered by the film 158 is approximately 6 inches. It is generally desirable to have the film-covered portion end at approximately the point on the blade 16 where the volutes of the coiled blade are in overlying relation to one another when the blade 16 is in its fully retracted configuration. Typically in a tape rule assembly, the tape blade starts to wrap on itself at approximately 9.5 inches when a typical reel size of approximately 2.9 inches in outer diameter is used in the construction. The film 158 is provided because most failures in a rule blade 16 occur within the first six inches of the free end of the blade

16 from cracks or tearing. The cracks or tearing occur because when the blade is wound back around reel under the spring force of the coil spring, the free end of the blade tends to "whip" as it enters the opening 22, causing the last several inches of the blade 16 to hit against the housing assembly 12. This can cause cracking or breaking of the free end of the blade 16 over time. The protective film 158 prevents these cracks and tears and other damage to the blade 16 associated with blade whipping.

The free end of the blade 16 is frequently handled by the user and this handling can over time cause the numbering and markings on the concave side of the blade 16 to wear off or become difficult to read, even where the protective coating 17 is applied. When applied to the concave side of the blade, the film 158 prevents this damage because it covers the numbering and markings on the free end of the blade and thereby protects the same from being worn off. Film 158 provided on the concave side of the blade may also be subjected to less wear in comparison to film provided on the convex side.

There are several possibilities for the protective film 158 that remain within the scope of the present invention. For example, the film 158 may cover only a portion of the width of the blade 16. A range of between about 25% to about 100% may be sufficient to provide an increase in the blade life while reducing the amount of material necessary to provide the film. Most preferably, however, about 100% of the blade width is covered. In addition, the film 158 may include a plurality of sub-layers. The sub-layers may be formed into the film prior to attachment to the blade 16, or may alternately be individually attached to the blade in an iterative process.

The construction of the hook member 34 and the manner in which it is disposed on the free end 20 of the blade 16 is best seen in FIGS. 1-4, 11. Preferably the end hook member 34 is formed of sheet metal of predetermined thickness and includes a concavo-convex mounting portion 150 (FIG. 11) having a U-shaped hook portion 152 bent at a generally right angle from an end of the concavo-convex mounting portion 150. The hook member 34 is mounted on the free end 20 of the blade 16 with the mounting portion 150 thereof secured in limited sliding engagement with a concave side of the free end 20 of the blade 16 and in overlying relation thereto.

More specifically, the mounting portion 150 is provided with large holes 167 (FIG. 4) and a plurality of rivets 169 extend through the holes 167 to slidably mount the hook member 34 to the blade 16 for limited longitudinal relative movement between the hook member 34 and the blade 16 (i.e., the diameter of each hole 167 is greater than the diameter of the associated rivet 169 by an amount approximately equal to the desired amount of hook movement). The limited sliding engagement allows the blade 16 to be measured externally from an external surface 161 of the U-shaped hook portion or internally from an internal surface 163 of the U-shaped hook portion 152. In other words, the sliding movement of the hook member 34 allows an accurate measurement to be taken with either surface 161 or 163 in abutting relation with the workpiece; the holding member 34 slides longitudinally with respect to the blade 16 a distance approximately equal to the thickness of the hook portion 152 (where the thickness is measured from surface 161 to surface 163) so that a measurement taken with either surface 161 or 163 in abutting engagement with the workpiece will yield an accurate measurement.

The U-shaped hook portion 152 includes a bight section 160 extending transversely downwardly from a convex side of the free end of the blade 16 and spaced leg sections 162 extending beyond transversely spaced corners 171 of the free end of the blade. The bight section 160 of the hook portion 152 of the hook member 34 provides an under-catch structure that can hookingly engage a workpiece to facilitate extension of the blade 16 and to temporarily secure the blade to the workpiece while a measurement is being taken. As can be appreciated from FIG. 11, the leg sections 162 extend beyond the longitudinally extending edges of the blade 16 to provide a side catch surface on each side of the blade that 16 can be used to hook the blade to an object or workpiece. The side catch structure provided by the legs 162 can function to secure the free end of the blade 16 during a measurement. The side catch structure provided by the leg sections 162 also allow the blade 16 to be easily and steadily held in a tilted position relative to a surface of the workpiece, thereby allowing a longitudinally extending edge of the blade 16 to be held against the workpiece. More specifically, when the convex side of the blade 16 is against the workpiece, the longitudinal edges are normally spaced from the surface because of the concavo-convex cross-section of the blade 16. The legs 162 of the hook member 34 provide a side catch that can be hooked over an edge of the workpiece to allow the user to hold steadily a longitudinal edge of the blade very close to or directly against the workpiece when the convex side of the blade 16 is against the workpiece, which facilitates reading a measurement. This is helpful in taking measurements because the curve height H of the cross section is preferably approximately 0.32 of an inch so that the curve height of the blade is relatively high.

The upper portions of the leg sections 162 extend generally upwardly and outwardly above the concave side of the blade 16 (FIG. 11) to provide structure above the concave surface of the blade 16 to hookingly engage the workpiece to facilitate extension of the blade 16 and to hold the free end of the blade 16 while a measurement is being read. For example, the blade 16 can be placed against a workpiece such that the concave side of the blade 16 is facing the workpiece and such that the opposite longitudinal edges of the blade 16 abut a surface on the workpiece at a point where they measurement is to be read. When the blade 16 is in this position, the upwardly extending portions of the legs 162 on the hook member 34 can be used to hold the free end 20 of the blade 16 against the workpiece.

It can also be appreciated from FIGS. 1-2 that the hook-shaped portion 152 of the hook member 34 provides an aesthetically pleasing "face" appearance on the front of the rule assembly 10 when the blade 16 is in the fully retracted position. Transversely spaced corners 171 on the free end 20 of the blade 16 are mitered (FIG. 4) inwardly from opposite longitudinal edges of the blade 16; the leg sections 162 of the hook member 34 extend beyond the mitered corners 171 on the opposite edges of the end 20 of the blade 16. The mitered corners 171 prevent the user from being scratched or cut by the corners on the end of blade 16. Preferably each corner 171 is mitered inwardly from the respective opposite longitudinal edge starting at a distance of approximately 3/32 of an inch from the free end of the blade 16.

Preferably, the housing opening 22 has a height dimension that exceeds the height dimension of the hook member mounting portion 150 and its connection with the free end of the blade 16 by an amount which is at least approximately equal to the amount the hook portion 152 of the hook member 34 extends below a bottom end surface 170 of the housing assembly 12 at the housing opening 22 when the hook member 34 is at the housing opening 22 (FIG. 11). This height of the opening 22 is provided to prevent possible damage to the hook member 34 when the blade 16 is fully retracted and the hook member 34 is impacted (by dropping or the like) in a direction that tends to move the hook member 34 upwardly with respect to the opening 22.

The details of the construction of the housing opening 22 can be appreciated from FIGS. 4 and 11. It can be appreciated that the axially extending fastener 58 in the corner 96 must be spaced upwardly in the housing assembly 12 a sufficient distance to allow the opening 22 to have sufficient height to protect the hook member during impact. The location of this fastener 58 in the corner 96 is restricted by the dimensions of the corner 96. Specifically, the arcuate path followed by the arcuate holding member 126 between its inoperative position and its blade holding position defines the interior extent of the bottom corner 96 of the housing assembly and a lower front wall portion 200 at the front of the housing assembly 12 generally defines the forward extent of the bottom corner 96. Thus, it can be appreciated FIG. 4 that the tape assembly 10 must be constructed so that the holding member 126 and the front wall portion 200 cooperate to allow the fastener 58 to be positioned upwardly relative to the housing assembly

12 sufficiently to allow the housing opening 22 to have the height as aforesaid. The heights of prior art housing openings are generally restricted by the position of a fastener over the housing opening. Prior art housing assembly construction prevented the fastener from being spaced upwardly far enough to provide an opening having a height dimension large enough to protect the hook member from impact damage as aforesaid. The present invention overcomes this problem by constructing the lower front wall portion 200 of the housing assembly so that it is essentially flush with the central portion 204 of the front of the housing assembly. By positioning the lower front wall portion 200 essentially flush with the central front wall portion 204, the associated axially extending fastener 58 can be moved upwardly sufficiently to allow the housing assembly opening 22 to have a height as recited sufficient to protect the hook member in the event of impact. Specifically, the increased housing opening height allows the bottom edge 177 to move upwardly to a position flush with the bottom surface 170 of the housing assembly 12 adjacent the opening 22 before the mounting portion 150 of the hook member 34 impacts any downwardly facing surfaces on the housing assembly 12.

It can be appreciated from FIG. 4 that in the exemplary embodiment of the tape assembly 10, the interior free end 128 of the holding member 126 is disposed generally above the mounting portion 150 of the hook member 34 when the hook member 34 is at the opening 22. The recess 129 is provided in the free end 128 of the holding member 126 so that if the hook member 34 is caused to move upwardly in the opening 22 because of an impact, the free end 128 of the holding member 126 does not prevent upward movement of the hook member 34 in the opening 22 so that the bottom edge 177 can move upwardly to a position flush with exterior housing assembly 12 bottom end surface 170. More particularly, the central recess 129 is of a width to operatively accommodate the width of the hook member mounting portion 150. Therefore when the hook member 34 is forced upwardly in housing opening 22 by an impact, the mounting portion 150 moves upwardly into the recess 129, thereby allowing the bottom edge 177 of the hook member 34 to move upwardly sufficiently so that it is flush with the bottom end surface 170 of the housing assembly adjacent the opening 22. If the recess 129 were not provided, the free end 128 of the holding member 126 could possibly restrict the upward movement of the mounting portion 150 so that an impact on the hook portion 152 of the holding member 34 could bend of the hook member 34 against the holding member 126. The recess 129 precludes the possibility of this type of damage to the hook member 34 by allowing the holding member 34 to move upwardly in the housing assembly opening 22 at least far enough to allow the bottom edge 177 to move flush with the surface 170 at the bottom end of the housing assembly 12.

The opening 22 is constructed to allow the hook member 34 to move upwardly in the opening 22 until the upper edges of the mounting portion 150 impacts structure at the top of the opening 22. More specifically, it can be appreciated from FIGS. 4 and 11 that the lateral edges of the mounting portion 150 adjacent the hook portion 152 provide upwardly facing surfaces 206 which engage one or more downwardly facing surfaces 208 defining the housing opening 22 to limit the upward movement of the hook member 34 within the opening 22. The lateral longitudinally extending edges 210 of the blade 16 extend upwardly and outwardly beyond the upwardly facing surfaces 206 of the hook member mounting portion 150, but the edges 210 do not limit the upward movement of the hook member 34 in the opening 22. This is because when the hook member 34 moves upwardly in the opening 22 during impact, the edges 210 of the blade 16 engage the downwardly facing housing opening surfaces 208 and deflect resiliently outwardly before the mounting portion 150 of the hook member 34 engages of the upwardly facing surfaces 206. In other words, in the exemplary embodiment of the tape assembly 10 shown, the concavo-convex cross sectional curve height of the blade 16 is such that the edges 210 are normally above the upwardly facing surfaces 206 on the mounting structure 150 of the hook member 34.

When the hook member 34 at the opening 20 is moved upwardly with respect to the housing assembly opening 22 by an impact, the edges 210 of the blade 16 impact the upper portion of the opening 22 first, causing the edges 210 of the blade to flex outwardly in opposite directions, slightly flattening the blade 16 to a degree sufficient to allow the mounting portion 150 of the hook member 34 to move toward and into contact with the downwardly facing surfaces 208 at housing opening 22. When the upwardly facing surfaces 206 on a mounting portion abut the downwardly facing surfaces 208 at the opening 22, the hook member 34 reaches the upper limiting position of its upward movement in the housing opening. This upper limiting position is usually not reached, however, because preferably the tape assembly 10 is constructed and arranged such that the bottom edge 177 of the hook member 34 moves upwardly to a position flush with the surface 170 on the bottom of the housing assembly 12 before the upwardly facing surfaces 206 on the hook member 34 impact the downwardly facing surfaces 208 on the housing assembly 12. When the bottom end 177 of the hook member 34 is flush with the bottom end surface 170 of the housing assembly, the hook member 34 is protected with further impact, thereby preventing damage to the hook member 34.

It can be understood that the coiled blade 16 has a tendency to unwind and return to a straight (in the longitudinal direction), extended configuration of concavo-convex cross-section. This tendency provides a downward force on the free end 20 of the fully retracted blade 16 with respect to the housing assembly opening 22 that maintains the extended portion of the fully retracted blade 16 against the bottom of the housing assembly interior at the opening 22 and thereby normally maintains a portion of the hook member 34 of the fully retracted blade 16 below the bottom surface 170 of the exterior of the housing assembly 12. This allows the tape assembly user to easily hook the hook member 34 on a structure such as a workpiece because a portion of the hook member 34 is normally below the surface 170.

One skilled in the art will understand that the embodiment of the tape rule assembly 10 shown in the figures and described above is exemplary only and not intended to be limiting. It is within the scope of the invention to provide any known tape rule assembly with any or all of the features of the present invention. For example, the clear film of plastic material can be applied to any known tape rule assembly. Similarly, an end hook member constructed according to the principles of the present invention can be applied to any known rule assembly.

The features of the housing assembly including the molded plastic construction, the shape of the housing, the use of relatively few bolts, the elimination of bolts in the upper portion of the housing assembly, the manner in which the spindle is mounted therein, the height dimension of the housing assembly opening relative to the dimension of the downwardly extending portion of the hook member on the free end of the blade and construction of the finger engaging portion on the bottom surface of housing assembly can be used separately or in combination on any existing tape rule assembly.

Similarly, the geometry of the cross-section of the blade and the general teachings of the dimensions and construction of the blade and coil spring can be used on any existing tape rule assembly.

The construction of the fitment, including the construction of the tangentially extending transversely spaced elongated ridges thereof can be used on any known tape rule assembly. It can also be understood that even though it is preferable to construct the tape rule assembly having the ridges on a separate fitment, it is contemplated to provide an embodiment of the tape rule assembly in which the ridges are formed integrally on the housing members of the housing assembly. It can also be appreciated that it is contemplated to use any of the aforementioned features singly or in any appropriate combination on a tape rule assembly that has a spring-powered retractable blade or, alternatively, on any tape rule assembly in which the blade is manually retracted.

It can be appreciated by one skilled in the art that it is within the scope of the present invention to apply the teachings presented herein to construct a tape measure of a wide range of sizes and that it is not intended to limit the invention to the embodiments or to the specific measurements or ranges of measurements presented herein. It can be understood, for example, that it is within the scope of the invention to construct a retractable tape measure assembly that includes a one inch wide (i.e., flattened width) tape blade with increased standout. Because it is contemplated to provide tape measure assemblies with the features of the invention enumerated herein separately or in any combination, it can be understood that a wide range of tape measure assemblies having one inch wide blades could be constructed. More specifically, a tape measure assembly having one inch wide blade could include for example, a cross-section blade geometry; a small footprint housing; a hook member; a protective film; a housing opening height and hook member size; and/or a fitment with transversely extending ribs all as described above in any combination.

It will thus be seen that the objects of the present invention have been fully and effectively accomplished. It will be realized, however, that the foregoing specific embodiments have been shown and described for the purposes of illustrating the functional and structural principles of the present invention and is subject to change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

WHAT IS CLAIMED IS:

1. A retractable rule assembly comprising

a housing assembly;

a reel rotatably mounted in said housing assembly;

an elongated blade formed of a ribbon of metal having one end connected to said reel, said blade extendable from a position tangential to said reel outwardly through a spaced opening in said housing assembly, said elongated blade housing a concavo-convex configuration when extended from said housing assembly, said elongated blade having measuring indicia formed on the concave side thereof, and a clear, protective coating provided on both said concave and convex side of said blade throughout the length of the blade for inhibiting wear of said measuring indicia;

a coil spring formed of a ribbon of metal constructed to rotate said reel in said housing assembly in a direction to wind up the elongated blade when extending outwardly of said housing assembly opening in said concavo-convex cross-sectional configuration onto said reel in an abutting volute coil formation in a flattened cross-sectional configuration; and

a blade holding assembly constructed to hold the blade in any position of extension outwardly of said housing assembly opening and to release the blade from any position in which it is held;

a relatively short free end portion of said blade having a film of plastic material overlying said protective coating on at least one of the convex and concave side of the blade, said film of plastic material having a thickness greater than a thickness of said protective coating.

2. A retractable rule as defined in claim 1, wherein said film is comprised of a material selected from a group consisting of polyurethane, Mylar and Nylon.

3. A retractable rule as defined in claim 2, wherein said film selected from said group is secured to said plastic coating with an acrylic adhesive.

4. A retractable rule as defined in claim 3, wherein said film extends from the free end of the blade to approximately the point where the blade is in said abutting volute configuration when said blade is fully retracted.

5. A retractable rule as defined in claim 3, wherein the length of the portion of the blade covered by said film is approximately 12 inches or less.

6. A retractable rule as defined in claim 5, wherein said film has a thickness dimension within a range of 0.006" to 0.014".

7. A retractable rule as defined in claim 6, wherein said retractable rule further comprises an end hook member formed of sheet metal of a predetermined thickness to include a concavo-convex mounting portion and a U-shaped hook portion that is bent at a generally right angle from an end of said mounting portion, and

said end hook member being mounted on the free end of said blade with the mounting portion of said hook member being secured for limited movement with respect to the free end of the blade so that said rule can be measured externally from an exterior surface of said U-shaped hook portion or internally from an interior surface of said U-shaped hook portion.

8. A retractable rule as defined in claim 3, wherein said film has a thickness dimension within a range of 0.006" to 0.014".

9. A retractable rule as defined in claim 8, wherein said retractable rule further comprises an end hook member formed of sheet metal of a predetermined thickness to include a concavo-convex mounting portion and a U-shaped hook portion that is bent at a generally right angle from an end of said mounting portion,

said end hook member being mounted on the free end of said blade with the mounting portion of said hook member being secured for limited movement with respect to the free end of the blade so that said rule can be measured externally from an exterior surface of said U-shaped hook portion or internally from an interior surface of said U-shaped hook portion, and

wherein said film is adhered to said convex side of said blade from the free end thereof a length that is within a range of from approximately 2" to approximately 12".

10. A retractable rule as defined in claim 8, wherein said housing opening has a height dimension which exceeds the height dimension of said hook member mounting portion and its connection with the free end of said blade an amount which is at least approximately equal to the amount said hook portion extends below said bottom end surface of said housing assembly when at said housing opening.

11. A retractable rule as defined in claim 10, wherein the lateral edges of said mounting portion adjacent said hook portion provide upwardly facing surfaces which engage one or more downwardly facing surfaces defining the housing opening to limit the upward movement of said hook member within said opening.

12. A retractable rule as defined in claim 11, wherein the lateral edges of said blade extend outwardly and upwardly beyond the upwardly facing surfaces of said hook member mounting portion which engage said downwardly facing housing opening surfaces and deflect outwardly prior to

the engagement of the upwardly facing surfaces of said mounting portion, said locking member including a blade engaging and locking free end portion, said locking free end portion including a central recess of a width to operatively accommodate the width of said hook member mounting portion.

13. A retractable rule as defined in claim 1, wherein the film of plastic material has measuring indicia formed thereon.

14. A retractable rule as defined in claim 1, wherein the film of plastic material comprises a plurality of layers of plastic material.

15. A retractable rule as defined in claim 1, wherein the film of plastic material comprises at least one reinforcing member.

16. A retractable rule as defined in claim 15, wherein the reinforcing member is a fiber.

17. A retractable rule as defined in claim 1, wherein the film of plastic material extends across a width of the blade ranging from about 25% to about 100% of the blade width.

18. A retractable rule as defined in claim 17, wherein the film of plastic material extends across 100% of the blade width.

19. A retractable rule according to claim 1, wherein said protective coating comprises a plastic material having a thickness dimension less than about .0035".

20. A retractable rule according to claim 1, wherein said indicia is provided by a layer of paint between said blade and said protective coating, said layer of paint having a thickness of between .0006" - .0014".

21. A retractable rule according to claim 20, wherein said protective coating is formed from a material selected from the group consisting of: polyamides, polyvinyl, polyesters, silicone, polyimides, polyethylene, fluoropolymers and polyethylene terephthalate.

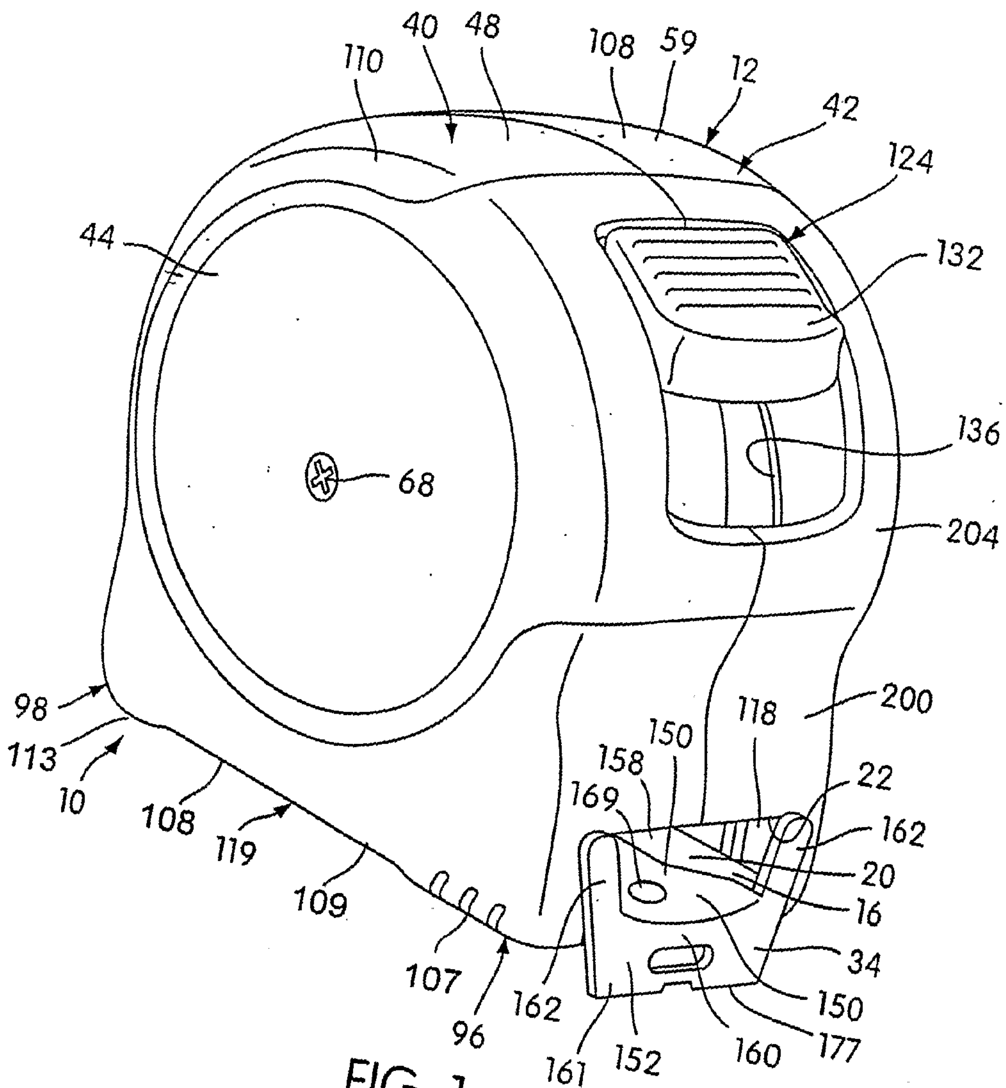
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FIG. 1

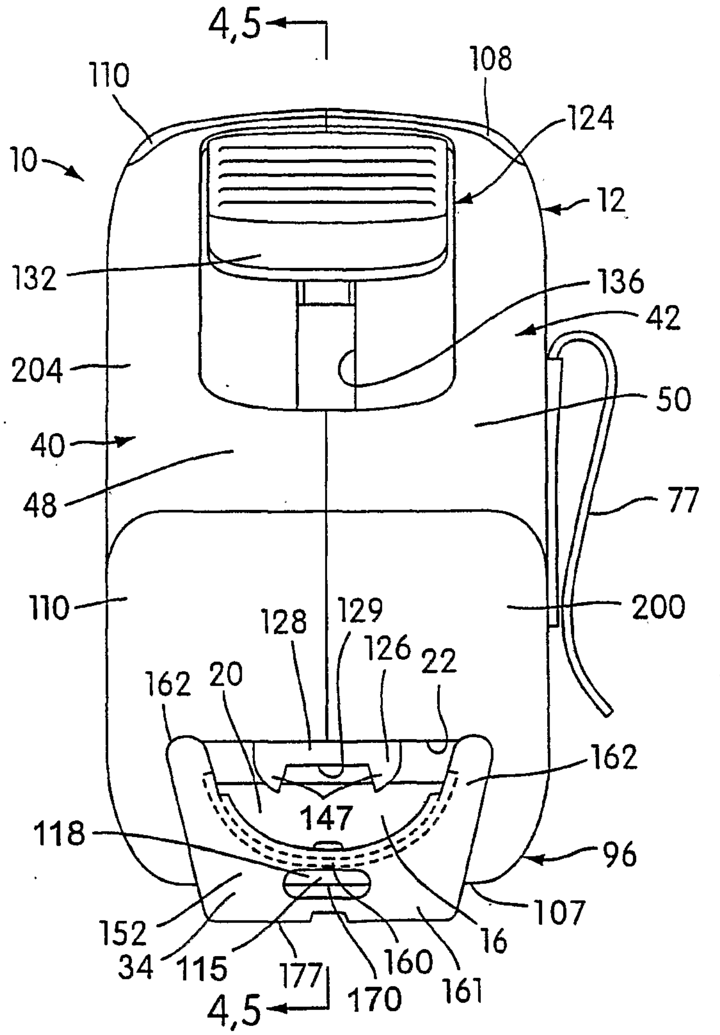
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FIG. 2

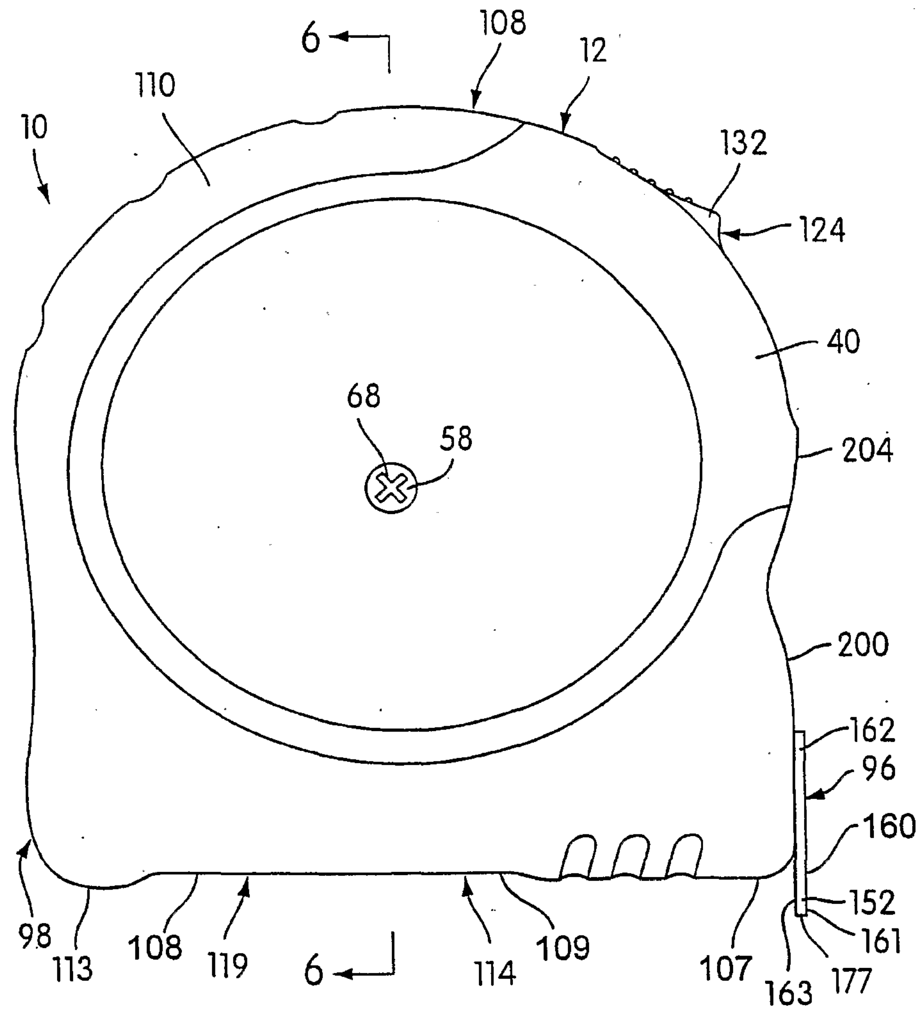
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FIG. 3

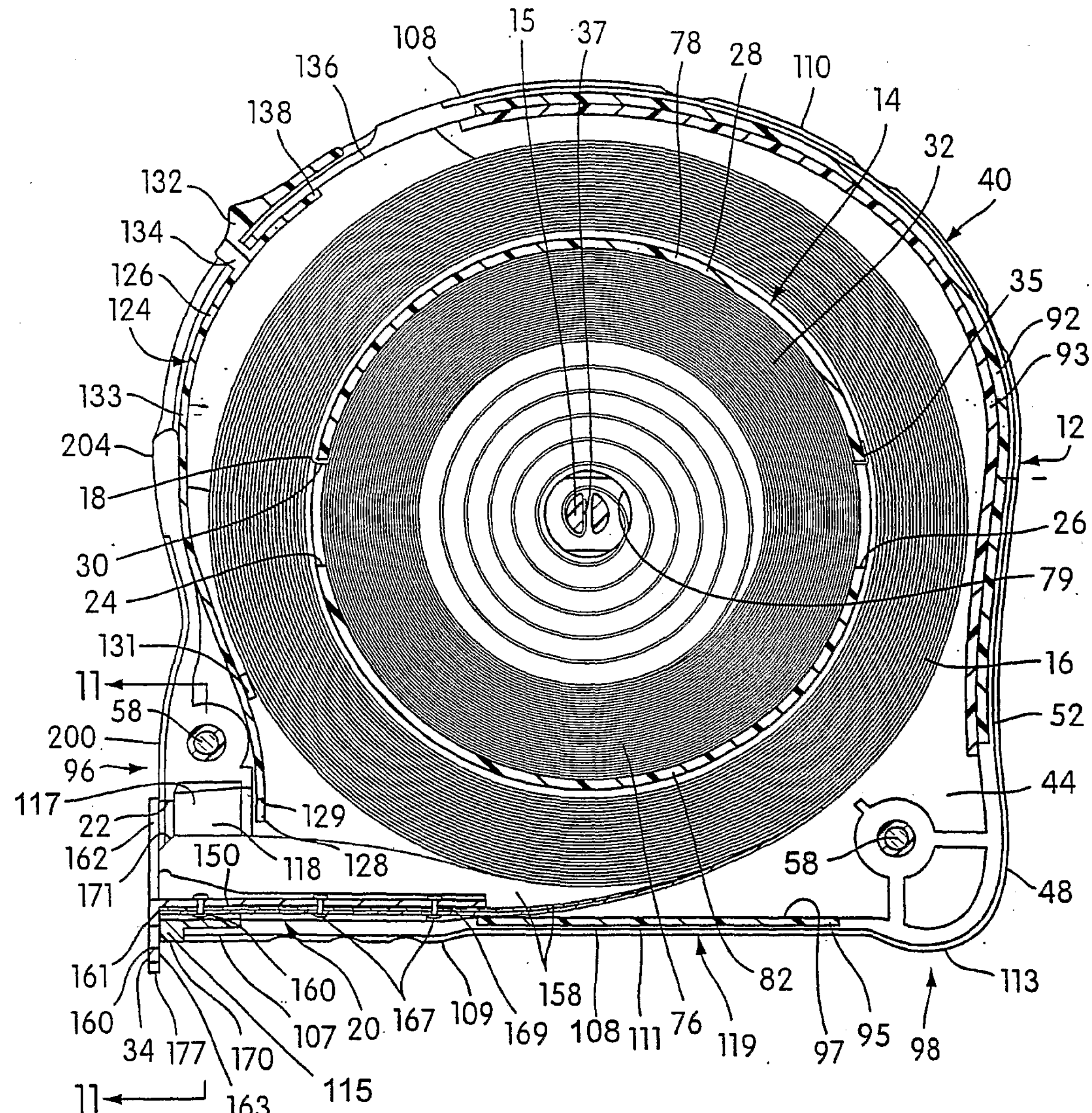
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FIG. 4

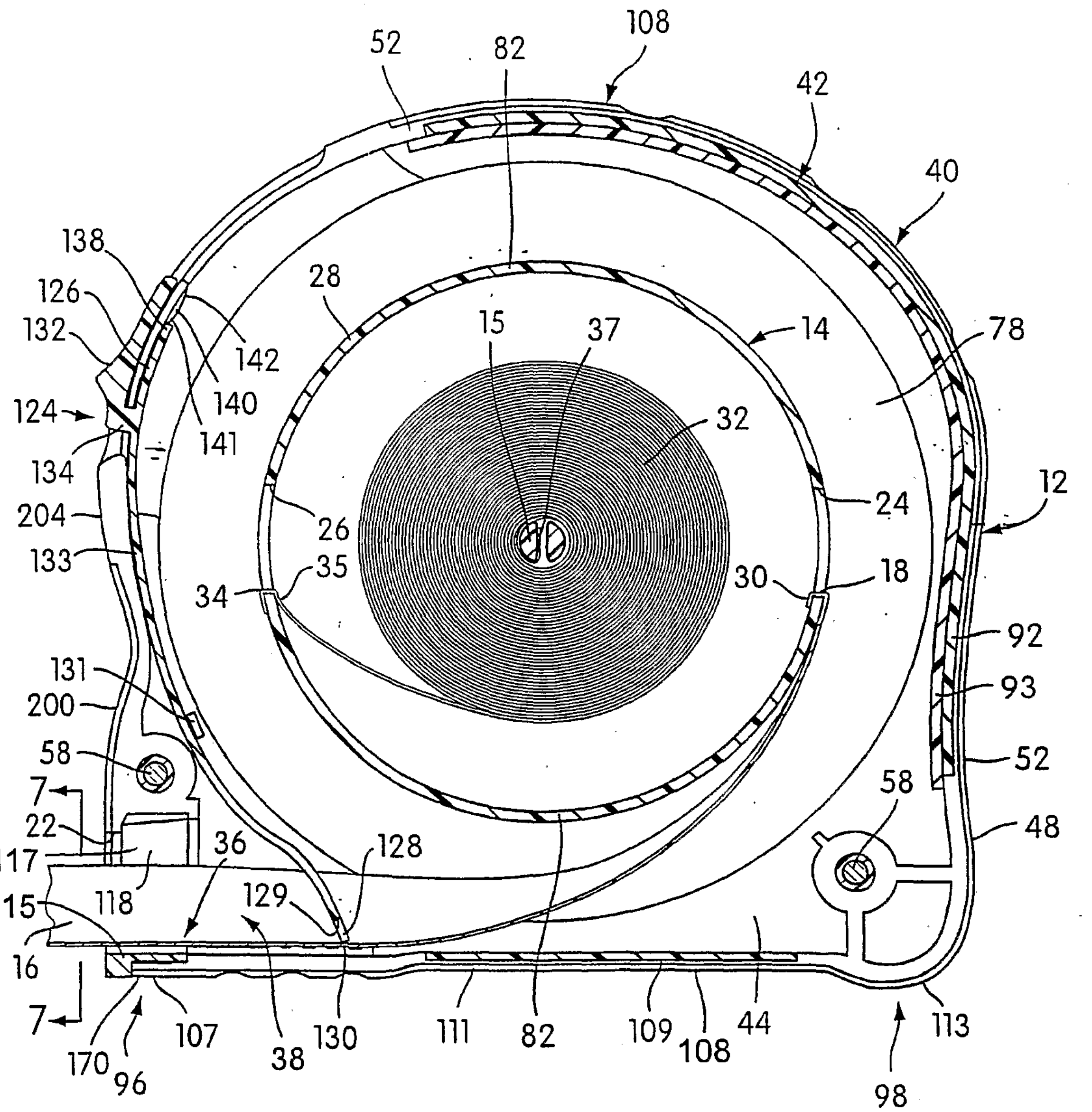
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FIG. 5

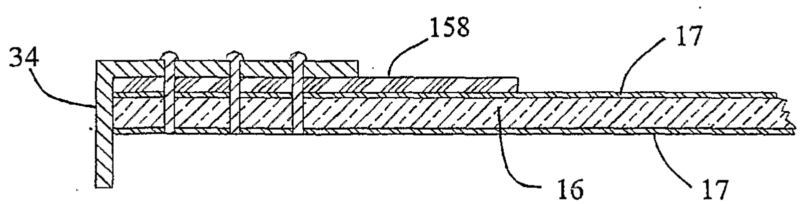

FIG. 5a

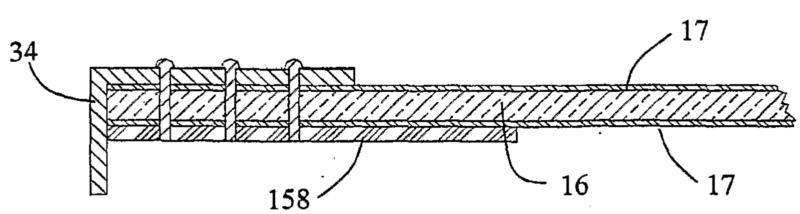

FIG. 5b

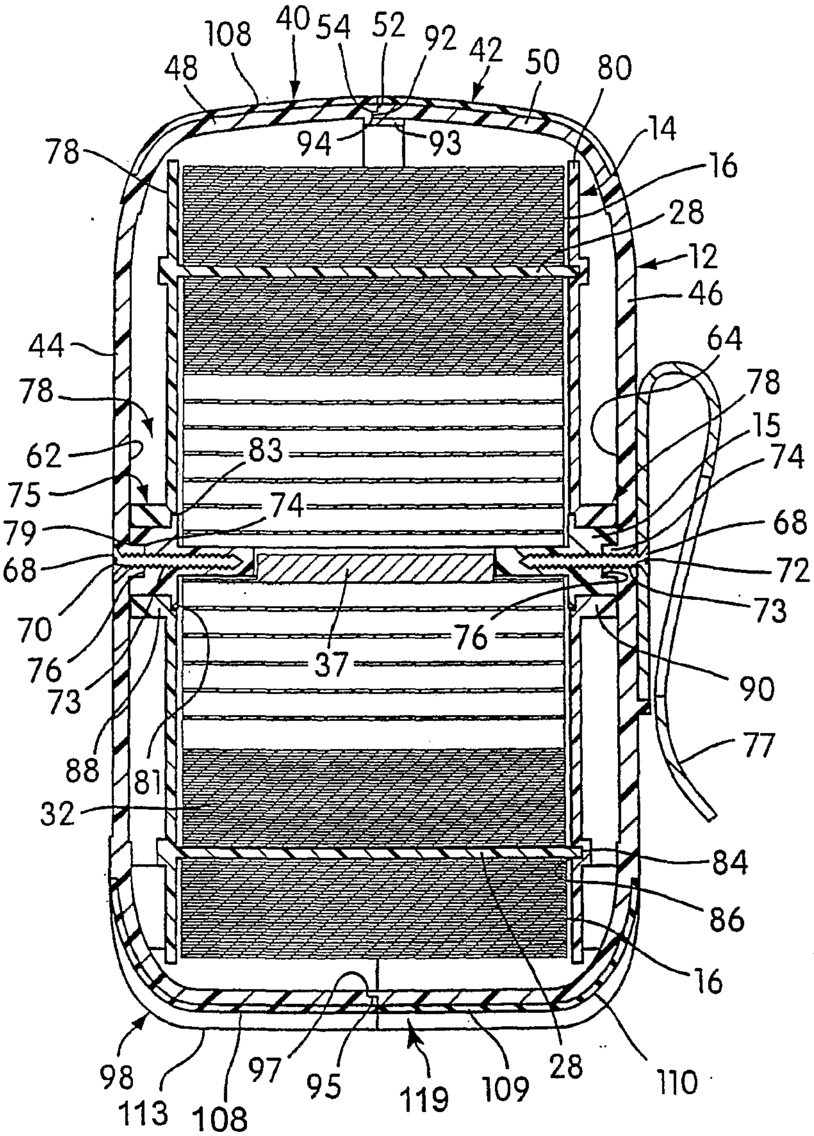
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FIG. 6

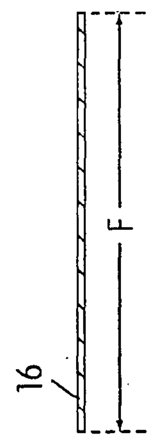

FIG. 8

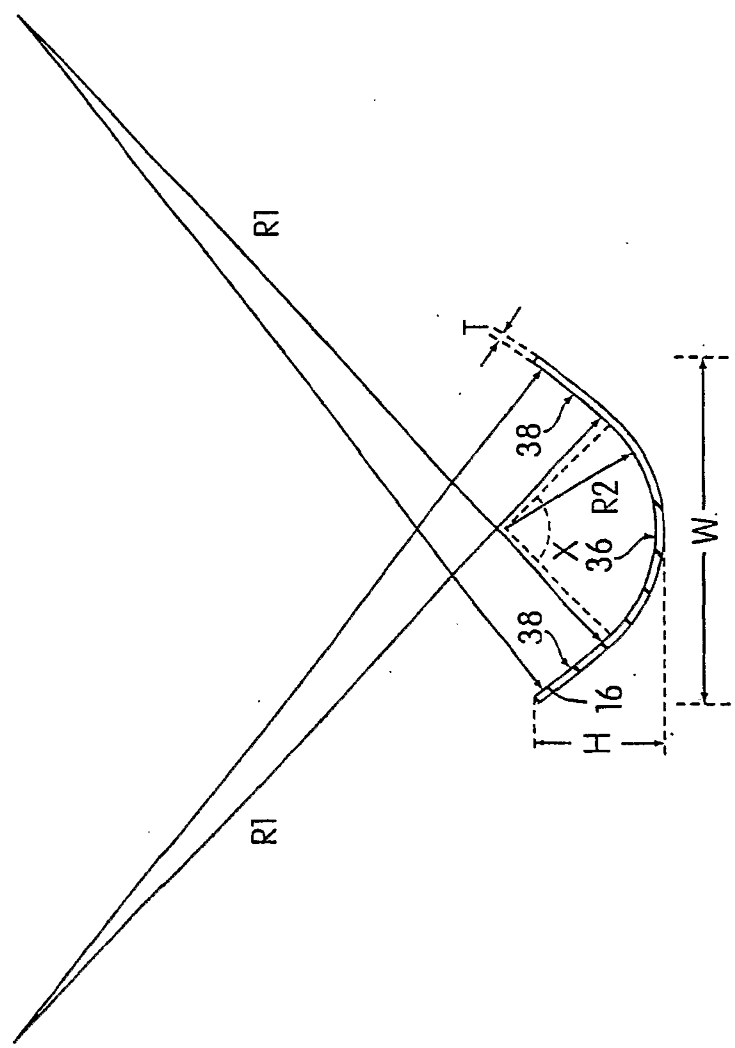

FIG. 7

	*BLADE / SPRING WIDTH (IN)	*BLADE / SPRING THICKNESS (IN)	"ARCUATE" LENGTH-OUT "C" (IN / FT) (RANGE +/- 6 (IN))	***LINEAR LENGTH-OUT "B" (IN) (RANGE +/- 3%)	TAPE RULE REQUIRED HEIGHT TO ACHIEVE FULL BLADE EXTENSION "A" (IN) (RANGE +/- 3%)	PERCENT LINEAR TO ARCUATE LEGNTH-OUT	**** MAXIMUM TAPE RULE ROTATION ANGLE "D" AT FULL EXTENSION (DEGREES)
PRIOR ART	1.000 / 0.875	0.0045 / 0.0051	84 / 7 FT	79	23	94%	>45
PRIOR ART	1.000 / 0.875	0.0051 / 0.0056	84 / 7 FT	80	22	95%	>45
PRIOR ART	1.000 / 0.875	0.0051 / 0.0056	96 / 8 FT	86	40	90%	>45
PRIOR ART	1.000 / 0.875	0.0056 / 0.0060	84 / 7 FT	81	18	96%	>45
PRIOR ART	1.000 / 0.875	0.0056 / 0.0060	96 / 8 FT	91	31	95%	=/<35
PRIOR ART	1.000 / 0.875	0.0056 / 0.0060	108 / 9 FT	93	53	86%	=/<25
	1.250 / 1.250	0.0051 / 0.0051	84 / 7 FT	83	5	99%	>45
	1.250 / 1.250	0.0051 / 0.0051	96 / 8 FT	95	8	99%	>45
	1.250 / 1.250	0.0051 / 0.0051	108 / 9 FT	107	17	99%	>45
	1.250 / 1.250	0.0051 / 0.0051	120 / 10 FT	119	30	99%	>45
	1.250 / 1.250	0.0051 / 0.0051	132 / 11 FT	129	38	98%	>45

* BLADE WIDTH MEASURED IN FLAT FORM OR ARCUATE PERIMETER OF THE CROSS SECTION
** RAW STEEL THICKNESS WITHOUT COATING(S)
*** ACTUAL UTILITY OF TAPE BLADE STANDOUT
**** ROTATION ANGLE REQUIRED WHEN MEASURING VERTICAL POINTS ABOVE HORIZONTAL PLANE OF BLADE TIP

FIG. 9

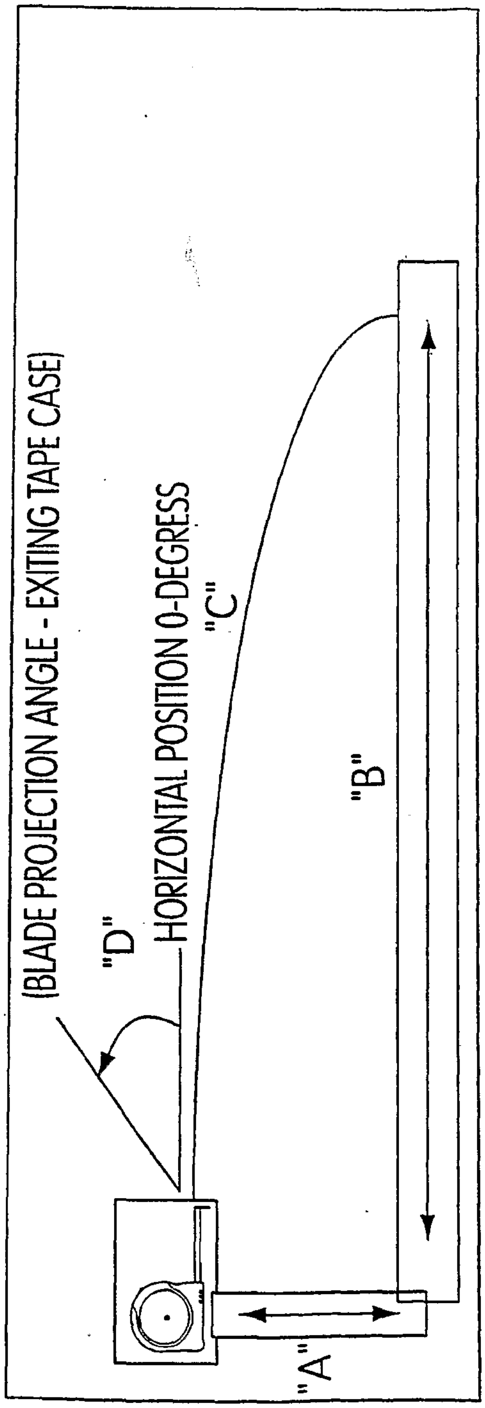
(BLADE PROJECTION ANGLE - EXITING TAPE CASE)
"D"
HORIZONTAL POSITION 0-DEGRESS
"C"
"B"
"A"

FIG. 10

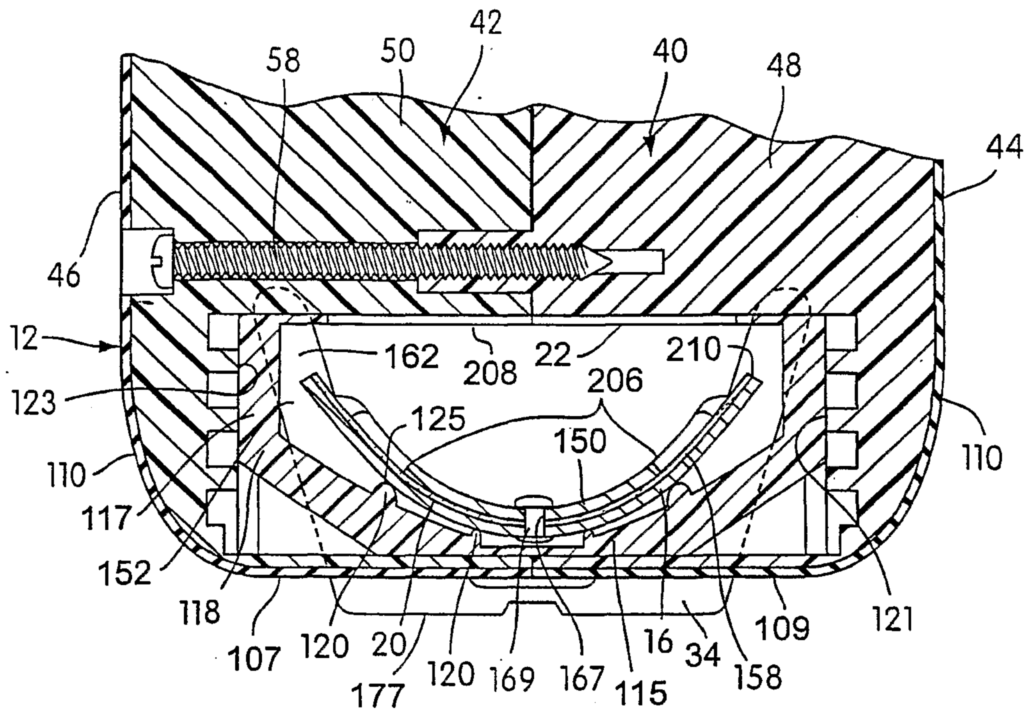
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FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US02/26616

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G01B 3/10

US CL : 33/771

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 33/771,755,757,759,760

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	DE 3621368 A1 (KAUFMANN) 26 June 1986 (26.06.1986), figures 1-7.	1,2,13-21 --- 1-21
X --- Y	US 5,544,420 A (CHOI) 13 August 1996 (13.08.1996), figures 1, 3, 5.	1,2,13-21 --- 1-21
X --- Y	US 4,900,392 A (BRADSHAW et al) 13 Feburary 1990, column 4, lines 27-39.	1,2,13-21 --- 3-6
X --- Y	US 2,994,958 A (BEEBER) 8 August 1961 (08.08.1961), figure 4.	1,2,13-21 --- 1-21

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
20 September 2002 (20.09.2002)	07 NOV 2002
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer Diego Gutierrez Telephone No. (703) 308-0956

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

PCT/US02/26616

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 1,303,756 A (BALLOU) 13 May 1919 (13.05.1919) figure 1.	3-6 --------- 7-12
A	US 3,409,988 A (ZELNICK) 12 November 1968 (12.11.1968).	
A	US 4,429,462 A (RUTTY et al) 7 February 1984 (07.02.1984).	
A	US 4,459,753 A (NAGASAWA et al) 17 July 1984 (17.07.1984).	
A	US 5,581,901 A (TAKAHASHI) 10 December 1996 (10.12.1996).	
A	US 5,738,743 A (LEE) 14 April 1998 (14.04.1998).	
A	US 5,979,238 A (BOEGE et al) 9 November 1999 (11.09.1999).	
A	EP 0100138 A2 (FISHER et al) 08 Febuary 1984 (02.08.1984).	
A	DE 3621368 A1 (KAUFMANN et al) 14 January 1988 (14.01.1988).	
A	JP 404054401 A (NAKAI) 21 Febuary 1992 (21.02.1992).	
A	JP404089501 A (KOBAYASHI et al) 23 March 1992 (23.03.1992)	
A	JP357128801 A (NISHIKAWA) 10 August 1982 (10.08.1982).	

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(74) Agents: **NAYLOR, Matthew, J.** et al.; Mewburn Ellis, York House, 23 Kingsway, London, Greater London WC2B 6HP (GB).

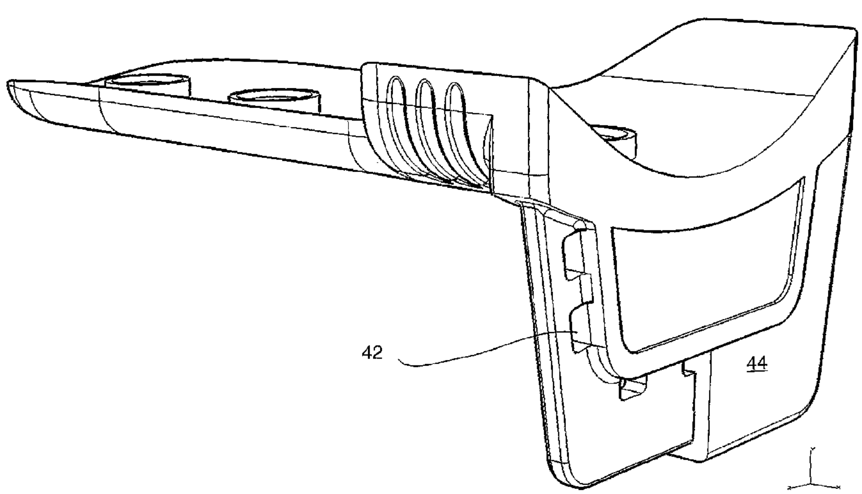
(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) **Title:** MEASURING TAPE AND MEASURING TAPE END PIECE



(57) **Abstract:** A measuring tape end piece (10) is disclosed having a support portion (28) and a grip portion (32). The grip portion is moulded onto the support portion. The support portion provides a keying interface on which the support portion is moulded. The keying interface includes at least one concave formation such as a hole or channel to allow the grip portion to be firmly secured to the support portion.

WO 2004/063659 A1

MEASURING TAPE AND MEASURING TAPE END PIECE

The present invention relates to an end piece for a measuring tape.

Measuring tapes are known which are in the form of a measuring blade which is spoolable within a casing. The measuring blade can be extended from the casing by drawing its free end from an opening in the casing. The blade is usually metallic with measurement graduations printed on one surface. Typically, when extended from the casing, the blade is transversely curved. This provides some longitudinal stiffness to the blade, enabling a relatively long section of blade to be extended from the casing without other support. Usually, a spring within the casing urges the blade from its extended configuration back towards the spooled configuration.

The free end of the blade is provided with an end hook. During use, for example when the measure is being used to measure a distance along a surface, the end hook is used to engage an edge or corner of the surface in order to retain the blade in the extended configuration against the urging of the spring. Alternatively, the end hook may be abutted against a surface in order to measure a distance extending away from the surface.

The end hook is usually a projection such as a tongue, extending approximately perpendicularly from the blade. The end hook usually has substantially flat forward and rearward faces lying approximately perpendicularly to the longitudinal direction of the extended blade.

The end hook may form part of an end piece which is longitudinally moveable with respect to the blade, between two stop points. Usually, these stop points are separated by a distance substantially equal to the thickness of the end hook, i.e. the distance between the forward and rearward faces of the end hook. This limited movement of the end piece accounts for the measurement being taken up to the rearward face of the end hook (e.g. when the rearward face is used to engage with an edge or corner) or up to the forward face of the end hook (e.g. when the forward face is used to abut against a surface to be measured from).

A problem with many known measures is the tendency of the end hook to slip, particularly when the rearward face of the end hook is used to retain the free end of the blade at an edge or corner. This tendency is even more pronounced when there is a component of force acting on the end hook urging it to slide with respect to the edge, corner or surface at which the end hook is located.

This problem has been addressed in US-A-5,210,956 by providing an abrasive high friction surface at the rearward face of the end hook. The abrasive is provided on an adhesive-backed film, allowing adhesion to the end hook. A similar solution is proposed in US-A-5,077,911 where the rearward face of the end hook is coated with friction bodies such as sapphire crystals having a grain size of about 0.12 mm.

However, the use of abrasive surfaces brings its own problems. In particular, such abrasives can scratch and damage surfaces which are being measured by the blade. Furthermore, they can wear away to leave little or no grip between the end hook and the surface to be measured.

An alternative solution has been proposed in JP-A-06-147802. In this document, a rubber film is applied to the rearward and/or forward faces of an end hook by an adhesive. However, this has the disadvantage that the rubber film is held with respect to the end hook only by the adhesive which may wear out or which may not withstand repeated use of the measure.

Accordingly, in a general aspect, the present invention provides a moulded grip portion on the end hook.

The inventors have found that a moulded grip portion can have an improved mechanical connection to a support portion of the end hook in comparison, for example, to an adhesive. Furthermore, the moulding can provide a more efficient method of forming the grip on the end hook. Also, the moulding can allow a complex shape to be formed with high tolerance.

Preferably, in one aspect, the present invention provides an end piece for attachment to a free end of a measuring tape, the end piece including an end hook with a support portion formed of a first material and a grip portion formed of a second material, wherein the support portion provides a keying interface on which the grip portion is moulded, thereby securing the grip portion to the support portion.

Additionally or alternatively, the grip portion may be secured to the support portion by a chemical bond. The chemical bond may be provided by selecting or modifying the material of the support portion and/or the grip material to achieve a chemical bond between them.

In a second aspect, the invention provides a measuring tape with a free end and an end piece according to the first aspect attached to the free end.

The keying interface preferably includes at least one (and preferably more) concave formation on the support portion. For example, the keying interface may include a concave step or steps, dent or dents, dimple or dimples, etc. Such a concave formation is preferably located on the rearward side of the support portion, but may alternatively or additionally be located on the forward side of the support portion.

Most preferably, the keying interface includes at least one channel formed in the support portion. The channel may extend from the rearward side to the forward side of the support portion. In particular, the channel may be a hole formed in the support portion. One or more holes are particularly preferred since these allow a connection of second, moulded material to extend from the rearward face to the forward face of the end hook. This connection ensures that either the moulded material or the support portion must tear or fracture in order to break the mechanical connection between the support portion and the grip portion.

Preferably, the support portion includes a plurality of concave formations (e.g. channels or holes) distributed in the support portion. Seven such formations are particularly preferred, since these can provide a suitable mechanical linkage between the support portion and the grip portion.

Additionally or alternatively, the support portion may include a dovetail shape which can cooperate with a corresponding shape in the moulded grip material.

The end hook or the support portion may include one or more surfaces (e.g. one surface on the rearward face and one surface on the forward face) which are not covered by the second material. The grip portion may be formed around such surfaces. At the interface between the surface of the grip portion and the non-covered part of the end hook, the surfaces may be substantially continuous and preferably substantially flat. In this way, the forward and rearward surfaces of the end hook may be substantially flat. This allows more accurate measurement of distances from a surface using the measure.

Preferably, the grip portion is formed so that it embraces the end surface or edge of the support portion. The end surface of the support portion is the surface of the support portion (before moulding of the grip portion) which is disposed furthest from the remainder of the end piece. After moulding of the grip portion, therefore, the surface of the end hook which is disposed furthest from the remainder of the end piece is a surface of the grip portion.

Preferably, the support portion is formed from a relatively rigid material. For example, the support portion may be moulded from a nylon material such as glass reinforced nylon. Preferably, this material is impact modified. Such a material combines suitable properties of rigidity, dimensional stability and toughness. Alternatively, the support portion may be formed from another plastics material such as Ixef or carbon fibre reinforced acetal. Alternatively, the support portion may be formed of a metallic material, such as steel (preferably stainless steel).

Preferably, the grip portion is formed of a relatively resilient material, for example one with a relatively high friction coefficient. Rubber or rubber-like material is suitable. For example, a polyurethane material (TPU) is particularly preferred. Alternatively, a thermoplastic elastomer (TPE) may be used.

An advantage of using the preferred first and second materials is that moulding the second material onto the first tends to give a relatively strong bond at the interface between them, particularly if one or both materials have been chemically modified to increase the bond strength between them.

In a third aspect, the present invention provides a method of forming a measuring tape end piece, e.g. according to the first aspect, the method including the steps of:

providing a support portion of an end hook, the support portion being formed of a first material and having a keying surface; and

moulding a grip portion, formed of a second material, onto the keying surface, thereby to secure the grip portion to the support portion.

The third aspect may include any of the preferred features according to the first or second aspect, for example as steps of forming those preferred features.

Preferably, the support portion is formed in a first moulding step. The grip portion is then formed in a second moulding step. The second moulding step may be performed in an overmould tool. However, preferably, both moulding steps are performed in the same tool, for example sequentially, using a twin shot tool.

In the case where the support portion is not formed by moulding, for example where the support portion is formed of a metallic material such as steel (e.g. stainless steel), the grip portion may be formed by a moulding step, e.g. in an insert moulding operation. The keying interface may be formed in the support portion by any suitable forming process such as forging, stamping, machining etc. This method constitutes a fourth, independent aspect of the invention.

Embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:-

Fig. 1 shows a schematic front perspective view of an end piece according to an embodiment of the invention.

Fig. 2 shows a schematic rear and side perspective view of the end piece shown in Fig. 1.

Fig. 3 shows a similar view to that of Fig. 1, but without the grip portion.

Fig. 4 shows a similar view to that shown in Fig. 2, but without the grip portion.

Fig. 5 shows a front view of the embodiment shown in Fig. 1, but with half of the grip portion cut away.

Fig. 6 shows the end piece of Fig. 5 in a front and side perspective view.

Fig. 7 shows an enlarged view of the end hook part of the end piece of Fig. 6.

Fig. 8 shows a schematic longitudinal sectional view of the end piece shown in Fig. 1, from a front and side perspective.

In the following, similar reference numerals are used for similar features shown in different drawings.

In Figs. 1 and 2, an end piece 10 is shown. This has a longitudinally extending connection portion 12 with a concavely curved upper surface 14 and a convexly curved lower surface 16. Upper surface 14 has generally cylindrical projections 18 with holes extending through the depth of connection portion 12. In use, a measuring blade sits on the surface 14 and is connected to the end piece by rivets or similar connection means through the holes in projections 18.

Connection portions 12 flare out in width at side walls 20. An end hook 22 projects approximately at right angles to connection portion 12 at the forward extremity of the end piece 10. The directions forward and rearward are in relation to the measuring tape to which the end piece is to be attached. The forward direction is the longitudinal direction of the measuring tape in which the printed measurement graduations decrease in magnitude. The rearward direction is the opposite direction, i.e. the direction in which the numbers on the measuring blade increase.

End hook 22 has a forward face 24 and a rearward face 26. The end hook has a support portion 28 which is shown in the drawings as having a slightly depressed region 30, although this is not essential to the operation of the end hook. Mounted on the support portion 28 is a grip portion 32. Grip portion 32 is formed by moulding. It embraces the edge (not shown in Figs. 1 and 2) of supporting portion 28.

The connection portion and support portion are formed integrally by moulding glass reinforced nylon which has been impact modified. The grip portion is nylon bondable thermoplastic elastomer or alternatively the grip portion is TPU or another rubber-like material.

The material of the connection portion and the support portion is glass reinforced nylon which has further been modified so that it preferentially forms a chemical bond with, in this case, TPU. Such materials are known and are generally referred to as TPU-bondable nylons. The same can be said of TPU-bondable ABS (another readily-available plastics material for use for moulding the support portion). In the case where the support portion material is modified so that it bonds well to the grip portion material, the grip portion material should not itself be modified to be bondable to the material of the support portion. Such combinations of materials tend not to bond well together. Therefore, another embodiment uses a standard nylon (glass reinforced) or ABS for the material of the support portion and uses nylon-bondable (or ABS-bondable, as appropriate) TPU material for the grip portion. Such TPU material is known and is readily available. In a further embodiment, the same material is used for the support portion as in any of the above embodiments but nylon-bondable (or ABS-bondable, as appropriate) TPE material is used for the grip portion.

Figs. 3 and 4 show the end piece without the grip portion. This is the shape which is moulded from glass reinforced nylon. These drawings show the whole of the support portion 28, because the grip portion is not shown. The support portion 28 includes a relatively thick central part 34. From the lateral surface (i.e. the surface connecting the forward and rearward faces) of the thick central portion 34 extends a relatively thin tongue 36. Tongue 36 extends in substantially the same direction as the remainder of the end hook, i.e. substantially perpendicular to the connection portion 12. Due to the difference in thickness between tongue portion 36 and thick central portion 34, a concave step 38 is formed between tongue 36 and central portion 34. A complimentary step 40 is formed on the rearward face (shown in Fig. 4).

Holes 42 are formed in tongue portion 36. These extend in the longitudinal direction of the end piece from the forward face to the rearward face of the support portion. In the drawings, three holes 42 are formed in the base part of the tongue portion 36 and two holes 42 are formed in each lateral part of the tongue portion 36, making up seven holes 42 in all. The function of the holes is described in more detail below.

Figs. 5, 6 and 7 show the end piece with part of the grip portion 32 cut away. Grip portion 32 is of similar thickness to thick central part 34 of support portion 28. Surface 44 lies flush and parallel to adjacent surface 34. In this way, the forward and rearward faces of the end hook are made substantially flat.

Grip portion 32 embraces the edge of tongue portion 36. In this way, the lower surface of the end hook is formed from the grip portion. In other words, the grip portion 32 extends further from central part 34 than does tongue portion 36 of the grip portion. Since the grip portion is moulded to lie flush with thick central part 34, concave steps 38 and 40 are filled by the grip portion. This cooperating shape provides a mechanical key which allows the grip portion 34 to be firmly bonded to support portion 28. The grip portion also bonds to surface 36, e.g. by a chemical bond.

Parts of the grip portion also extend through holes 42, as shown well in Figs. 6 and 7. In particular, Fig. 7 shows a mechanical linking portion 46 extending through a hole 42. The grip portion is formed in one piece by moulding. The support portion is also formed in one piece by moulding. Therefore, with mechanical links 46 holding the grip portion with respect to the support portion, the only way in which the grip portion may be mechanically separated from the support portion is by one or both of the support portion and the grip portion fracturing or tearing. This feature, combined with the strong bond between the TPU or thermoplastic elastomer (TPE) of the grip portion and the glass reinforced nylon material (impact modified) of the support portion makes the grip portion particularly difficult to dislodge from the support portion. For this reason, the grip portion is unlikely to break away from the support portion during use of the tape measure.

Fig. 8 shows a schematic longitudinal cross-section of the end piece. This drawing shows the mechanical link 46 extending from the forward to the rearward face of the grip portion. This drawing also shows part of the tongue portion 36 below one of the holes 42. It is clearly shown here that the material of the grip portion 32 surrounds and encapsulates part of support portion 28.

The end piece may be made by injection moulding. In particular, the glass reinforced nylon of the connection portion 12 and support portion 28 may be injected in a tool (not shown) in a first injection step. Subsequently, the TPU or TPE material of the grip portion is injected into the second tool in a second injection step. Accordingly, the end piece is formed via "two shot" moulding.

The preferred embodiments have been described by way of example only. Modifications of these embodiments, further embodiments and modifications thereof will be apparent to those skilled in the art and as such are within the scope of the invention.

CLAIMS

1. An end piece for attachment to a free end of a measuring tape, the end piece including an end hook with a support portion formed of a first material and a grip portion formed of a second material, wherein the support portion provides a keying interface on which the grip portion is moulded, thereby securing the grip portion to the support portion.

2. An end piece according to claim 1 wherein the keying interface includes at least one concave formation on the support portion.

3. An end piece according to claim 2 wherein concave formation includes a concave step or steps, dent or dimple.

4. An end piece according to claim 2 or claim 3 wherein the concave formation is located at least on the rearward side of the support portion.

5. An end piece according to any one of claims 1 to 4 wherein the keying interface includes at least one channel formed in the support portion.

6. An end piece according to claim 5 wherein the channel is a hole extending from the rearward side to the forward side of the support portion.

7. An end piece according to any one of claims 1 to 6 wherein the support portion includes a surface either on the rearward face and or on the forward face of the end hook which are not covered by the second material, the grip portion being disposed adjacent said surface or surfaces.

8. An end piece according to any one of claims 1 to 7 wherein the grip portion is formed so that it embraces the end surface or edge of the support portion.

9. An end piece according to any one of claims 1 to 8 wherein the grip portion is formed of a relatively resilient material (in comparison to the first material).

10. A measuring tape with a free end and an end piece according to any one of claims 1 to 9 attached to the free end.

11. A method of forming a measuring tape end piece, e.g. according to any one of claims 1 to 9, the method including the steps of:

providing a support portion of an end hook, the support portion being formed of a first material and having a keying surface; and

moulding a grip portion, formed of a second material, onto the keying surface, thereby to secure the grip portion to the support portion.

12. A method according to claim 11 wherein the support portion is formed in a first moulding step and the grip portion is then formed in a second moulding step.

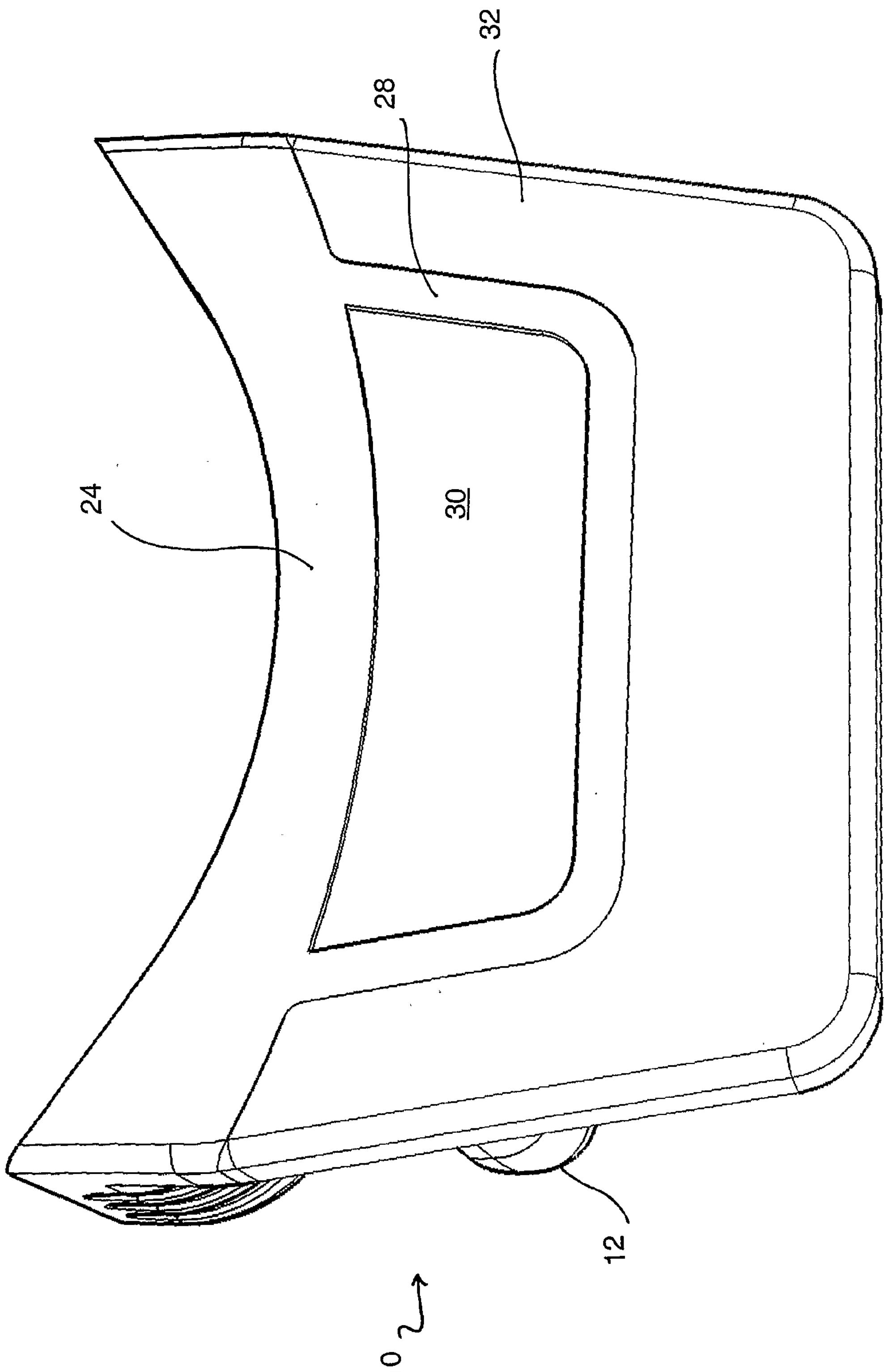


Fig. 1

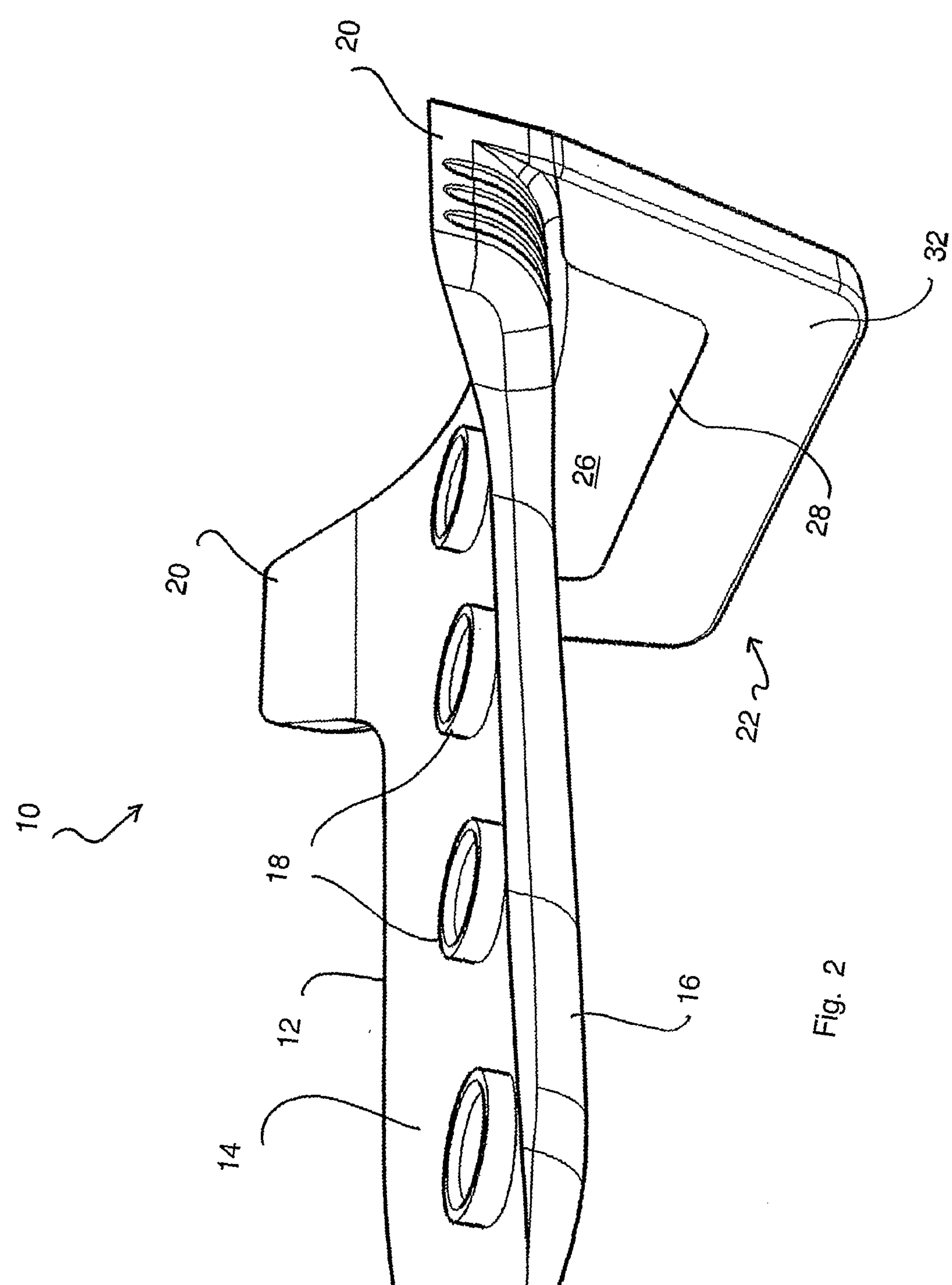


Fig. 2

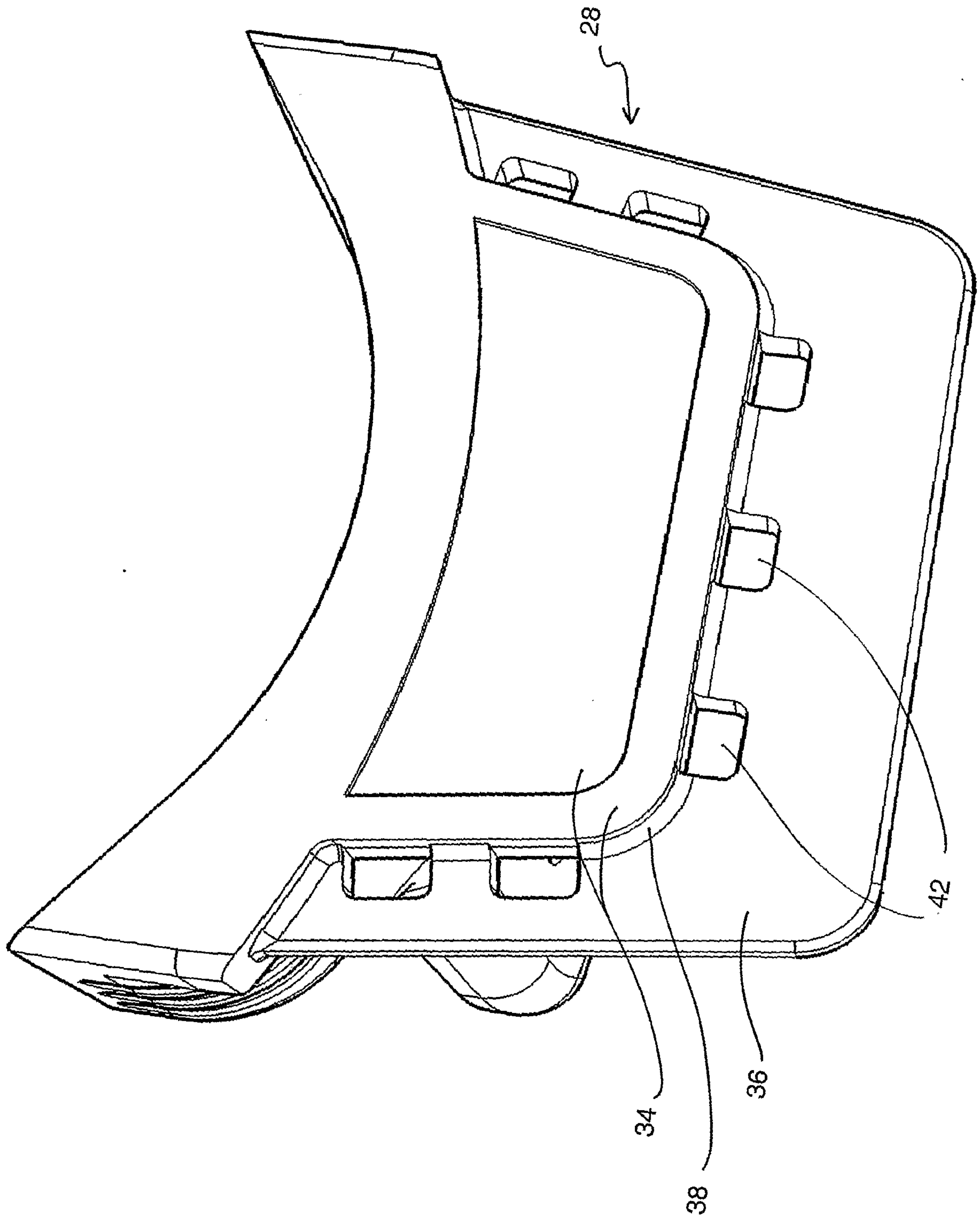


Fig. 3

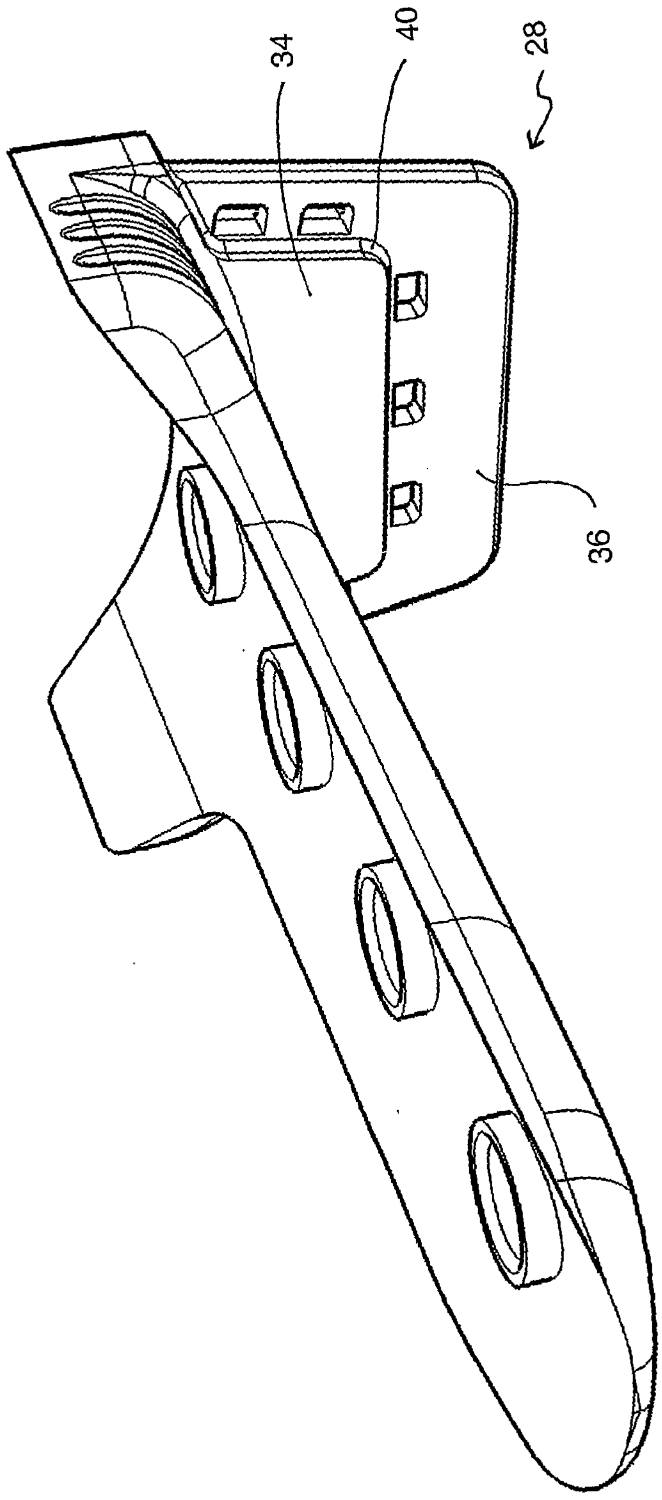


Fig. 4

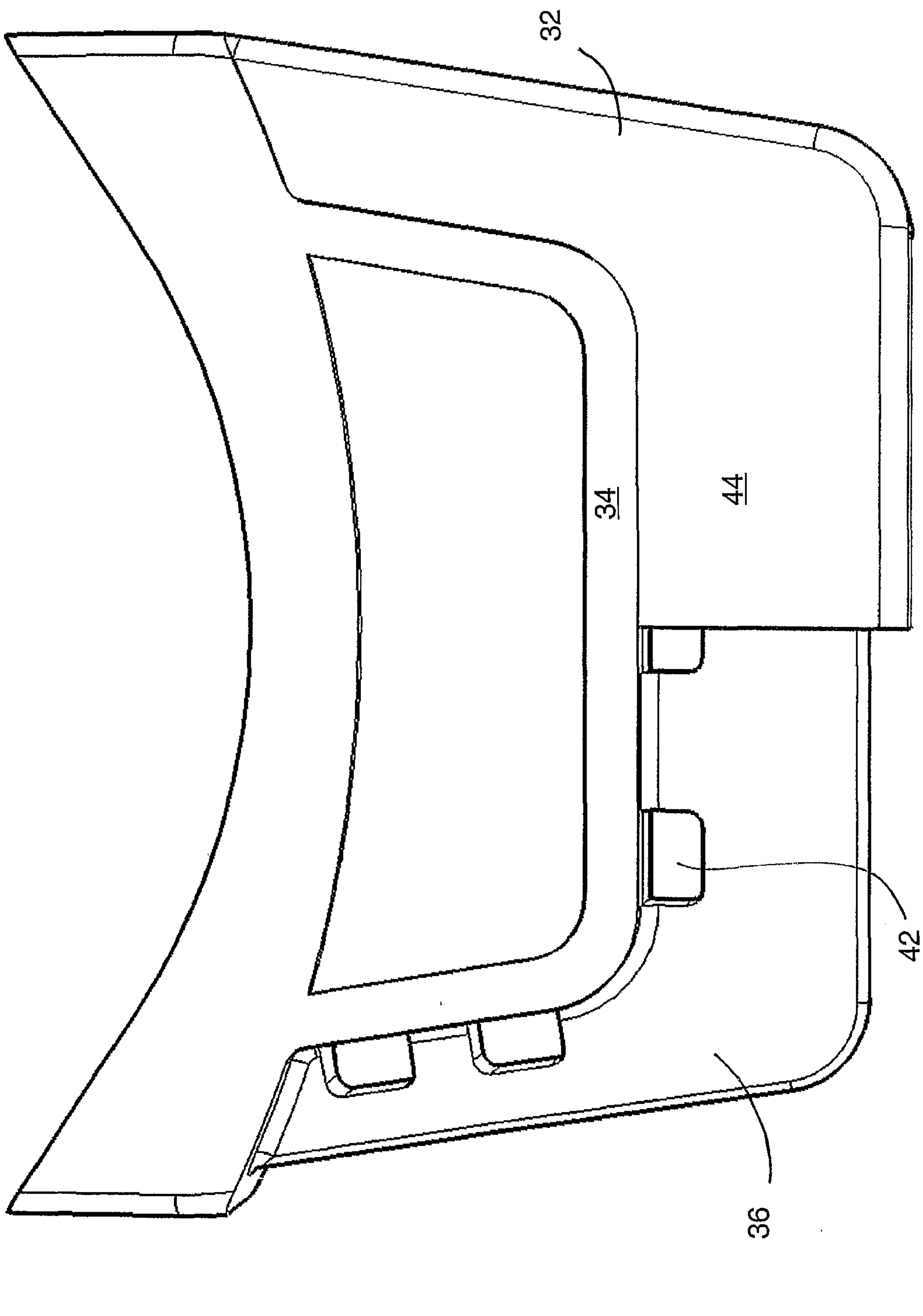


Fig. 5

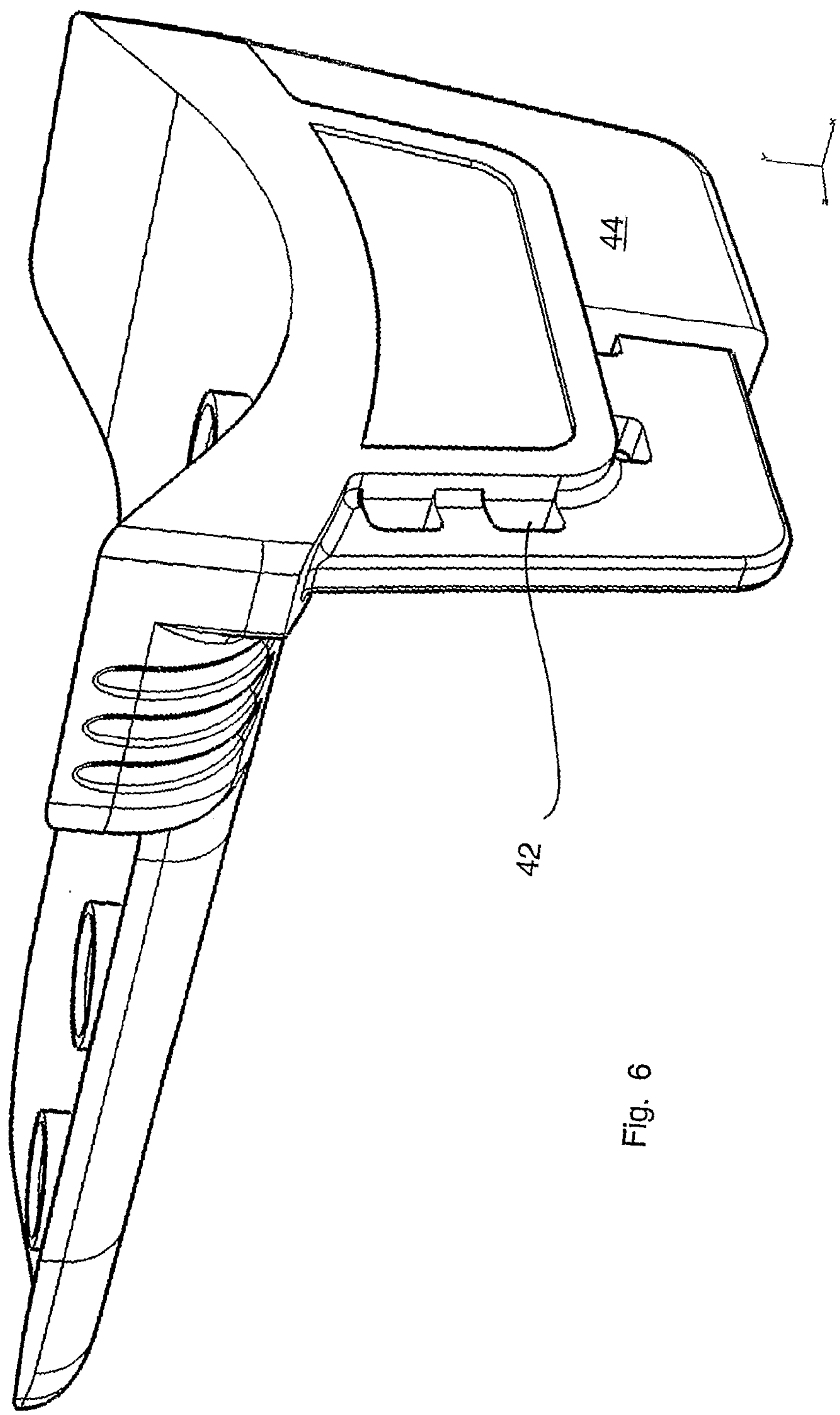


Fig. 6

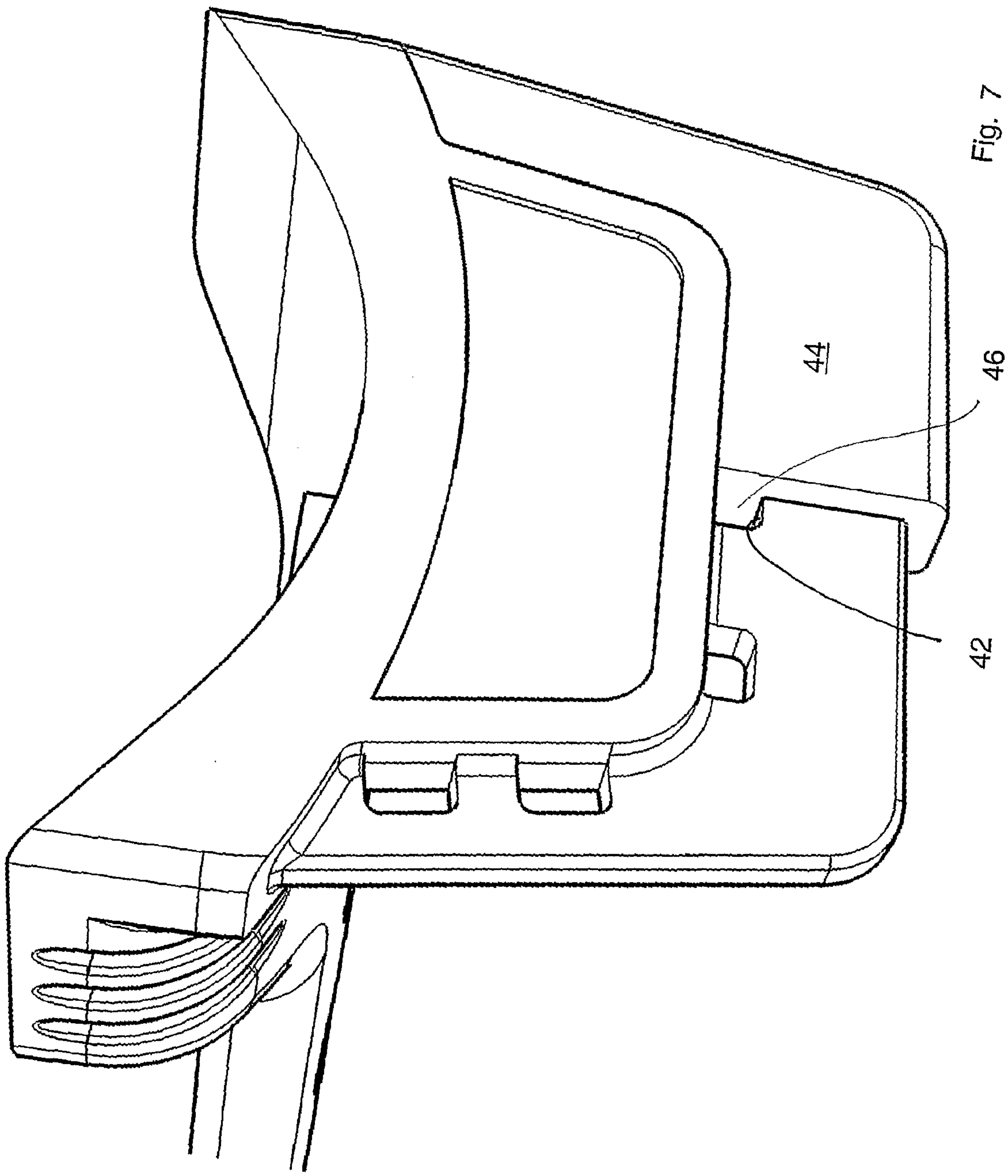


Fig. 7

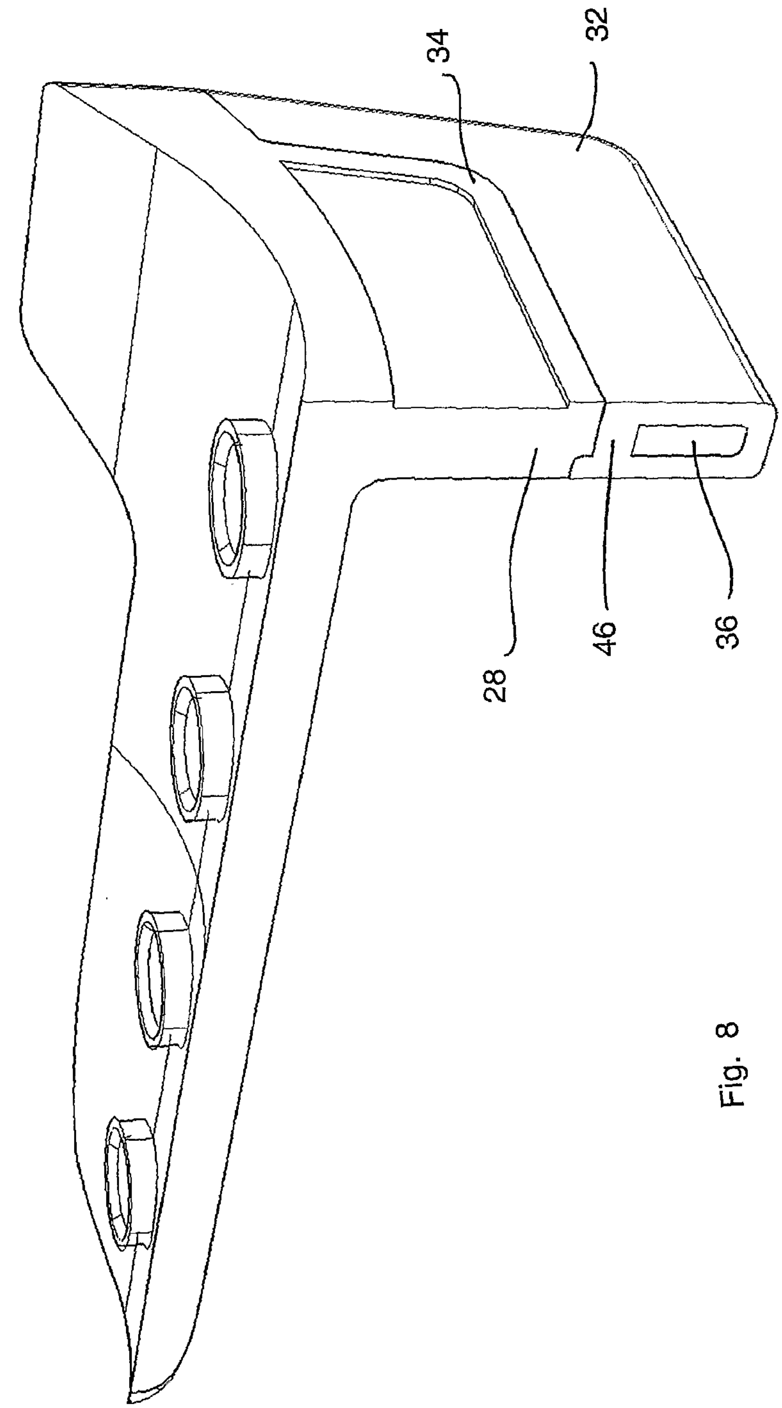


Fig. 8

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GB 03/00113

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 G01B3/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 G01B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 050 737 A (GEN HOUSEWARES CORP) 8 November 2000 (2000-11-08) column 1, line 5,6 column 2, line 2-13 column 2, line 42-47 column 3, line 28-45 column 3, line 52-54 column 7, line 3 -column 8, line 11 figures 10-12	1-7,9-11
A		8,12
A	US 5 077 911 A (VON WEDEMEYER PETER) 7 January 1992 (1992-01-07) column 2, line 45 -column 3, line 4 figures 1,2	1,11

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"A" document defining the general state of the art which is not considered to be of particular relevance

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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
7 July 2003	18/07/2003

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Grand, J-Y

INTERNATIONAL SEARCH REPORT

Internat| Application No
PCT/GB 03/00113

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 402 583 A (KOMURA MANABU) 4 April 1995 (1995-04-04) column 3, line 3 - line 22 figure 3 ---	1,11
A	US 2002/184783 A1 (ENOS JAMES ET AL) 12 December 2002 (2002-12-12) paragraphs '0021!,'0032! figure 1 -----	1,11

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/GB 03/00113

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			WO	0033017	A1	08-06-2000

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Published:
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(54) **Title**: PRINTING ON A FLEXIBLE SUBSTRATE AND SYSTEM FOR THE SAME

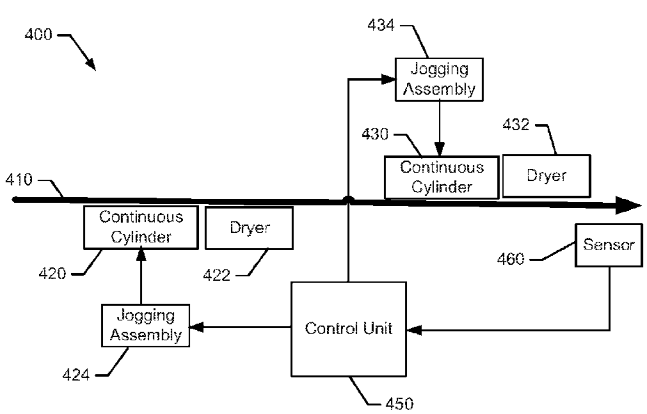


FIG. 4.

(57) Abstract: A printing assembly may include a first continuous cylinder and a first jogging assembly. The first continuous cylinder may be configured to apply print media to a flexible substrate responsive to contact with the flexible substrate. The first continuous cylinder may include a plurality of partitions configured such that only one of the partitions is aligned for contact with the flexible substrate at any given time, and each of the partitions may have a unique print characteristic associated therewith. The first jogging assembly may be operably coupled with the first continuous cylinder to move the first continuous cylinder along an axis thereof to change alignment of the partitions relative to the flexible substrate.

WO 2017/172683 A2

PRINTING ON A FLEXIBLE SUBSTRATE AND SYSTEM FOR THE SAME

CROSS REFERENCE TO RELATED APPLICATIONS

This application claims priority to U.S. 62/315,171 filed March 30, 2016, the entire contents of which are incorporated by reference it its entirety.

TECHNICAL FIELD

Example embodiments generally relate to printing technology, and particularly relate to technology for printing measuring tape and other such products that employ a long flexible substrate.

BACKGROUND

Measuring tapes are typically printed using a conventional flexographic printing process. This type of printing process is also used to print on other flexible substrates like bread bags, product wrappers, and the like. In flexographic printing, the image is created by applying ink directly to a flexible printing plate, which is then brought into contact with stock to transfer the ink. The printing plate is a multi-layered, light sensitive flat (but flexible) sheet that is "exposed" and "developed" to create the printing plate. The printing plate is wrapped around a cylinder (or belt) for printing

When placed on a press, an anilox roller transfers ink from an ink pan to the raised areas of the printing plate. An impression cylinder creates a light pressure between the substrate and the plate to allow the ink to transfer to the stock. The largest commercially available print plate is 50 by 80 inches. Thus, to print a 25 ft tape, four plates are needed, and three joins exist between the four plates. For metric tapes at 8 m, five plates with four joins placed every 2010 mm would be required.

As can be appreciated from the description above, relative to printing on longer flexible substrates such as measuring tapes, the length of the printing plate available has been the limiting factor. Moreover, the joins between the plates create gaps in the print. Traditionally, the joins are hidden in a non-print area between gradation marks. This means that it is impossible to print a solid color on a tape measure. Thus, traditional measuring tapes are surface painted (or powder coated) in a light color (e.g., yellow or white) that covers the entire surface of the measuring tape. Then, dark (typically black) gradations are printed on the measuring tape, and another dark color (typically red) is used to print the numbers.

Accordingly, it may be desirable to continue to develop improved mechanisms by which to implement printing on flexible substrates so that the problem of design and length limitation due to the need to hide joins can be overcome.

BRIEF SUMMARY OF SOME EXAMPLES

Some example embodiments may enable the provision of a device that allows printing without creating the need to hide joins, as described above. In this regard, some example embodiments may provide for the use of a continuous multilayered cylinder without joins in the printing process. Thus, a continuous repeating pattern can be provided to allow, for example, printing light numbers and gradations on a dark base layer.

In an example embodiment, a printing assembly is provided. The printing assembly may include a first continuous cylinder and a first jogging assembly. The first continuous cylinder may be configured to apply print media to a flexible substrate responsive to contact with the flexible substrate. The first continuous cylinder may include a plurality of partitions configured such that only one of the partitions is aligned for contact with the flexible substrate at any given time, and each of the partitions may have a unique print characteristic associated therewith. The first jogging assembly may be operably coupled with the first continuous cylinder to move the first continuous cylinder along an axis thereof to change alignment of the partitions relative to the flexible substrate.

In another example embodiment, a method of printing on a flexible substrate is provided. The method may include moving a flexible substrate proximate to a continuous cylinder and applying print media to the flexible substrate responsive to contact between the continuous cylinder and the flexible substrate. The continuous cylinder may include a plurality of partitions configured such that only one of the partitions is aligned for contact with the flexible substrate at any given time, and each of the partitions has a unique print characteristic associated therewith. The method may further include determining when a first partition of the continuous cylinder has fully applied print media to the flexible substrate, and moving the continuous cylinder along an axis thereof to align a second partition of the continuous cylinder with the flexible substrate.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

Having thus described some example embodiments in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

FIG. 1 illustrates a cross section of materials used to form such a cylinder in accordance with an example embodiment;

FIG. 2 illustrates a perspective view of the cylinder and corresponding partitions provided thereon according to an example embodiment;

FIG. 3 illustrates a conceptual diagram showing various components of a system for printing in accordance with an example embodiment;

FIG. 4 is a block diagram of a system for printing in accordance with an example embodiment; and

FIG. 5 illustrates a method of printing on a flexible substrate in accordance with an example embodiment.

DETAILED DESCRIPTION

Some example embodiments now will be described more fully hereinafter with reference to the accompanying drawings, in which some, but not all example embodiments are shown. Indeed, the examples described and pictured herein should not be construed as being limiting as to the scope, applicability or configuration of the present disclosure. Rather, these example embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like reference numerals refer to like elements throughout. Furthermore, as used herein, the term "or" is to be interpreted as a logical operator that results in true whenever one or more of its operands are true. As used herein, operable coupling should be understood to relate to direct or indirect connection that, in either case, enables functional interconnection of components that are operably coupled to each other.

As indicated above, some example embodiments may relate to the provision of a device that allows printing without creating the need to hide joins so that, for example, printing light numbers and gradations on a dark base layer becomes possible. This is accomplished by employing a continuous multilayered cylinder without joins. FIG. 1 illustrates a cross section of materials used to form such a cylinder in accordance with an example embodiment.

As shown in FIG. 1, a cylinder 100 (see FIG. 2) of an example embodiment may include a base layer 110, which may be a polyester film or a metallic material in some cases. An adhesive and anti-halation layer 112 may bind the base layer 110 to a photosensitive polymer layer 114. A laser ablation layer 116 may be provided on the photosensitive polymer layer 114. In some cases, a protective cover film 118 (e.g., a polyester film) may be provided on top of the laser ablation layer 116.

Laser ablation is a process of removing material from a solid (or occasionally liquid) surface by irradiating the material with a laser beam. At low laser flux, the material is heated by the absorbed energy from the laser, and the material evaporates or sublimates. Of note, in some cases, other processes could be employed instead of laser ablation. For example, laser engraving or chemical etching may be employed to replace the laser ablation layer with a corresponding layer dependent upon the removal process employed. However, laser ablation may be preferred for some applications. When laser ablation is employed, an image can be lasered onto the surface of the cylinder 100. The cylinder 100 is created as a continuous cylinder sleeve with no joins. Thus, the cylinder 100 is essentially a solid print cylinder (i.e., having no joins). When printing with such a cylinder, the limitation on printing becomes the capability of the laser ablation process to image the cylinder and the length of the "repeat" on, for example, a tape measure.

On an 8 m measuring tape, the repeat may occur, for example, in increments of 10 cm. On a 25 ft measuring tape, the repeat occurs in 12 inch increments. To overcome the repeat length issue, the cylinder 100 may be partitioned. Thus, for example, the cylinder 100 may be a continuous cylinder with repeat lengths broken down into multiple partitions of a given length (e.g., 1 m, 1 ft, etc.). The cylinder 100 could then be axially moved (e.g., jogged) to use corresponding different partitions at appropriate times to access each respective section (e.g., meter) of print so that a full and unique (e.g., 8 m) length of measuring tape can be created. This concept can be applied to any desirable length of tape, and can be used for metric or imperial tapes.

FIG. 2 illustrates a perspective view of the cylinder 100 and corresponding partitions provided thereon. The partitions include a first partition 210, a second partition, 220, a third partition 230, a fourth partition 240, a fifth partition 250, and a sixth partition 260. However, it should be appreciated that any desirable number of partitions may be employed in various example embodiments. Each of the partitions may have a unique set of numbers (or gradations, or other symbols). Thus, for example, the first partition 210 may be printed with a sequence of numbers (e.g., 0, 10, 20, 30, 40, 50, 60, 70, 80, 90), the second partition 220 may be printed with a different (sequentially incremented) sequence of numbers (e.g., 100, 110, 120, 130, 140, 150, 160, 170, 180, 190), the third partition 230 may be printed with a different (sequentially incremented) sequence of numbers (e.g., 200, 210, 220, 230, 240, 250, 260, 270, 280, 290), etc. This sequence can be repeated for any desired number of partitions. After one partition has been fully printed, a jog or axial movement of the cylinder 100 may be performed in order to align the next partition for printing. After the next partition has been fully printed, another jog occurs and so on until the full sequence of numbers is printed. For a cylinder having a 1 m circumference, the first meter (e.g., 100 cm) of printing can be accomplished before the jog to the second meter (e.g., centimeter gradations 100 to 200) is performed. Then, a jog to the third meter (e.g., centimeter gradations 200 to 300) is performed, and so on for the full length of printing on the corresponding measuring tape.

By using this process, or combination of processes, a unique capability is provided relative to enabling the creation of a continuous solid print design with changing features over the length of the design. Moreover, the partitioning and jogging of the continuous cylinders allows repeat lengths to be printed that are greater than the circumference of the largest available cylinder. As such, there is no theoretical limit to the length that can be printed.

FIG. 3 illustrates a conceptual diagram showing various components of a system for printing in accordance with an example embodiment. Referring to FIG. 3, one or more rolls of a flexible substrate 300 may originate from one or more feed rolls 310. In some cases, the system of FIG. 3 may be configured to process and print on multiple flexible substrates in parallel simultaneously.

As shown in FIG. 3, the flexible substrate 300 (or each instance thereof) may be passed through a series of powered and unpowered rollers to a first print assembly 320. The first print assembly 320 may include one or more continuous cylinders (e.g., print cylinders) of a first set of continuous cylinders 322. The first set of continuous cylinders 322 may be configured to contact (and print on) a first side of the flexible substrate 300, while an impression cylinder 324 contacts the opposite side of the flexible substrate 300. The continuous cylinders may have print medium (e.g., ink) transferred thereon by a media applicator 326 immediately before the continuous cylinders roll to the point where the flexible substrate 300 is pressed between each continuous cylinder of the first set of continuous cylinders 322 and the impression cylinder 324. Thus, at the point where the flexible substrate 300 is pressed between each continuous cylinder of the first set of continuous cylinders 322 and the impression cylinder 324, the print medium is transferred to the first side of the flexible substrate 300.

After the print medium has been transferred to the flexible substrate 300, one or more UV dryers 330 may be provided to dry the print medium on the flexible substrate 300. Thus, for example, the ink applied at the first set of continuous cylinders 322 may be dried on the flexible substrate 300 by the UV dryers 330. In some cases, the first set of continuous cylinders 322 may apply print medium to define print applied directly to the flexible substrate

300. However, in other cases, the first print assembly 320 may actually apply the print over the top of a base print layer applied by a base roller 340 and corresponding UV dryer 342. The base print layer could be a continuous base color or an initial pattern. In some cases, the base roller 340 may provide gradations and the other continuous cylinders may apply number sequences that need to change (e.g., via jogging to different partitions) based on location.

In cases where it is desirable to print on both sides of the flexible substrate 300, a second print assembly 350 may be provided. The second print assembly 350 may operate similarly to the first print assembly 320, except that the second print assembly 350 places continuous cylinders of a second set of continuous cylinders 352 into contact with the opposite side of the flexible substrate 300 to that which was printed on by the first set of continuous cylinders 322.

Thus, for example, the second set of continuous cylinders 352 may be configured to contact (and print on) a second side of the flexible substrate 300 (opposite the first side), while an impression cylinder 354 contacts the opposite side of the flexible substrate 300 (i.e., the first side). Each of the continuous cylinders may have print medium (e.g., ink) transferred thereon by a media applicator 356 immediately before the continuous cylinders roll to the point where the flexible substrate 300 is pressed between each continuous cylinder of the second set of continuous cylinders 352 and the impression cylinder 354. Thus, at the point where the flexible substrate 300 is pressed between each continuous cylinder of the second set of continuous cylinders 352 and the impression cylinder 354, the print medium is transferred to the second side of the flexible substrate 300.

After the print medium has been transferred to the second side of the flexible substrate 300 by the second print assembly 350, one or more UV dryers 360 may be provided to dry the print medium on the flexible substrate 300. Thus, for example, the ink applied at the second set of continuous cylinders 352 may be dried on the flexible substrate 300 by the UV dryers 360. The flexible substrate 300 may then be provided to finish rolls 370 on which the finished product is collected.

As can be appreciated from FIG. 3 in the context of the discussion above, either or both of the first and second sides of the flexible substrate 300 can be printed with corresponding different patterns that repeat. The multiple cylinders of the first and second sets of continuous cylinders 322 and 352 may provide different repeatable patterns, the same repeatable patterns or combinations thereof. Moreover, if the patterns repeat at different intervals, corresponding ones of the continuous cylinders may have different sizes (i.e., different circumferences or perimeters) and therefore may need jogging at corresponding different intervals.

Some or all of the continuous cylinders may include partitions that have unique patterns (e.g., gradations and/or number sequences) provided thereon. Thus, the cylinders may be jogged at corresponding appropriate times to cycle to a next partition at the appropriate time. In some cases, one or more cylinders may be used for printing gradations, and another one or more different cylinders can be used to print number sequences in a same or different color. However, in other cases, the same cylinders could be used to print both gradations and number sequences (e.g., in the same color). The jogging may occur along the axial direction of each of the continuous cylinders (i.e., into or out of the page for FIG. 3). In an example embodiment, the jogging may be accomplished using a geared drive assembly or servo to axially adjust the alignment of the continuous cylinders so that a selected one of the partitions is aligned with the flexible substrate 300.

Example embodiments may enable continuous printing to be achieved with multiple colors on single or double sided tapes. Thus, for example, three color printing can be performed even in situations where the base color is a darker color than the colors printed thereon via inline printing. Inline powder coating and/or inline clear coating may be expansion possibilities by employing the technology described herein. Example embodiments may also enable single minute exchange of dies (SMED) to be achieved, which would eliminate significant press downtime. Costly photopolymer belt replacement may also be eliminated by employing example embodiments.

FIG. 4 is a block diagram of a system for printing in accordance with an example embodiment. FIG. 4 shows a press or printing assembly 400 that may be used to print on any length of flexible substrate 410 one or more sides thereof. The printing assembly 400 includes a first continuous cylinder 420. As discussed above, the first continuous cylinder 420 is divided into a plurality of partitions. Only one of the partitions is aligned for contact with the flexible substrate 410 at any given time, and each of the partitions has a unique print characteristic associated therewith (e.g., a unique number set or sequence, a unique design, and/or the like).

While any given one of the partitions is aligned with the flexible substrate 410, the corresponding unique print characteristic associated therewith can be applied to the flexible substrate 410 by contact between the flexible substrate 410 and the first continuous cylinder 420. Of note, the first continuous cylinder 420 may be one of a plurality of such cylinders that may print respective different colors or designs on the same side of the flexible substrate 410. Color print applied to the flexible substrate 410 may be dried by a first dryer 422.

When the entire perimeter or circumference of a particular one of the partitions of the first continuous cylinder 420 has been used for printing, a jogging assembly 424 may be used to shift the position (and therefore alignment) of the first continuous cylinder 420 axially so that a next partition is aligned with the flexible substrate 410. The next partition may then print its own unique print characteristic upon the flexible substrate 410. When the next partition has been completely traversed, then still another partition may be aligned and used for printing.

Transitioning between each partition is mechanically conducted by the jogging assembly 424. The jogging assembly 424 may be embodied as a gear set, servo, electric motor, or any other such suitable device for translating the position of the first continuous cylinder 420 axially. In an example embodiment, each partition of the first continuous cylinder 420 may be similar in size and therefore have the same perimeter or circumference. Moreover, the width of the flexible substrate 410 may substantially match the width of each partition. Thus, the jogging assembly 424 may apply an axial movement to the first continuous cylinder 420 that is the same (e.g., substantially equal to the width of the partitions) for each partition transition. The first continuous cylinder 420 may therefore have the ability to repeat printing with each new partition by sequentially moving to adjacent partitions in a single direction until the full complement of partitions has been cycled through completely. At that point, the full length of the flexible substrate 410 should have been printed.

If both sides of the flexible substrate 410 are to be printed on, the printing assembly 400 may include a second continuous cylinder 430 (or multiple instances thereof), a second dryer 432, and a second jogging assembly 434, which may operate similar to the corresponding components described above, but do so relative to the opposite side of the flexible substrate 410. In some cases, the diameter of the second continuous cylinder 430 (and therefore also the perimeter or circumference thereof) may be different from the diameter of the first continuous cylinder 420. Accordingly, different jogging times may be needed for respective ones of the first continuous cylinder 420 and the second continuous cylinder 430. Furthermore, the number of partitions of the second continuous cylinder 430 may be different from the number of partitions of the first continuous cylinder 420. Accordingly, a different number of jogging operations may be performed for respective ones of the first continuous cylinder 420 and the second continuous cylinder 430 to cycle through all partitions.

In an example embodiment, a control unit 450 may be operably coupled to each of the first jogging assembly 424 and the second jogging assembly 434 in order to control the timing and implementation of the jogging activities. Thus, for example, the control unit 450 may be aware of the number of partitions, width of partitions, speed of motion of the flexible substrate 410, perimeter or circumference of the partitions, etc., in order to enable the control unit 450 to manage jogging activities. In an example embodiment, the printing assembly 400 may include one or more instances of a sensor 460 to facilitate the operation of the control unit 450.

The sensor 460 (or sensors) may detect the speed of motion of the flexible substrate 410. In this regard, the sensor 460 may read the speed at which partitions pass the sensor 460 to determine such speed, or may determine the speed of one or more rollers or cylinders to determine such speed. In some cases, the sensor 460 may also detect location information and be able to determine or infer location proximate to other components of the printing assembly 400. Thus, based on the location information and/or speed information provided by the sensor 460, the control unit 450 may intelligently direct the initiation of jogging activity. The sensor 460 may be an optical sensor in some cases.

In an example embodiment, the control unit 450 may be a programmable logic controller (PLC), field programmable gate array (FPGA), or other processing circuitry capable of intelligently controlling the jogging activity. As such, in some cases, the control unit 450 may include processing circuitry such as a processor and memory. The memory may store instructions and/or data (e.g., information descriptive of the circumference of each partition and number of partitions of each cylinder) along with instructions for triggering the jogging activity.

FIG. 5 illustrates a method of printing on a flexible substrate in accordance with an example embodiment. As shown in FIG. 5, the method of printing on a flexible substrate may include moving a flexible substrate proximate to a continuous cylinder at operation 500 and applying print media to the flexible substrate responsive to contact between the continuous cylinder and the flexible substrate at operation 510. The continuous cylinder may include a plurality of partitions configured such that only one of the partitions is aligned for contact with the flexible substrate at any given time, and each of the partitions has a unique print characteristic associated therewith. The method may further include determining when a first partition of the continuous cylinder has fully applied print media to the flexible substrate at operation 520, and moving the continuous cylinder along an axis thereof to align a second partition of the continuous cylinder with the flexible substrate at operation 530.

In some cases, the method (or portions or operations thereof) may be augmented or modified, or additional optional operations may be included. For example, in some cases, the first continuous cylinder may include a circumference having a laser ablated surface that defines the unique print characteristic of each of the partitions. In an example embodiment, the unique print characteristic may define a unique number set or sequence for each of the partitions. In some cases, the unique number set of each partition sequentially follows a number set of a preceding adjacent partition. In an example embodiment, moving the continuous cylinder may be performed via a control unit operably coupled to a jogging assembly. In some cases, the control unit stores information indicative of a circumference of the continuous cylinder, and the control unit determines location information regarding the flexible substrate to determine when to trigger the jogging assembly to adjust alignment of the continuous cylinder relative to the flexible substrate. In an example embodiment, the method may further include employing a sensor to determine a speed of the flexible substrate. In some cases, applying the print media to the flexible substrate may include printing a base layer on the flexible substrate. The base layer may be a dark color, and printing gradations or numbers over the base layer may include printing the gradations or numbers in a color that is lighter than the dark color of the base layer.

By using the continuous cylinders of an example embodiment, continuous unique or non-repeating patterns can be printed with virtually any combination of colors and in any desirable length. Thus, for example, example embodiments may allow a solid black area to be printed with the base layer showing through as the gradations. Of note, the base layer could be any color.

Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Moreover, although the foregoing descriptions and the associated drawings describe exemplary embodiments in the context of certain exemplary combinations of elements and/or functions, it should be appreciated that different combinations of elements and/or functions may be provided by alternative embodiments without departing from the scope of the appended claims. In this regard, for example, different combinations of elements and/or functions than those explicitly described above are also contemplated as may be set forth in some of the appended claims. In cases where advantages, benefits or solutions to problems are described herein, it should be appreciated that such advantages, benefits and/or solutions may be applicable to some example embodiments, but not necessarily all example embodiments. Thus, any advantages, benefits or solutions described herein should not be thought of as being critical, required or essential to all embodiments or to that which is claimed herein. Although specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

THAT WHICH IS CLAIMED:

1. A measuring tape printing assembly comprising:

a first continuous cylinder configured to apply print media to a flexible substrate responsive to contact with the flexible substrate, the first continuous cylinder comprising a plurality of partitions configured such that only one of the partitions is aligned for contact with the flexible substrate at any given time, and each of the partitions has a unique print characteristic associated therewith; and

a first jogging assembly operably coupled with the first continuous cylinder to move the first continuous cylinder along an axis thereof to change alignment of the partitions relative to the flexible substrate.

2. The printing assembly of claim 1, wherein the first continuous cylinder comprises a circumference having a laser ablated, laser engraved, or chemical etched surface that defines the unique print characteristic of each of the partitions.

3. The printing assembly of claim 2, wherein the unique print characteristic defines a unique number set or sequence for each of the partitions.

4. The printing assembly of claim 3, wherein the unique number set of each partition sequentially follows a number set of a preceding adjacent partition.

5. The printing assembly of claim 1, further comprising a control unit operably coupled to the first jogging assembly to control the first jogging assembly.

6. The printing assembly of claim 5, wherein the control unit stores information indicative of a circumference of the first continuous cylinder, and wherein the control unit determines location information regarding the flexible substrate to determine when to trigger the first jogging assembly to adjust alignment of the first continuous cylinder relative to the flexible substrate.

7. The printing assembly of claim 6, wherein the control unit is operably coupled to a sensor that determines speed of the flexible substrate.

8. The printing assembly of claim 7, further comprising a second continuous cylinder and a second jogging assembly.

9. The printing assembly of claim 1, further comprising a second continuous cylinder and a second jogging assembly.

10. The printing assembly of claim 1, wherein the print assembly is configured to print a base layer on the flexible substrate, the base layer having a dark color, and
wherein the print assembly is configured to print gradations or numbers over the base layer, the gradations or numbers being printed in a color that is lighter than the dark color of the base layer.

11. The printing assembly of claim 10, wherein the flexible substrate is a measuring tape and a circumference of each partition of the first continuous cylinder is one meter and each partition sequentially increases count by one hundred centimeter increments.

12. The printing assembly of claim 10, wherein the flexible substrate is a measuring tape and a circumference of each partition of the first continuous cylinder is one foot and each partition sequentially increases count by twelve inch increments.

13. A method of printing on a flexible substrate, the method comprising:
moving a flexible substrate proximate to a continuous cylinder
applying print media to the flexible substrate responsive to contact between the continuous cylinder and the flexible substrate, the continuous cylinder comprising a plurality of partitions configured such that only one of the partitions is aligned for contact with the flexible substrate at any given time, and each of the partitions has a unique print characteristic associated therewith;
determining when a first partition of the continuous cylinder has fully applied print media to the flexible substrate; and
moving the continuous cylinder along an axis thereof to align a second partition of the continuous cylinder with the flexible substrate.

14. The method of claim 13, wherein the first continuous cylinder comprises a circumference having a laser ablated, laser engraved, or chemical etched surface that defines the unique print characteristic of each of the partitions.

15. The method of claim 14, wherein the unique print characteristic defines a unique number set or sequence for each of the partitions.

16. The method of claim 15, wherein the unique number set of each partition sequentially follows a number set of a preceding adjacent partition.

17. The method of claim 13, wherein moving the continuous cylinder is performed via a control unit operably coupled to a jogging assembly.

18. The method of claim 17, wherein the control unit stores information indicative of a circumference of the continuous cylinder, and wherein the control unit determines location information regarding the flexible substrate to determine when to trigger the jogging assembly to adjust alignment of the continuous cylinder relative to the flexible substrate.

19. The method of claim 18, further comprising employing a sensor to determine a speed of the flexible substrate.

20. The method of claim 13, wherein applying the print media to the flexible substrate comprises printing a base layer on the flexible substrate, the base layer having a dark color, and

printing gradations or numbers over the base layer, the gradations or numbers being printed in a color that is lighter than the dark color of the base layer.

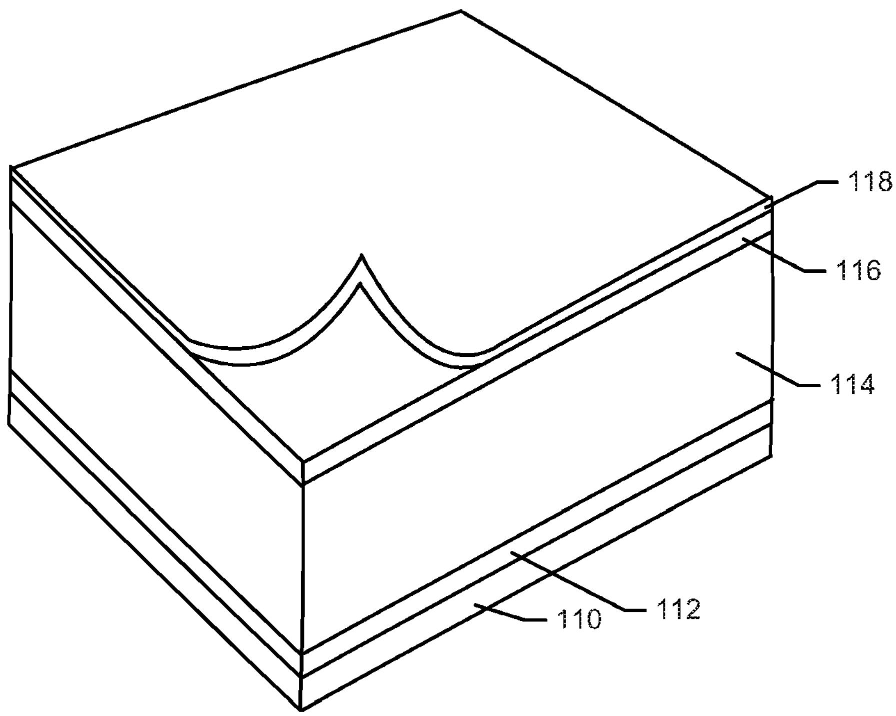


FIG. 1.

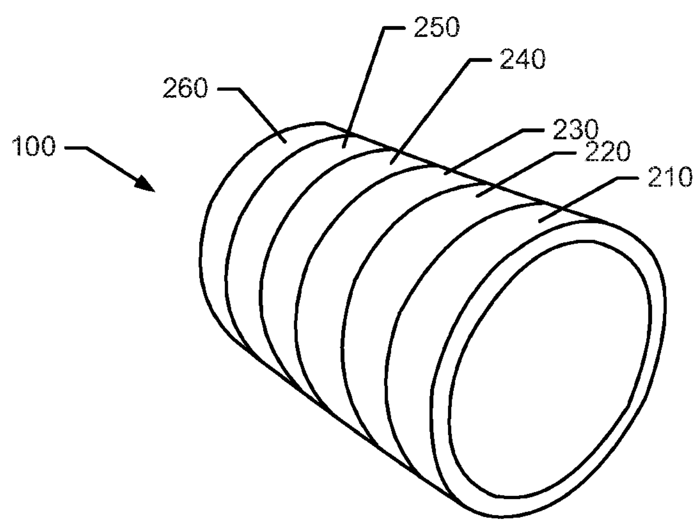
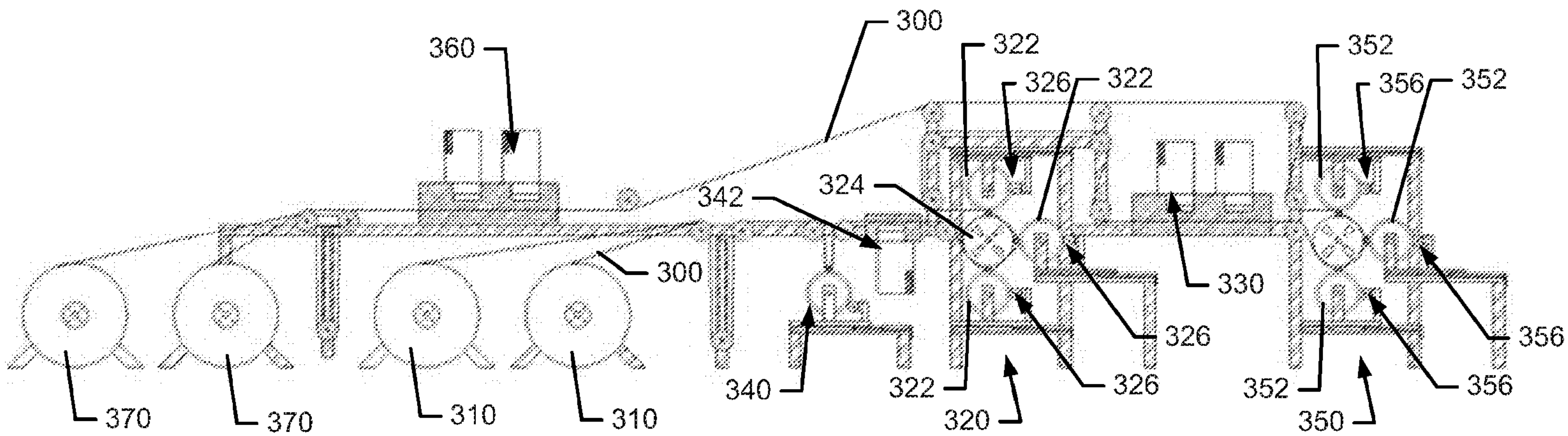


FIG. 2.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322
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310

FIG. 3.

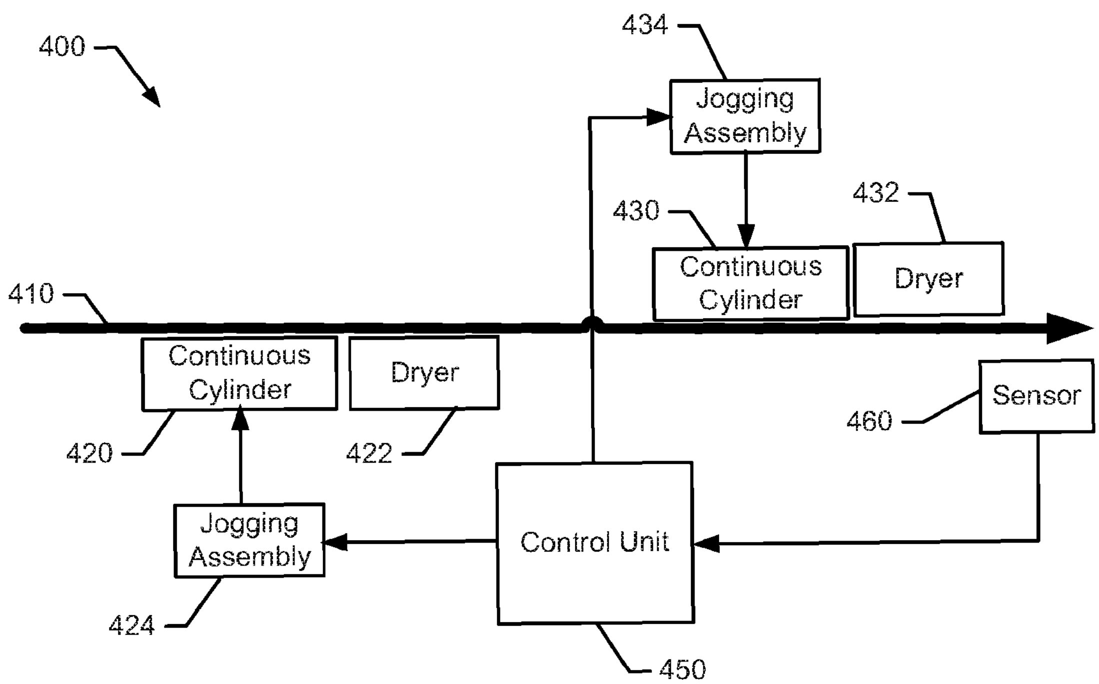
400
434
Jogging Assembly
430
432
Continuous Cylinder
Dryer
410
Continuous Cylinder
Dryer
Sensor
460
420
422
Jogging Assembly
Control Unit
424
450

FIG. 4.

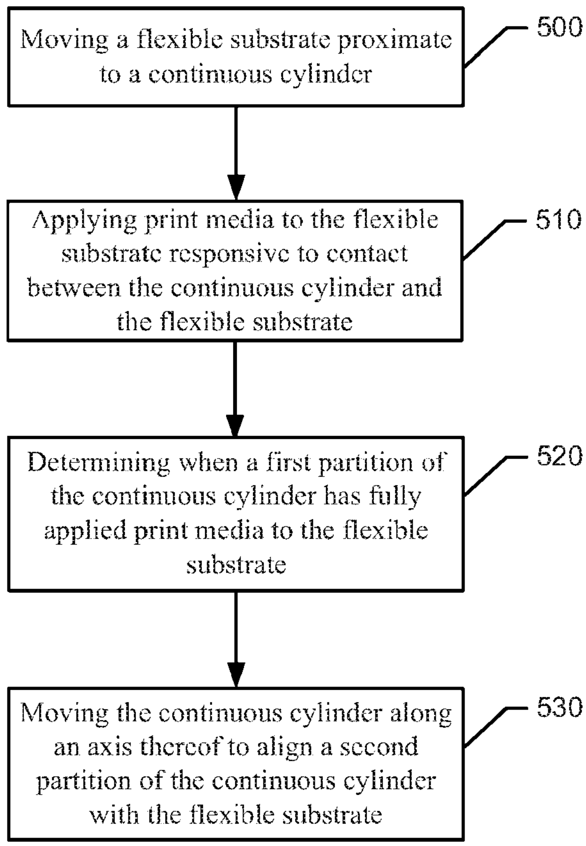
Moving a flexible substrate proximate to a continuous cylinder
500
Applying print media to the flexible substrate responsive to contact between the continuous cylinder and the flexible substrate
510
Determining when a first partition of the continuous cylinder has fully applied print media to the flexible substrate
520
Moving the continuous cylinder along an axis thereof to align a second partition of the continuous cylinder with the flexible substrate
530

FIG. 5.

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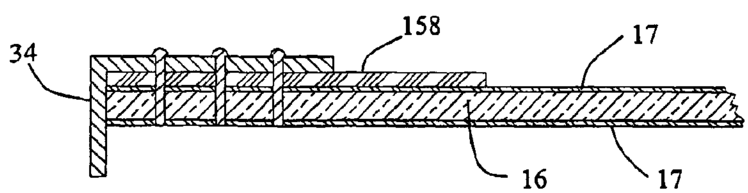
For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: RULE ASSEMBLY WITH PROTECTIVE FILM



(57) Abstract: A retractable rule assembly (10) includes a housing assembly (12) and a reel (14) in the housing assembly (12). An elongated blade (16) formed of a ribbon of metal having one end connected to reel (14) is able to extend outwardly through a space opening (22) in the housing assembly (12). A coil spring (37) is arranged within the housing assembly opening (22) and to release the blade (16) when extending from the housing (12). A blade holding assembly (126) is actuatable to hold the blade (16) outwardly of the housing assembly opening (22) and to release the blade (16) from any position in which it is held. A relatively short free end portion of the blade (16) has a film (158) of plastic material adhered to a convex or a concave side thereof. The clear film (158) of plastic material protects the covered portion of the blade (16) from cracking or tearing and protects any indicia on the end of the blade (16) from wear.

WO 03/031903 A1

RULE ASSEMBLY WITH PROTECTIVE FILM

This application claims priority from U.S. application No. 09/973,955, filed October 11, 2001, which iis a continuation-in-part of co-pending U.S. patent application number 09/366,782, filed August 4, 1999, herein incorporated by reference.

This invention is generally related to retractable tape rule assemblies and more particularly to rule assemblies of the spring retractable type.

BACKGROUND OF THE INVENTION

A typical retractable tape rule assembly includes an elongated thin metal rule blade that is mounted on a reel rotatably disposed within a housing assembly. The rule blade is retracted into the housing assembly for storage by coiling it about the reel. A coil spring is mounted between the reel and housing assembly to provide spring powered rewinding of the blade about the reel to the fully retracted position of the blade after the measurement has been taken. Repeated extension and retraction is stressful on the blade, however. It has been found that the first several inches of the free end of the blade are particularly susceptible to damage and wear over the life of the tape assembly. The leading end of the blade is frequently handled, for example, by the tape assembly user to pull the tape out of the housing assembly or to hold the free end of the tape on the workpiece. This repeated handling of the free end of the tape exposes the numbering and graduation lines on the face of the tape to wear and over time can wear these markings off. Spring powered retraction of the blade may cause fairly rapid rewinding of the blade into the housing assembly, causing the last several inches of the rewinding tape (i.e., the several inches on the free end of the tape) to "whip" or hit against the portions of the housing assembly that define the housing assembly opening. Over time, this hitting action of the tape against the housing assembly opening leads to cracks or tears in the tape and eventual tape breakage. Most breaks in the tapes of tape assemblies in commercial use occur in the first six inches of the blade.

Although tape breakage could be reduced by increasing the thickness of the metal of the blade, this is undesirable for several reasons. A thick blade increases tape assembly size, weight and material cost. A uniformly thick blade may have a detrimental effect on blade standout by increasing the weight of the extended portion of the blade. Furthermore, experience has shown that thickening or reinforcement of the entire blade length is not necessary to maximize service life of a rule assembly because most breaks and most blade wear occur in the several leading inches of the blade.

A need exists for a low cost, lightweight, durable material to cover and reinforce a selected length of a retractable tape blade that is easy to apply, highly durable and that can be used on any known tape rule product.

BRIEF DESCRIPTION OF THE INVENTION

A retractable rule assembly comprising a housing assembly; a reel rotatably mounted in said housing assembly; an elongated blade formed of a ribbon of metal having one end connected to said reel, said blade extendable from a position tangential to said reel outwardly through a spaced opening in said housing assembly, said elongated blade housing a concavo-convex configuration when extended from said housing assembly, said elongated blade having measuring indicia formed on the concave side thereof, and a clear, protective coating provided on both said concave and convex side of said blade throughout the length of the blade for inhibiting wear of said measuring indicia; a coil spring formed of a ribbon of metal constructed to rotate said reel in said housing assembly in a direction to wind up the elongated blade when extending outwardly of said housing assembly opening in said concavo-convex cross-sectional configuration onto said reel in an abutting volute coil formation in a flattened cross-sectional configuration; and a blade holding assembly constructed to hold the blade in any position of extension outwardly of said housing assembly opening and to release the blade from any position in which it is held; a relatively short free end portion of said blade having a film of plastic material overlying said protective coating on at least one of the convex and concave side of the blade, said film of plastic material having a thickness greater than a thickness of said protective coating.

The thin film may be any flexible or semiflexible plastic such as thermoset, thermoplastic, thermoplastic elastomer or rubber materials. Preferably, the film is made of polyurethane and is adhered to the blade by an acrylic adhesive. Alternatively, a polyester, silicone, polyimides, polyethylene, fluoropolymers, Nylon® or Mylar® film could be used to cover the blade. Preferably, the film has a thickness dimension within a range of about 0.006" to about 0.014".

In one preferred embodiment the retractable rule assembly further includes an end hook member formed of sheet metal of a predetermined thickness to include a concavo-convex mounting portion and a U-shaped hook portion that is bent at a generally right angle from an end of the mounting portion. The end hook member is mounted on the free end of the blade with the mounting portion of the hook member being secured for limited movement with respect to the free end of the blade so that the rule can be measured externally from an exterior surface of the U-shaped hook portion or internally from an interior surface of the U-shaped hook portion. When the hook member is included, preferably the film is adhered to the concave side of the blade from the free end thereof a length that is within a range of from approximately 2" to approximately 12" so that one end portion of the film is disposed between the concave side of the blade and the mounting portion of the end hook member so that the portion of the tape on which the hook member is movably mounted is covered by tape.

The film of material provides localized strengthening and slight thickening of the blade to provide localized protection against cracking and breaking of the blade. The thin film also provides a transparent covering that can be used to cover the numbering and graduation lines on sections of the blade that are frequently handled. Because the thin film is very lightweight, it has no appreciable adverse effect on blade standout, even when it is applied on the first few inches of the blade.

It is contemplated to provide a wide range of tape assembly embodiments that include at least one section of the blade covered by a protective film as described above. More particularly, in the more specific aspects of the present invention, it is a further object to provide a retractable rule assembly having a blade that includes a protective film to provide the localized blade strengthening and protection previously described with any combination of the following additional features:

1. The blade has a blade width, thickness and height of concavo-convex curvature sufficient to enable the blade to stand out arcuately a length measured along the blade of approximately 11 feet with a horizontal linear length of standout thereof greater than 97% of the arcuate length of standout.

2. A retractable rule assembly wherein the elongated blade has a width in the flattened configuration thereof having a dimension within the range of 1.10" - 1.5", a height in the concavo-convex configuration thereof having a dimension within the range of 0.25" - 0.40" and a thickness in either configuration thereof having a dimension within the range of 0.0045" to 0.0063".

3. A retractable rule assembly wherein the concavo-convex cross-sectional configuration of the blade includes an arcuate central section having a predetermined radius of curvature and integral arcuate end sections each having the same radius of curvature, the radius of curvature of the central section being a dimension within the range of 0.35" to 0.60" and the radius of curvature of each end section being a dimension within the range of 1.0" to 5.0".

4. A retractable rule assembly wherein the metal ribbon of the spring has a width which is 95%-120% of the width of the metal ribbon of the blade.

5. A retractable rule assembly wherein the blade has an end hook member on the free end thereof, the end hook member being formed of sheet metal of a predetermined thickness to include a concavo-convex mounting portion having a U-shaped hook portion bent at a generally right angle from an end thereof, the end hook member being mounted on the free end of the blade with the mounting portion thereof secured in limited sliding engagement with a concave side of the free end of the blade so that the rule can be measured externally from an exterior surface of the U-shaped hook portion or internally from an interior surface of the U-shaped hook portion, the U-shaped hook portion including a bight section extending transversely from a convex side of the free end of the blade and spaced leg sections extending beyond transversely spaced corners of the free end of the blade.

6. A retractable rule assembly wherein the housing assembly includes a pair of cooperating housing members, each including an end wall having a peripheral wall extending from a periphery thereof and terminating in a free edge, the housing members being fixed together with their free edges interengaged by a plurality of bolts extending through one of the housing members and threadedly engaged in the other at spaced positions adjacent the peripheral walls thereof and by a fixed reel spindle having a non-circular interengaging recess-projection connection at each end thereof with the central interior of the adjacent end wall, each end of the spindle being interiorly threaded to threadedly receive a bolt therein extending through a central hole in the adjacent end wall and the recess-projection connection between the central hole and threaded interior.

7. A retractable rule assembly wherein the housing assembly includes a fitment defining a part of the housing assembly opening adjacent a convex side of the blade, the fitment having a plurality of tangentially extending transversely spaced elongated ridges defining surfaces for engaging the convex side of the blade extending tangentially from the reel to said housing assembly opening.

8. The housing assembly includes a bottom wall having an exterior portion at an end position adjacent the housing assembly opening which projects below the exterior surface portion extending therefrom toward an opposite end to provide a finger grip enhancing configuration.

9. The housing opening has a height dimension which exceeds the height dimension of the blade an amount that is at least approximately equal to the amount the hook portion extends below the bottom end surface of the housing assembly at the housing opening.

In the broadest aspects of the present invention, it is an object to provide any known tape rule product with a protective film along at least a portion of the blade as previously described.

These and other objectives, features, and advantages of the present invention will become apparent from the following detailed description, the accompanying drawings, and the appended claims.

DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a prospective few of a tape rule assembly constructed according to the principles of the present invention;

FIG. 2 shows a front of elevational view of the tape rule assembly;

FIG. 3 shows a side of elevational view of the tape rule assembly;

FIG. 4 shows a cross-sectional view of the tape rule assembly taken through the line 4-4 in FIG. 2 showing a blade thereof in a fully retracted configuration;

FIG. 5 is a view similar to FIG. 4 except showing the blade in a fully extended configuration;

FIGS. 5a-b show two cross sections of configurations of the blade with a film of plastic material on the concave and convex sides, respectively.

FIG. 6 is a cross-sectional view taken through the line 6-6 in FIG. 3;

FIG. 7 is a transverse cross-sectional view taken through a portion of the extended blade;

FIG. 8 is a transverse cross-sectional view taken through a portion of the blade when the blade is in a flattened configuration;

FIG. 9 is a table showing a comparison of the construction and standout characteristics of a plurality of exemplary prior art tape rule assemblies with an embodiment of the tape rule assembly constructed according to the principles of the present invention;

FIG. 10 is a schematic representation of an extended tape blade extending from a housing assembly to illustrate the linear length-out, arcuate length-out of the blade and the rotational angle of the housing assembly; and

FIG. 11 is a cross-sectional view of a fragment of the tape rule assembly taken through the line 11-11 of FIG. 4.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. 1-3 show an exterior view of a retractable rule assembly that is generally designated 10 and is constructed according to the principles of the present invention. The rule assembly 10 includes a housing assembly 12 and a reel 14 that is rotatably mounted inside the housing assembly 12 (best seen in the cross-sectional views of FIGS. 4-6). The reel 14 is mounted in the housing assembly 12 by a reel spindle 15 that is secured within the housing assembly 12 (FIGS. 4-6). An elongated tape rule blade 16 is mounted on the reel 14.

The blade 16 is formed of a ribbon of metal, the preferred metal being steel, and the top concave surface of the blade is printed with measuring lines and digits (not shown) for measuring lengths and distances. One longitudinal end 18 of the blade 16 is connected to the reel 14 and a second longitudinal free end 20 of the blade 16 extends generally outwardly of the reel 14. The blade 16 is constructed and arranged with respect to the housing assembly 12 to extend generally from a position tangential of the reel 14 outwardly through a spaced opening 22 provided in the housing assembly 12 (as shown, for example, in FIG. 4).

Preferably the reel 14 is made of a molded plastic and is provided with slots or openings 24, 26 in a central cylindrical wall portion 28 thereof. The one end 18 of the blade terminates in a hook-like structure 30 that hookingly engages an edge of the wall portion 28 of the reel 14 at opening 24 to connect the end 18 of the blade 16 to the reel 14 (FIGS. 4, 5).

A coil spring 32 has a construction and arrangement between the housing assembly 12 and the reel 14 to rotate the reel 14 with respect to the housing assembly 12 in a direction to wind the elongated blade 16 about the reel when the blade 16 is extending outwardly of the housing assembly opening 22. The coil spring 32 is generally enclosed within the central wall portion 28 of the reel 14 (FIGS. 4-6). One longitudinal end 35 of the coil spring 32 hookingly engages an edge of the wall portion 28 of the reel 14 that defines the opening 26; a second longitudinal end 37 of the blade 16 hookingly engages the spindle 15. The spindle 15 is rigidly mounted to the housing assembly 12 in a manner considered in detail below. Preferably the spring 32 is a thin, flat ribbon of metal, the preferred metal being steel.

The blade 16 is generally movable between a fully retracted position outwardly of the housing assembly 12 to a fully extended position. The fully retracted position of the blade 16 is shown in FIG. 4 and the fully extended position of the blade is shown (in fragmentary view) in FIG. 5. It can be appreciated from a comparison of FIG. 4 and FIG. 5 that as the blade is unwound from the reel 14, the coil spring 32 is wound around the rigidly fixed spindle 15. This winding of the spring around the spindle stores energy in the spring to provide spring powered rewinding of the blade 16 around the reel 14 when the extended blade is released.

The blade 16 is constructed of a ribbon of sheet metal that is shaped during the manufacturing to have a normal or memory configuration that has a generally arcuate or concavo-convex transverse cross-section. The blade 16 has a layer of paint on both sides thereof, with the paint on the concave side of the blade 16 providing measuring indicia. The paint layer on each side of the blade preferably has a thickness of about .0006" - .0014", and more preferably between .0008" -.0012." A water-based paint or solvent-based paint is preferred. In order to reduce damage to the paint layer from rust, corrosion and wear, the paint layer on both sides of the entire blade length is preferably coated with a thin, clear plastic protective coating 17 as shown in Figure 5a and as described in U.S. Patent 3,121,957, herein incorporated by reference. The thin plastic coating 17 is preferably provided throughout the length of the blade and on both sides of the blade, with each side of the blade having a coating thickness of less than .0035", and even more preferably between about .0005" and about .001". Any appropriate flexible or semi-flexible material may be used, but Mylar, Polyester, Nylon, Lacquer or Acrylic are most preferred. In addition, an appropriate thermoset, rubber, thermoplastic, thermoplastic elastomer, polyamide, polyvinyl, silicone, polyimide, polyethylene, fluoropolymer or polyethylene terephthalate may be also used, for example. The coating 17 provides a war-resistant layer that reduces or inhibits wear of the indicia on the blade. It also preferably provides a sealing function to inhibit rust formation on the blade. If the plastic coating 17 is omitted, it is preferable to use a wear resistant paint to provide the measuring indicia.

When a portion of the blade 16 is wound about the reel 14, the wound portion has a flat transverse cross-section (FIGS. 6 and 8) and the wound layers of the coiled blade provide the wound blade with an abutting volute coil configuration. A representative transverse cross-section of the extended blade 16 showing its concavo-convex configuration is illustrated in FIG. 7. It can therefore be understood from a comparison of FIGS. 4-5 (and from a comparison of FIGS. 7-8) that when the blade 16 is wound around the reel 14, it has the flat cross-section of FIG. 8 and when the blade 16 is withdrawn from the housing assembly 12 to measure an object, it returns to the concavo-convex cross-section shown in FIG. 7. Thus, the coil spring 32 is constructed and arranged between the housing assembly 12 and the reel 14 to rotate the reel 14 about the spindle with respect to the housing assembly 12 in a direction to wind up the elongated blade 16 when extending outwardly of the housing assembly opening 22 in a normal concavo-convex cross-sectional configuration onto the reel 14 in an abutting volute coil formation in a flattened cross-sectional configuration. The concavo-convex cross-section provides the extended blade with rigidity and maintains the blade essentially straight in the longitudinal direction.

The concavo-convex cross-section of the blade generally provides the unsupported blade 16 with blade standout. As described in greater detail below, the blade 16 has a blade width, thickness and height of concavo-convex curvature sufficient to enable the blade 16 to standout arcuately a length measured along the blade of at least 10.5 feet with a horizontal linear length of standout thereof that is greater than 97 percent of the arcuate length of standout. As also described in greater detail below, the concavo-convex transverse cross-section of the blade 16 is provided with a geometry that also improves blade standout.

Generally, one skilled in the art will understand that the length of blade standout depends on many factors, including (but not limited to) blade width (i.e. the transverse width of the blade measured when the blade is in its flattened condition shown, for example, in FIG. 8 and designated F); the height of the blade 16 in the concavo-convex configuration (designated H in FIG. 7); blade thickness (designated T in FIG. 7); and the geometry of the blade transverse cross-section when the same is in its normal concavo-convex than configuration. Preferably, the blade 12 has a width in the flattened condition thereof having a dimension within the broad range of from approximately 1.10 inches to approximately 1.5 inches; a height H in the concavo-convex configuration thereof having a dimension within the broad range of approximately 0.25 inch to approximately 0.40 inch; and a thickness in either configuration thereof having a dimension within the broad range of approximately 0.0045 inch to approximately 0.0063 inch. More preferably, the blade 12 has a width in the flattened condition thereof having a dimension within the narrower range of from approximately 1.25 inches to approximately 1.39 inches; a height H in the concavo-convex configuration thereof having a dimension within the narrower range of approximately 0.30 inch to approximately 0.35 inch; and a thickness in either configuration thereof having a dimension within the narrower range of approximately 0.005 inch to approximately 0.0056 inch. Most preferably the blade 16 width is approximately 1.25 inch, the blade height H is approximately 0.32 inch and the blade thickness T is approximately 0.0051 inch. A blade constructed according to these principles has a blade standout of up to approximately 13 feet. More specifically, a blade construction having dimensions within the broadest ranges identified immediately above for the width F, height H and thickness T can have a blade standout in the preferred broad range of at least 10.5 feet to approximately 13 feet; a blade construction having dimensions within the more preferred narrower ranges identified immediately above for the width F, height H and thickness T can have a blade standout in the range of at least 10.5 feet to approximately 12.5 feet; and a blade construction having the most preferred dimensions identified immediately above for the width F, height H and thickness T has a blade standout of approximately 11 feet.

The concavo-convex cross-section of the blade 16 has a unique geometry (shown in FIG. 7) that increases its standout ability. The concavo-convex cross-sectional configuration of the blade 16 includes an arcuate central section 36 and integral arcuate end sections 38. Each arcuate end section 38 has the same radius of curvature (indicated for one of the two end sections 38 in FIG. 7 by the line designated R1). The central section 36 has a radius of curvature designated R2 (FIG. 7). The radii of curvature R1 for the two end sections 38 are greater than the radius of curvature R2 of the central section 36. The central section having a radius R2 extends through an angular extent designated X in FIG. 7. Preferably angle X is approximately 84 degrees.

Preferably the arcuate central section 36 has a radius of curvature R2 that is a dimension within the broad range of approximately 0.30" to approximately 0.60"; and the radius of curvature R1 of each end section 38 is a dimension within the broad range of approximately 1.0" to approximately 5.0". More preferably the arcuate central section 36 has a radius of curvature R2 that is a dimension within the narrower range of approximately 0.40" to approximately 0.50" and the radius of curvature R1 of each end section 38 is a dimension within the narrower range of approximately 2.0" to approximately 4.0". Most preferably, the arcuate central section 36 has a radius of curvature R2 of approximately 0.46" and the radius of curvature of each end section R1 is approximately 3.0".

The transverse cross-sections of prior art tape blades are either constant curves (i.e., constant radius of curvature) or are constant curves in the center of the blade with straight (i.e. flat) sections at each transverse end of the cross-section when the blade is extended. Blades constructed to have either these basic cross-sections are less stable during blade standout and show a greater tendency to buckle than blades having cross-sections constructed according to the present invention.

FIG. 9 shows a comparison of the construction and standout capabilities of three prior art rule assemblies (shown in the first six rows of the table and indicated with a bracket) with a preferred embodiment of the rule assembly 10 constructed according to the principal of the present invention (shown in the last five rows of the table). As the first column of FIG. 9 indicates, typical prior art rule blades did not exceed one inch in width (measured in the flattened, coiled configuration of the blade). The second column indicates that prior art blade thickness for a one inch blade ranged from 0.0045 inch to 0.0056 inch and produced blade having a standout length of from approximately 7 feet to approximately 9 feet as indicated in FIG. 9, the third column.

The embodiment of the rule assembly constructed according to the principles of the present invention shown in FIG. 9 has a blade width of 1.250 inches (in the flat configuration) and a blade thickness of 0.0051 inch. Preferably, the blade described in FIG. 9 has a concavo-convex cross-section in the extended configuration as described above and as shown in FIG. 8.

The last five columns in FIG. 9 compare the standout characteristics of the three prior art tape assemblies with the tape assembly 10 constructed according to the principles of the invention. The standout characteristics of the blade of a given tape assembly are best understood by comparing the arcuate (i.e., actual) length-out measured along the surface of the blade with the linear length-out of the blade. These two characteristics are often expressed as a percentage of linear length-out to arcuate length-out. FIG. 10 shows a schematic diagram that illustrates what is meant by arcuate length-out and linear length-out.

Arcuate length-out is represented by arcuate line C in FIG. 10 and is a measure of the total length of the extended portion of the blade. Linear length-out is designated B in FIG. 10 and is a measure of the linear length of the projection of the extended blade on an imaginary horizontal surface below the tape assembly 10. Line A designates the height the housing assembly 10 is required to be above the horizontal surface when the housing assembly 12 is angularly oriented with respect to the surface at an angle D to position the arcuately extending blade so that the free end thereof just touches the surface. Thus, angle D generally represents the degree of tape rule housing assembly rotation (with respect to the horizontally extending surface) required to achieve maximum standout for a given length of extended tape.

The comparison of the prior art and the present invention given in FIG. 9 indicates that the maximum prior art arcuate length-out that could be achieved with a one inch wide blade was approximately nine feet. Because of the relatively shallow (relative to the present invention) cross-sectional blade height H of approximately 0.21 inch (not shown in FIG. 9) typically used in prior art one inch blades and because of the relatively high thickness of the metal of the prior art blades (which thickness is required for the arcuate length-out to be achieved), however, the linear length-out B was approximately 93 inches. This results in a percent of linear to arcuate length-out of approximately 86 percent. It can be appreciated that the third embodiment of the prior art shown in the fourth through the sixth rows of FIG. 9 shows relatively little bending for seven feet of standout (96% linear to arcuate length-out), but that this embodiment bends a very large degree when two additional feet of the blade are extended. This high degree of arcuate bending of the 1 inch blade at standout lengths approaching 9 feet makes the task of measuring a large distance difficult for a single person using the prior art tape rule assembly. As indicated in FIG. 9, the present invention provides a rule assembly that can achieves seven feet to approximately 11 feet of arcuate length-out while maintaining the percent of linear to arcuate length-out in the approximate range of 99 percent to 98 percent. This greatly facilitates the task of measuring a length for the tape assembly user. Greater degrees of standout with a comparable percentage of linear to arcuate length-out can be achieved by making the blade wider. It is, for example, within the scope of the present invention to provide a blade width of 1.5 inches or greater.

It can be understood by one skilled in the art that the 1.25 inch blade width of a preferred embodiment of the assembly 10 allows the blade height H to be increased without increasing the overall blade curvature to a degree that would make reading the gradations and lettering printed on the concave surface of the blade 16 difficult. This construction results in a blade with relatively high height H that is also easy to read. (In contrast, one inch blades having a curve height of the extended blade of over 0.21 become very difficult to read and are thus not commercially practical.) Increasing the blade width of the blade of the present invention also allows the printing on the blade to be made larger, thus making measurements easier by making the blade easier to read. When the preferred 1.25 inch blade (flat width F) is in its concavo-convex cross-sectional configuration (FIG. 7), the height H thereof, as mentioned above, is approximately 0.32 inch and the curved or arcuate width W is approximately 1.018 inches. This relatively wide width W of the extended blade also facilitates reading a measurement from the blade 16.

The blade of the rule assembly 10 is thus able to achieve the approximately 11 feet of standout while improving the percent of linear to arcuate length-out relative to the prior art. This length of standout is achieved while the bottom surface of the housing is angled approximately 45 degrees with respect to the horizontal surface S (as indicated in the right most column of FIG. 9) which is comparable to the three prior art rule assembly embodiments shown in FIG. 9.

One skilled in the art will appreciate that when the rule assembly 10 is provided with a 33 foot long blade, a coil spring 32 must be provided to accommodate outward movement of the blade 16 to its fully extended position. It can be appreciated that it is desirable to construct a rule assembly 10 so that the housing assembly 12 is small enough and compact enough to fit easily in one hand of a user. Because the rule assembly 10 has a wide blade, the width of the housing assembly 12 is comparably wide. It is desirable to construct a retractable rule assembly 10 so that the height and length of the housing assembly 12 (also called the "footprint" of the housing assembly 12) are as small as possible. Because both the spring 32 and the blade 16 can be quite long in some embodiments of the invention (up to approximately 33 feet of blade length, for example), the spring 32 must be carefully constructed so that it provides sufficient spring forced to retract the fully extended blade and yet fits within a housing assembly 12 having a footprint that is dimensioned to easily fit in a user's hand.

The coil spring is constructed of a coiled ribbon of metal (typically steel). The spring force provided by the spring is approximately directly proportional to the spring width and the spring thickness. A thick spring undesirably increases the height and length of the housing assembly 12, however. It has been found that the most desirable construction of a rule assembly constructed according to the principles of the present invention has a coil spring that is relatively thin and relatively wide compared to prior art springs. Preferably the spring 32 of the rule assembly 10 has a width that is approximately 95 percent to approximately 120 percent of the width of the blade (for a given blade width in the broad range set forth above for the flattened blade). More preferably, the spring has a width that is approximately 100 percent to approximately 110 percent of the width of the metal ribbon of the blade, and is most preferably 100% of (i.e., equal to) the blade width (as shown in FIG. 9). Because the spring width is relatively great, the spring can be made the same thickness as or thinner than the blade 16. The reduction in the spring thickness relative to blade thickness (as compared to the prior art) allows the housing assembly 12 to be constructed so that it has a minimal footprint to provide a housing assembly 12 that can be easily gripped in one hand.

Typical springs used with prior art one-inch blades have a width that is less than the width of the blade, usually in the range of 0.8 to 0.89 inch. FIG. 9 shows a typical value of 0.875-inch for the spring width for all three embodiments of the one-inch blades described in the figure. Prior art spring thickness ranges from about 0.0051 to about 0.0060 inch. Generally, prior art spring thickness is approximately 0.0003-0.0006 greater than the blade thickness. Thus, prior art construction uses springs that are thicker and significantly narrower than the blade. It can be appreciated that although it is possible to use this prior art construction and the present invention, it is undesirable because the relatively thick spring of the prior art would result in a housing assembly footprint that too large to fit comfortably within the average user's hand. Thus there is a need for a new spring construction that can be used with the blade 16 that will allow the footprint of the housing assembly to be made small to be comfortably gripped using one hand.

It can thus the understood that the relatively wide spring allows the thickness of the spring to remain relatively small and this allows the footprint of the housing assembly to be small enough to be easily gripped in a single hand of the most users. More specifically, preferably, when the spring width is approximately equal to the blade width, the spring 32 of the present invention is 0 percent to 10 percent thinner than the blade 16. As another example, if the spring 32 is made one hundred twenty percent the width of the blade 16, the spring 32 is preferably 0 percent to 25 percent of thinner than the blade. In terms of actual measurement, this means that typically the spring thickness is up to 0.0005 inch thinner than the thickness of the blade. Furthermore, because the spring of the present invention is made wide relative to the width of the blade, the overall length of the spring can be made shorter relative to the length of prior art springs for comparable measuring blade 16 lengths. For example, a typical one inch wide, 25 foot long prior art blade has a spring that is approximately 240 inches in length; the length of a wide spring 32 constructed according to the principles of the present invention for the rule assembly 10 having a 25 foot blade is approximately 230 inches.

By increasing the spring width of the spring 16, the thickness of the spring can be decreased and the length decreased while still providing sufficient spring force to retract the blade without increasing the footprint of the housing assembly to an undesirable degree. Examples of specific housing assembly 12 heights for particular blade lengths will be considered below after other structural details of the construction of the rule assembly 10 are considered.

The housing assembly 12 is further constructed to easily and comfortably fit in a hand of the user because it optimizes the use of space within the housing assembly 12 to house the blade 16, coil spring and other cooperating components. The details of the internal structure of the housing assembly 12 and the blade 16 mounted therein are shown in FIGS. 4-6 and 11. Preferably the housing assembly 12 and the reel 14 are constructed of a molded plastic. As best appreciated from FIG. 6, the housing assembly 12 includes a pair of cooperating molded plastic housing members 40, 42. Each housing member 40, 42 includes an end wall 44, 46, respectively, having a peripheral wall 48, 50, respectively, extending from a periphery thereof and terminating in a free edge 52, 54, respectively. The pair of cooperating housing members 40, 42 are movable toward one another in an axial direction into cooperating relation to define the housing assembly (where "axial direction" refers to the direction of the axis of rotation of the reel defined by the spindle).

When the housing members 40, 42 are fixed together in the assembled rule assembly 10, the free edges 52, 54 are interengaged as shown in FIG. 6. A plurality of axially extending bolts 58 extend through one of the housing members 42 and threadedly engage the other housing member 40 (FIG. 11) at spaced positions adjacent the peripheral walls 48, 50. The housing members 40, 42 are also fixed together by the threaded engagement of bolts 68 with the fixed reel spindle 15. The axially extending spindle 15 is fix at a central portion of the housing assembly 12. Specifically, the fixed spindle 15 has a noncircular interengaging recess-projection connection (shown in FIG. 6 and described below) at each end thereof generally with a central interior region 62, 64, respectively, of the end walls 44, 46 of the housing assembly 12. Each end of the fixed spindle 15 is interiorly threaded to threadedly receive the bolts 68 therein. The bolts 68 extend through central holes 70, 72 formed in the respective adjacent end walls 44, 46 of the housing assembly and threadedly engage internal threading 73 in each end of the spindle 15. Each bolt 68 extends through a recess-projection connection, generally designated 75, when each bolt 68 is disposed in a respective central hole 70, 72 and threaded interior 73. A metal clip 77 is secured to one side of the housing assembly by one of the bolts 68.

Preferably the fixed spindle 15 is constructed of a molded plastic or nylon. The construction of the recess-projection connections 75 between the ends of the spindle 15 and the walls 44, 46 is shown in cross-section in FIG. 6. Each recess-projection connection 75 is identical. Specifically, projections 74 having exterior noncircular cross-sections are integrally formed on the walls 44, 46 and are received within recesses 76 having complementary non-circular interior cross-sections formed on each end of the spindle 15. The noncircular interior and exterior cross-sections cooperate to prevent rotation of the spindle 15 with respect to the housing assembly 12 when the ends of the spindle 15 are mounted on the projections 74 in the assembled rule assembly 10. Each end of the spindle 15 extends through a hole 79 of circular cross-section formed in opposite sides of the reel 14. The portions of the spindle 15 that extend through the holes 79 in the reel 14 have circular exterior cross sections. A flange 81 on the spindle 15 engages an annular groove 83 in the reel 14 surrounding the hole 79 to guide the rotation of the reel on the spindle. Thus, the reel 14 is rotatably mounted on the spindle 15 for bi-directional rotational movement of the reel with respect to the housing assembly 12. As can best be appreciated from FIGS. 4 and 6, the spindle 15 is internally slotted to receive the one longitudinal end 37 of the spring 32 to thereby secure the one end 37 of the spring to the spindle.

The molded plastic reel 14 includes two reel members 78, 80 (FIG. 6). Reel member 78 includes the integral cylindrical wall portion 28 about which the blade 12 is wound. Reel member 80 is essentially disk shaped. Each reel member 78, 80 includes an outwardly extending cylindrical wall portion 88, 90, respectively, formed around the hole 79. An annular edge portion 84 on the wall portion 82 is received within an annular groove 86 formed within reel member 80 to help hold the reel 14 together. The abutting engagement of the wall portions 88, 90 on the reel with the end walls 44, 46 of the housing assembly 12 maintain the edge portion 84 within the groove 86 in the assembled rule assembly.

The housing members 40, 42 include portions along the abutting free edges thereof 52, 54, respectively, of tongue and groove construction (FIG. 6) to help secure the molded housing members 40, 42 of the assembled rule assembly 10 together. Specifically, at a top portion of the housing assembly 12, a wall portion 92 formed on edge 54 is received within a groove 94 formed along a portion of the edge 52; and an integral wall portion 93 formed on edge 52 is disposed in underlying, abutting relation to wall portion 50 of the housing member 44. At a bottom portion of the housing assembly 12, a wall portion 95 formed along a length of edge 54 is received within a recess 97 formed on a portion of the wall portion 48 of housing member 40.

When viewed from the side elevational view, the housing assembly 12 includes only two corner portions (see FIG. 4, for example), generally designated 96, 98. One corner 96 is adjacent the housing assembly opening 22 and the other corner portion 98 is at an opposite bottom end of the housing assembly 12. The two bolts 58 are positioned in the only two corner portions 96, 98, respectively, of the housing assembly 12. Thus, it can be appreciated that the housing assembly 12 is secured together using threaded fasteners in only three locations (from the point of view of one looking at the side elevational view of, for example, FIG. 4): at the opposite corners 96, 98 (bolts 58) at the bottom portion of the housing assembly 12 and in the center of the housing assembly 12 (bolts 68). This use of the bolts 68 on opposite ends of the reel spindle 15 allows the housing assembly 12 to be secured together without using any bolts in a peripheral top portion or portions of the housing assembly 12.

This arrangement of the bolts helps reduce the size of the footprint of the housing assembly 12 to allow the housing assembly 12 for a 33-foot long blade constructed according to the principles of the invention to have up to 13 feet of blade standout, for example, to easily fit in a hand of a user. Specifically, it is within the scope of the invention to provide tape assemblies constructed according to the principles taught herein wherein the height (and length) of the housing assembly does not substantially exceed 3.65 inches for a blade length that is at most approximately 33 feet; wherein the height (and length) of the housing assembly does not substantially exceed 3.45 inches for a blade length that is at most approximately 30 feet; and wherein the height (and length) of the housing assembly does not substantially exceed 3.25 inches for a blade length that is at most approximately 8 meters.

As best appreciated from FIGS. 3-4, because the housing assembly does not require bolts in the upper periphery of the housing assembly 12, the top portion 108 of the housing assembly 12 can be made to have a relatively arcuate profile (FIG. 2, for example) that generally conforms to the profile of the reel, thus minimizing the footprint of the housing assembly 12, eliminating corners in the upper portion of the housing assembly and providing a comfortable curved top surface to receive the palm of a user's hand. This arc-shaped upper surface of the housing assembly 12 also increases impact resistance of the housing assembly 12 in case the assembly 10 is dropped.

A peripheral portion of housing assembly 12 is provided with a rubber-like coating 110 around the gripped portion of the housing assembly 12 to provide increased frictional engagement between the housing assembly and a user's hand and to provide a relatively soft comfortable surface for the user's hand.

The housing assembly 12 includes a bottom wall 109 (FIGS. 4-5) having an exterior portion 107 at an end position adjacent the housing assembly opening 22 which projects below an exterior surface portion 108 extending therefrom toward an opposite end 113 of the bottom wall 109 to provide a finger grip enhancing configuration, generally designated 119 for a gripping hand of the user. More specifically, the bottom wall 109 (FIGS. 3-4) has a forward end portion 107 adjacent the housing assembly opening 22 and a rearward end portion 113 at the opposite end of the bottom wall 109; the portion 108 of the wall 109 therebetween is generally recessed to provide the finger grip enhancing configuration 119 for the gripping hand of the user. This recessed area or gripping area 119 on the bottom of the housing assembly 12 is preferably completely covered with the overmolded rubber or rubber-like polymeric material. It can thus be appreciated that the housing assembly 12 is constructed to be easily held in one hand of a user such that the user's fingers engage the finger grip enhancing portion 119 and the user's palm and thumb are generally in overlying relation with a top portion of the housing assembly.

The housing assembly includes a fitment 118 (FIG. 11) which forms a part of the housing assembly opening 22 adjacent a convex side of the blade 16. The fitment 118 is an essentially U-shaped structure having a transversely extending cross member 115 and two upstanding arms 117 extending upwardly from opposite sides of the cross member 115. The cross member 115 defines the lower edge of the housing opening; a bottom surface 170 of the cross member 115 is flush with the adjacent surface portion 107 of the bottom wall 109 so that a bottom surface portion 170 of the fitment 118 forms part of the bottom surface of the housing assembly 12 adjacent the opening 22. The fitment 118 is preferably an integral molded plastic structure. The fitment 118 is held within appropriately sized opposing recesses 121, 123 (FIG. 11) formed in the respective housing members 40, 42 and which recesses are disposed on opposite sides of the opening 22 when the housing members 40, 42 are secured together. The cross member 115 of the fitment 118 has a plurality of tangentially extending, transversely spaced elongated ridges 120 which define surfaces 125 along the bottom of the opening 22 for engaging and supporting the convex side of the blade 16 extending tangentially from the reel 14 of the housing assembly opening 22. Thus, the ridges 120 slidably engage the convex side of the blade 16 and provide a low friction engagement between the housing assembly 12 and blade 16.

A holding assembly, generally designated to 124, is constructed and arranged to be manually actuated to hold the blade 16 in any position of extension outwardly of the housing assembly opening 22 and to release the blade 16 from any position in which it is held. The structure and operation of the holding assembly 124 is best appreciated from a comparison of FIGS. 4-5. The holding assembly 124 includes a holding member 126 mounted on the housing assembly 12 for movement in opposite directions between a normally inoperative position (FIG. 4) and a holding position (FIG. 5). It can be appreciated that the blade holding member 126 is an arcuate member that is movable along an arcuate path between the two positions as aforesaid. The holding member 126 has an interior free end portion 128 that is movable into wedging engagement with the tangentially extending portion of the blade 16 to engage and hold the blade against an interior holding structure 130 (FIG. 5) on the housing assembly 12 when the holding member 126 is in its holding position. The free end portion 128 includes a central recess 129 (FIG. 2, for example) that is described in detail below. The holding member 126 has an exterior thumb engaging portion 132 configured to be moved digitally to selectively move the holding member 126 from its normally inoperative position and its holding position. The exterior thumb engaging portion 132 is best seen in FIGS. 1-2.

Preferably the holding member 126 is an integral structure made of an appropriate durable flexible plastic. The thumb engaging portion 132 is connected by an integral outwardly extending neck portion 134 to an elongated arcuate flexible body portion 133 that terminates in the interior free end 128. The outwardly extending portion 134 is slidably held within and guided by a slot 136 formed within a front part of housing assembly 12 by the members 40, 42. The movement of a lower portion of the holding member 126 is guided by a pair of tabs 131 integrally formed on respective housing members 40, 42 (only one tab is shown in the figures). An integral locking structure 138 on the holding member 126 engages holding structure 140 (FIG. 5) integrally formed on the housing assembly 12 to releasably lock the holding member 126 in the holding position in wedging engagement with the blade 16.

More specifically, to lock the blade 16 in a given position of extension, the user (while holding the blade 16 outwardly of the housing assembly 12 against the spring force of the coil spring 32) slides the thumb engaging portion 132 downwardly with respective to the housing assembly 12 causing the locking structure 138 to slide over a ramped surface 142 on the holding structure 140 and causing the free end 128 to move in a locking direction with respect to the blade 16. The flexible plastic locking structure 138 bends resiliently outwardly slightly as it passes over the holding structure 140. After the free end 128 contacts the blade 16, continued movement of the thumb engaging portion 132 in the locking (downward) direction thereafter wedges the free end 128 of the flexible body portion 133 against blade 16 to hold the blade 16 in place against the spring force of the coil spring 32 and moves the locking structure 138 into abutting engagement with a locking surface 141 on the holding structure 140. The holding member flexes slightly as the free end 128 is wedged against the blade 16. The abutting engagement between the locking structure 138 and the locking surface 141 locks the holding member 126 in its holding position. It can be understood from FIG. 5 that the blade 16 is held in an extended position (against the spring force of the coil spring 32) between the free end 128 of the body portion 133 and the interior holding structure 130 by the downward force exerted by the wedged body portion 133. The interior holding structure 130 (not visible in detail) is a series of longitudinally spaced, transversely extending ribs that are constructed and arranged to support the convex side of the blade 16. When viewed from the point of view of FIG. 5 (i.e., on a transversely directed line of sight), the top surfaces (not visible in the FIGS.) of the ribs cooperate to provide a generally downwardly sloped support (in a direction toward the opening 22) for the blade 16; and when viewed from the front, (i.e., on a longitudinally directed line of sight) the top surfaces (not visible in the figures) of each rib of the interior holding structure 130 are transversely spaced in a concave array to receive and support the convex side of the blade.

To release the blade 16, the user pulls upwardly on the thumb engaging portion 132 which causes the locking structure 138 on the plastic holding member 126 to move resiliently outwardly and past the locking surface 141 to release the holding member 126 from engagement with a blade 16. The holding member 126 resiliently returns to its normal arcuate shape. It can be appreciated from FIG. 2 that the recess 129 on the free end

128 of the holding member 126 defines two transversely spaced teeth 147 which have spaced arcuate side surfaces 144 sized to conform to the concave surface of the blade 16 to hold the same in locked position.

It can be understood that the use of the holding member 126 when a measurement is being taken is optional. When taking a measurement, the user typically holds the housing assembly 12 in one hand and manually pulls the blade 16 out of the housing assembly 12 with the other hand. When a sufficient length of blade 16 has been withdrawn from the housing assembly 12, the user can lock the blade 16 with respect to the housing assembly 12 using the holding member 126 to prevent the blade 16 from retracting back into the housing assembly 12 (under the spring force of spring 32) when the user releases the blade 16. When the measurement has been taken, the user simply releases the holding member 126 from holding engagement with the blade 16 by moving the free end 128 thereof out of wedging engagement with the blade 16 in the manner described above. If the holding member 126 is not used during the taking of a measurement, the user can simply hold the blade 16 with his other hand while the measurement is being taken or, alternatively, the hook member 34 can be placed in hooking engagement with the workpiece to hold the blade 16 outwardly of the housing assembly 12 in a controlled and steady manner against the spring force of spring 32 while the measurement is being taken.

When the blade 16 is released after taking the measurement, the spring 32 rotates the reel 14 with respect to the housing assembly 12 in a blade-winding direction to wind the blade 16 around the reel 14. A relatively short free end portion of the blade 16 has a film 158 of plastic material adhered to the concave and/or to the convex side thereof (FIG. 11) to protect the blade 16 while the same is out of the housing assembly 12 and while the blade 16 is being retracted under the spring force of the spring 32 back into the housing assembly 12. Though the film 158 may be clear to permit reading of measuring indicia beneath the film, it may also be opaque, particularly in the case where it is on the convex side of the blade 16 as shown in Figure 5b. Moreover, if an opaque film 158 is used on the concave side of the blade, it may itself contain the measuring indicia for that portion of the blade, so that even if the film obscures printed indicia on the blade 16, the device can still be readily used. Preferably the film 158 is made of polyurethane and is adhered to the blade (i.e., over the paint layer), or, in the case that the blade includes a protective plastic coating 17, to the coating 17, by an acrylic adhesive. Adhesive may not be necessary if the plastic coating is made of the same material as the film, since the two components can chemically bond, for example under heat treatment, obviating the need for adhesive. It is also contemplated to use Mylar® or Nylon® to construct the film. The film 158 has a thickness dimension that is larger than the thickness dimension of the thin plastic coating 17, if coating 17 is provided. The film 158 preferably has a thickness within the range of approximately 0.006 inches to approximately 0.014 inches. It is within the scope of the invention to apply this film to the blade of any known tape rule assembly.

Preferably the film 158 is self-adhering and is placed over several leading inches (preferably within a broad range of approximately 2 inches to approximately 12 inches) of the free end 20 of the blade 16, including the portion of the blade on which the hook member 34 is disposed so that preferably the film goes under the hook member 34 all the way to the free end 20 of the blade 16. More preferably, the film 158 is applied along a length from the free end 20 of the blade 16 that is less than 10.5 inches; and most preferably, the length of the blade 16 from the free end thereof that is covered by the film 158 is approximately 6 inches. It is generally desirable to have the film-covered portion end at approximately the point on the blade 16 where the volutes of the coiled blade are in overlying relation to one another when the blade 16 is in its fully retracted configuration. Typically in a tape rule assembly, the tape blade starts to wrap on itself at approximately 9.5 inches when a typical reel size of approximately 2.9 inches in outer diameter is used in the construction. The film 158 is provided because most failures in a rule blade 16 occur within the first six inches of the free end of the blade

16 from cracks or tearing. The cracks or tearing occur because when the blade is wound back around reel under the spring force of the coil spring, the free end of the blade tends to "whip" as it enters the opening 22, causing the last several inches of the blade 16 to hit against the housing assembly 12. This can cause cracking or breaking of the free end of the blade 16 over time. The protective film 158 prevents these cracks and tears and other damage to the blade 16 associated with blade whipping.

The free end of the blade 16 is frequently handled by the user and this handling can over time cause the numbering and markings on the concave side of the blade 16 to wear off or become difficult to read, even where the protective coating 17 is applied. When applied to the concave side of the blade, the film 158 prevents this damage because it covers the numbering and markings on the free end of the blade and thereby protects the same from being worn off. Film 158 provided on the concave side of the blade may also be subjected to less wear in comparison to film provided on the convex side.

There are several possibilities for the protective film 158 that remain within the scope of the present invention. For example, the film 158 may cover only a portion of the width of the blade 16. A range of between about 25% to about 100% may be sufficient to provide an increase in the blade life while reducing the amount of material necessary to provide the film. Most preferably, however, about 100% of the blade width is covered. In addition, the film 158 may include a plurality of sub-layers. The sub-layers may be formed into the film prior to attachment to the blade 16, or may alternately be individually attached to the blade in an iterative process.

The construction of the hook member 34 and the manner in which it is disposed on the free end 20 of the blade 16 is best seen in FIGS. 1-4, 11. Preferably the end hook member 34 is formed of sheet metal of predetermined thickness and includes a concavo-convex mounting portion 150 (FIG. 11) having a U-shaped hook portion 152 bent at a generally right angle from an end of the concavo-convex mounting portion 150. The hook member 34 is mounted on the free end 20 of the blade 16 with the mounting portion 150 thereof secured in limited sliding engagement with a concave side of the free end 20 of the blade 16 and in overlying relation thereto.

More specifically, the mounting portion 150 is provided with large holes 167 (FIG. 4) and a plurality of rivets 169 extend through the holes 167 to slidably mount the hook member 34 to the blade 16 for limited longitudinal relative movement between the hook member 34 and the blade 16 (i.e., the diameter of each hole 167 is greater than the diameter of the associated rivet 169 by an amount approximately equal to the desired amount of hook movement). The limited sliding engagement allows the blade 16 to be measured externally from an external surface 161 of the U-shaped hook portion or internally from an internal surface 163 of the U-shaped hook portion 152. In other words, the sliding movement of the hook member 34 allows an accurate measurement to be taken with either surface 161 or 163 in abutting relation with the workpiece; the holding member 34 slides longitudinally with respect to the blade 16 a distance approximately equal to the thickness of the hook portion 152 (where the thickness is measured from surface 161 to surface 163) so that a measurement taken with either surface 161 or 163 in abutting engagement with the workpiece will yield an accurate measurement.

The U-shaped hook portion 152 includes a bight section 160 extending transversely downwardly from a convex side of the free end of the blade 16 and spaced leg sections 162 extending beyond transversely spaced corners 171 of the free end of the blade. The bight section 160 of the hook portion 152 of the hook member 34 provides an under-catch structure that can hookingly engage a workpiece to facilitate extension of the blade 16 and to temporarily secure the blade to the workpiece while a measurement is being taken. As can be appreciated from FIG. 11, the leg sections 162 extend beyond the longitudinally extending edges of the blade 16 to provide a side catch surface on each side of the blade that 16 can be used to hook the blade to an object or workpiece. The side catch structure provided by the legs 162 can function to secure the free end of the blade 16 during a measurement. The side catch structure provided by the leg sections 162 also allow the blade 16 to be easily and steadily held in a tilted position relative to a surface of the workpiece, thereby allowing a longitudinally extending edge of the blade 16 to be held against the workpiece. More specifically, when the convex side of the blade 16 is against the workpiece, the longitudinal edges are normally spaced from the surface because of the concavo-convex cross-section of the blade 16. The legs 162 of the hook member 34 provide a side catch that can be hooked over an edge of the workpiece to allow the user to hold steadily a longitudinal edge of the blade very close to or directly against the workpiece when the convex side of the blade 16 is against the workpiece, which facilitates reading a measurement. This is helpful in taking measurements because the curve height H of the cross section is preferably approximately 0.32 of an inch so that the curve height of the blade is relatively high.

The upper portions of the leg sections 162 extend generally upwardly and outwardly above the concave side of the blade 16 (FIG. 11) to provide structure above the concave surface of the blade 16 to hookingly engage the workpiece to facilitate extension of the blade 16 and to hold the free end of the blade 16 while a measurement is being read. For example, the blade 16 can be placed against a workpiece such that the concave side of the blade 16 is facing the workpiece and such that the opposite longitudinal edges of the blade 16 abut a surface on the workpiece at a point where they measurement is to be read. When the blade 16 is in this position, the upwardly extending portions of the legs 162 on the hook member 34 can be used to hold the free end 20 of the blade 16 against the workpiece.

It can also be appreciated from FIGS. 1-2 that the hook-shaped portion 152 of the hook member 34 provides an aesthetically pleasing "face" appearance on the front of the rule assembly 10 when the blade 16 is in the fully retracted position. Transversely spaced corners 171 on the free end 20 of the blade 16 are mitered (FIG. 4) inwardly from opposite longitudinal edges of the blade 16; the leg sections 162 of the hook member 34 extend beyond the mitered corners 171 on the opposite edges of the end 20 of the blade 16. The mitered corners 171 prevent the user from being scratched or cut by the corners on the end of blade 16. Preferably each corner 171 is mitered inwardly from the respective opposite longitudinal edge starting at a distance of approximately 3/32 of an inch from the free end of the blade 16.

Preferably, the housing opening 22 has a height dimension that exceeds the height dimension of the hook member mounting portion 150 and its connection with the free end of the blade 16 by an amount which is at least approximately equal to the amount the hook portion 152 of the hook member 34 extends below a bottom end surface 170 of the housing assembly 12 at the housing opening 22 when the hook member 34 is at the housing opening 22 (FIG. 11). This height of the opening 22 is provided to prevent possible damage to the hook member 34 when the blade 16 is fully retracted and the hook member 34 is impacted (by dropping or the like) in a direction that tends to move the hook member 34 upwardly with respect to the opening 22.

The details of the construction of the housing opening 22 can be appreciated from FIGS. 4 and 11. It can be appreciated that the axially extending fastener 58 in the corner 96 must be spaced upwardly in the housing assembly 12 a sufficient distance to allow the opening 22 to have sufficient height to protect the hook member during impact. The location of this fastener 58 in the corner 96 is restricted by the dimensions of the corner 96. Specifically, the arcuate path followed by the arcuate holding member 126 between its inoperative position and its blade holding position defines the interior extent of the bottom corner 96 of the housing assembly and a lower front wall portion 200 at the front of the housing assembly 12 generally defines the forward extent of the bottom corner 96. Thus, it can be appreciated FIG. 4 that the tape assembly 10 must be constructed so that the holding member 126 and the front wall portion 200 cooperate to allow the fastener 58 to be positioned upwardly relative to the housing assembly

12 sufficiently to allow the housing opening 22 to have the height as aforesaid. The heights of prior art housing openings are generally restricted by the position of a fastener over the housing opening. Prior art housing assembly construction prevented the fastener from being spaced upwardly far enough to provide an opening having a height dimension large enough to protect the hook member from impact damage as aforesaid. The present invention overcomes this problem by constructing the lower front wall portion 200 of the housing assembly so that it is essentially flush with the central portion 204 of the front of the housing assembly. By positioning the lower front wall portion 200 essentially flush with the central front wall portion 204, the associated axially extending fastener 58 can be moved upwardly sufficiently to allow the housing assembly opening 22 to have a height as recited sufficient to protect the hook member in the event of impact. Specifically, the increased housing opening height allows the bottom edge 177 to move upwardly to a position flush with the bottom surface 170 of the housing assembly 12 adjacent the opening 22 before the mounting portion 150 of the hook member 34 impacts any downwardly facing surfaces on the housing assembly 12.

It can be appreciated from FIG. 4 that in the exemplary embodiment of the tape assembly 10, the interior free end 128 of the holding member 126 is disposed generally above the mounting portion 150 of the hook member 34 when the hook member 34 is at the opening 22. The recess 129 is provided in the free end 128 of the holding member 126 so that if the hook member 34 is caused to move upwardly in the opening 22 because of an impact, the free end 128 of the holding member 126 does not prevent upward movement of the hook member 34 in the opening 22 so that the bottom edge 177 can move upwardly to a position flush with exterior housing assembly 12 bottom end surface 170. More particularly, the central recess 129 is of a width to operatively accommodate the width of the hook member mounting portion 150. Therefore when the hook member 34 is forced upwardly in housing opening 22 by an impact, the mounting portion 150 moves upwardly into the recess 129, thereby allowing the bottom edge 177 of the hook member 34 to move upwardly sufficiently so that it is flush with the bottom end surface 170 of the housing assembly adjacent the opening 22. If the recess 129 were not provided, the free end 128 of the holding member 126 could possibly restrict the upward movement of the mounting portion 150 so that an impact on the hook portion 152 of the holding member 34 could bend of the hook member 34 against the holding member 126. The recess 129 precludes the possibility of this type of damage to the hook member 34 by allowing the holding member 34 to move upwardly in the housing assembly opening 22 at least far enough to allow the bottom edge 177 to move flush with the surface 170 at the bottom end of the housing assembly 12.

The opening 22 is constructed to allow the hook member 34 to move upwardly in the opening 22 until the upper edges of the mounting portion 150 impacts structure at the top of the opening 22. More specifically, it can be appreciated from FIGS. 4 and 11 that the lateral edges of the mounting portion 150 adjacent the hook portion 152 provide upwardly facing surfaces 206 which engage one or more downwardly facing surfaces 208 defining the housing opening 22 to limit the upward movement of the hook member 34 within the opening 22. The lateral longitudinally extending edges 210 of the blade 16 extend upwardly and outwardly beyond the upwardly facing surfaces 206 of the hook member mounting portion 150, but the edges 210 do not limit the upward movement of the hook member 34 in the opening 22. This is because when the hook member 34 moves upwardly in the opening 22 during impact, the edges 210 of the blade 16 engage the downwardly facing housing opening surfaces 208 and deflect resiliently outwardly before the mounting portion 150 of the hook member 34 engages of the upwardly facing surfaces 206. In other words, in the exemplary embodiment of the tape assembly 10 shown, the concavo-convex cross sectional curve height of the blade 16 is such that the edges 210 are normally above the upwardly facing surfaces 206 on the mounting structure 150 of the hook member 34.

When the hook member 34 at the opening 20 is moved upwardly with respect to the housing assembly opening 22 by an impact, the edges 210 of the blade 16 impact the upper portion of the opening 22 first, causing the edges 210 of the blade to flex outwardly in opposite directions, slightly flattening the blade 16 to a degree sufficient to allow the mounting portion 150 of the hook member 34 to move toward and into contact with the downwardly facing surfaces 208 at housing opening 22. When the upwardly facing surfaces 206 on a mounting portion abut the downwardly facing surfaces 208 at the opening 22, the hook member 34 reaches the upper limiting position of its upward movement in the housing opening. This upper limiting position is usually not reached, however, because preferably the tape assembly 10 is constructed and arranged such that the bottom edge 177 of the hook member 34 moves upwardly to a position flush with the surface 170 on the bottom of the housing assembly 12 before the upwardly facing surfaces 206 on the hook member 34 impact the downwardly facing surfaces 208 on the housing assembly 12. When the bottom end 177 of the hook member 34 is flush with the bottom end surface 170 of the housing assembly, the hook member 34 is protected with further impact, thereby preventing damage to the hook member 34.

It can be understood that the coiled blade 16 has a tendency to unwind and return to a straight (in the longitudinal direction), extended configuration of concavo-convex cross-section. This tendency provides a downward force on the free end 20 of the fully retracted blade 16 with respect to the housing assembly opening 22 that maintains the extended portion of the fully retracted blade 16 against the bottom of the housing assembly interior at the opening 22 and thereby normally maintains a portion of the hook member 34 of the fully retracted blade 16 below the bottom surface 170 of the exterior of the housing assembly 12. This allows the tape assembly user to easily hook the hook member 34 on a structure such as a workpiece because a portion of the hook member 34 is normally below the surface 170.

One skilled in the art will understand that the embodiment of the tape rule assembly 10 shown in the figures and described above is exemplary only and not intended to be limiting. It is within the scope of the invention to provide any known tape rule assembly with any or all of the features of the present invention. For example, the clear film of plastic material can be applied to any known tape rule assembly. Similarly, an end hook member constructed according to the principles of the present invention can be applied to any known rule assembly.

The features of the housing assembly including the molded plastic construction, the shape of the housing, the use of relatively few bolts, the elimination of bolts in the upper portion of the housing assembly, the manner in which the spindle is mounted therein, the height dimension of the housing assembly opening relative to the dimension of the downwardly extending portion of the hook member on the free end of the blade and construction of the finger engaging portion on the bottom surface of housing assembly can be used separately or in combination on any existing tape rule assembly.

Similarly, the geometry of the cross-section of the blade and the general teachings of the dimensions and construction of the blade and coil spring can be used on any existing tape rule assembly.

The construction of the fitment, including the construction of the tangentially extending transversely spaced elongated ridges thereof can be used on any known tape rule assembly. It can also be understood that even though it is preferable to construct the tape rule assembly having the ridges on a separate fitment, it is contemplated to provide an embodiment of the tape rule assembly in which the ridges are formed integrally on the housing members of the housing assembly. It can also be appreciated that it is contemplated to use any of the aforementioned features singly or in any appropriate combination on a tape rule assembly that has a spring-powered retractable blade or, alternatively, on any tape rule assembly in which the blade is manually retracted.

It can be appreciated by one skilled in the art that it is within the scope of the present invention to apply the teachings presented herein to construct a tape measure of a wide range of sizes and that it is not intended to limit the invention to the embodiments or to the specific measurements or ranges of measurements presented herein. It can be understood, for example, that it is within the scope of the invention to construct a retractable tape measure assembly that includes a one inch wide (i.e., flattened width) tape blade with increased standout. Because it is contemplated to provide tape measure assemblies with the features of the invention enumerated herein separately or in any combination, it can be understood that a wide range of tape measure assemblies having one inch wide blades could be constructed. More specifically, a tape measure assembly having one inch wide blade could include for example, a cross-section blade geometry; a small footprint housing; a hook member; a protective film; a housing opening height and hook member size; and/or a fitment with transversely extending ribs all as described above in any combination.

It will thus be seen that the objects of the present invention have been fully and effectively accomplished. It will be realized, however, that the foregoing specific embodiments have been shown and described for the purposes of illustrating the functional and structural principles of the present invention and is subject to change without departure from such principles. Therefore, this invention includes all modifications encompassed within the spirit and scope of the following claims.

WHAT IS CLAIMED IS:

1. A retractable rule assembly comprising

a housing assembly;

a reel rotatably mounted in said housing assembly;

an elongated blade formed of a ribbon of metal having one end connected to said reel, said blade extendable from a position tangential to said reel outwardly through a spaced opening in said housing assembly, said elongated blade housing a concavo-convex configuration when extended from said housing assembly, said elongated blade having measuring indicia formed on the concave side thereof, and a clear, protective coating provided on both said concave and convex side of said blade throughout the length of the blade for inhibiting wear of said measuring indicia;

a coil spring formed of a ribbon of metal constructed to rotate said reel in said housing assembly in a direction to wind up the elongated blade when extending outwardly of said housing assembly opening in said concavo-convex cross-sectional configuration onto said reel in an abutting volute coil formation in a flattened cross-sectional configuration; and

a blade holding assembly constructed to hold the blade in any position of extension outwardly of said housing assembly opening and to release the blade from any position in which it is held;

a relatively short free end portion of said blade having a film of plastic material overlying said protective coating on at least one of the convex and concave side of the blade, said film of plastic material having a thickness greater than a thickness of said protective coating.

2. A retractable rule as defined in claim 1, wherein said film is comprised of a material selected from a group consisting of polyurethane, Mylar and Nylon.

3. A retractable rule as defined in claim 2, wherein said film selected from said group is secured to said plastic coating with an acrylic adhesive.

4. A retractable rule as defined in claim 3, wherein said film extends from the free end of the blade to approximately the point where the blade is in said abutting volute configuration when said blade is fully retracted.

5. A retractable rule as defined in claim 3, wherein the length of the portion of the blade covered by said film is approximately 12 inches or less.

6. A retractable rule as defined in claim 5, wherein said film has a thickness dimension within a range of 0.006" to 0.014".

7. A retractable rule as defined in claim 6, wherein said retractable rule further comprises an end hook member formed of sheet metal of a predetermined thickness to include a concavo-convex mounting portion and a U-shaped hook portion that is bent at a generally right angle from an end of said mounting portion, and

said end hook member being mounted on the free end of said blade with the mounting portion of said hook member being secured for limited movement with respect to the free end of the blade so that said rule can be measured externally from an exterior surface of said U-shaped hook portion or internally from an interior surface of said U-shaped hook portion.

8. A retractable rule as defined in claim 3, wherein said film has a thickness dimension within a range of 0.006" to 0.014".

9. A retractable rule as defined in claim 8, wherein said retractable rule further comprises an end hook member formed of sheet metal of a predetermined thickness to include a concavo-convex mounting portion and a U-shaped hook portion that is bent at a generally right angle from an end of said mounting portion,

said end hook member being mounted on the free end of said blade with the mounting portion of said hook member being secured for limited movement with respect to the free end of the blade so that said rule can be measured externally from an exterior surface of said U-shaped hook portion or internally from an interior surface of said U-shaped hook portion, and

wherein said film is adhered to said convex side of said blade from the free end thereof a length that is within a range of from approximately 2" to approximately 12".

10. A retractable rule as defined in claim 8, wherein said housing opening has a height dimension which exceeds the height dimension of said hook member mounting portion and its connection with the free end of said blade an amount which is at least approximately equal to the amount said hook portion extends below said bottom end surface of said housing assembly when at said housing opening.

11. A retractable rule as defined in claim 10, wherein the lateral edges of said mounting portion adjacent said hook portion provide upwardly facing surfaces which engage one or more downwardly facing surfaces defining the housing opening to limit the upward movement of said hook member within said opening.

12. A retractable rule as defined in claim 11, wherein the lateral edges of said blade extend outwardly and upwardly beyond the upwardly facing surfaces of said hook member mounting portion which engage said downwardly facing housing opening surfaces and deflect outwardly prior to

the engagement of the upwardly facing surfaces of said mounting portion, said locking member including a blade engaging and locking free end portion, said locking free end portion including a central recess of a width to operatively accommodate the width of said hook member mounting portion.

13. A retractable rule as defined in claim 1, wherein the film of plastic material has measuring indicia formed thereon.

14. A retractable rule as defined in claim 1, wherein the film of plastic material comprises a plurality of layers of plastic material.

15. A retractable rule as defined in claim 1, wherein the film of plastic material comprises at least one reinforcing member.

16. A retractable rule as defined in claim 15, wherein the reinforcing member is a fiber.

17. A retractable rule as defined in claim 1, wherein the film of plastic material extends across a width of the blade ranging from about 25% to about 100% of the blade width.

18. A retractable rule as defined in claim 17, wherein the film of plastic material extends across 100% of the blade width.

19. A retractable rule according to claim 1, wherein said protective coating comprises a plastic material having a thickness dimension less than about .0035".

20. A retractable rule according to claim 1, wherein said indicia is provided by a layer of paint between said blade and said protective coating, said layer of paint having a thickness of between .0006" - .0014".

21. A retractable rule according to claim 20, wherein said protective coating is formed from a material selected from the group consisting of: polyamides, polyvinyl, polyesters, silicone, polyimides, polyethylene, fluoropolymers and polyethylene terephthalate.

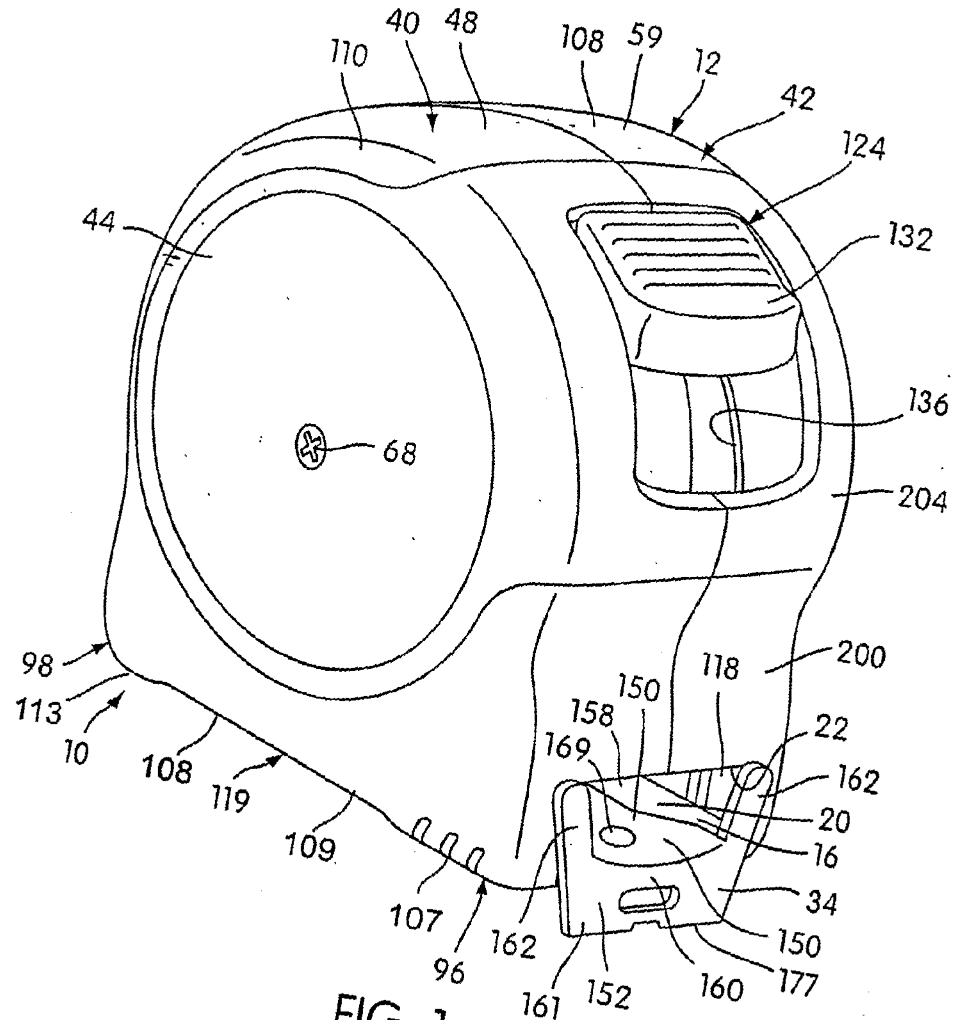

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FIG. 1

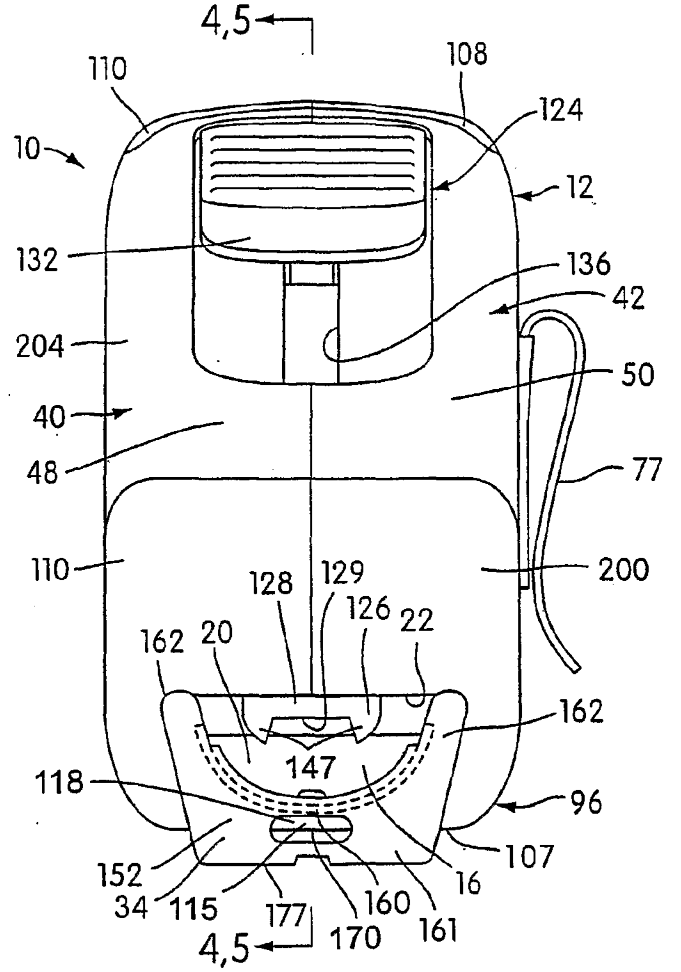
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FIG. 2

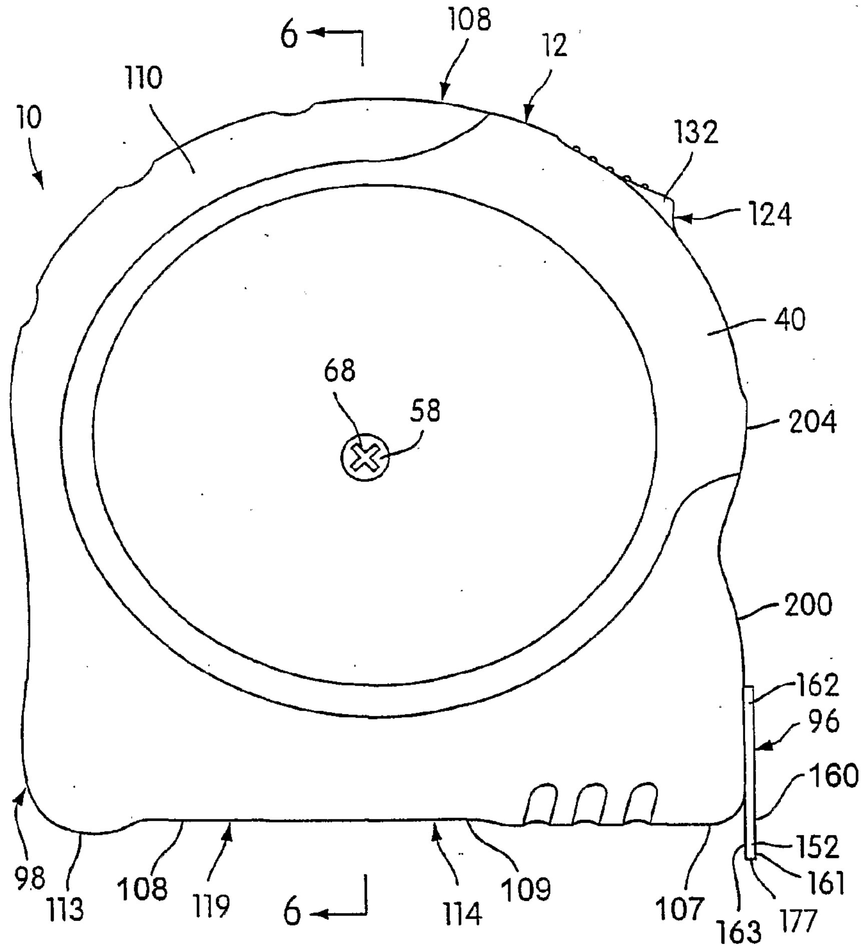
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FIG. 3

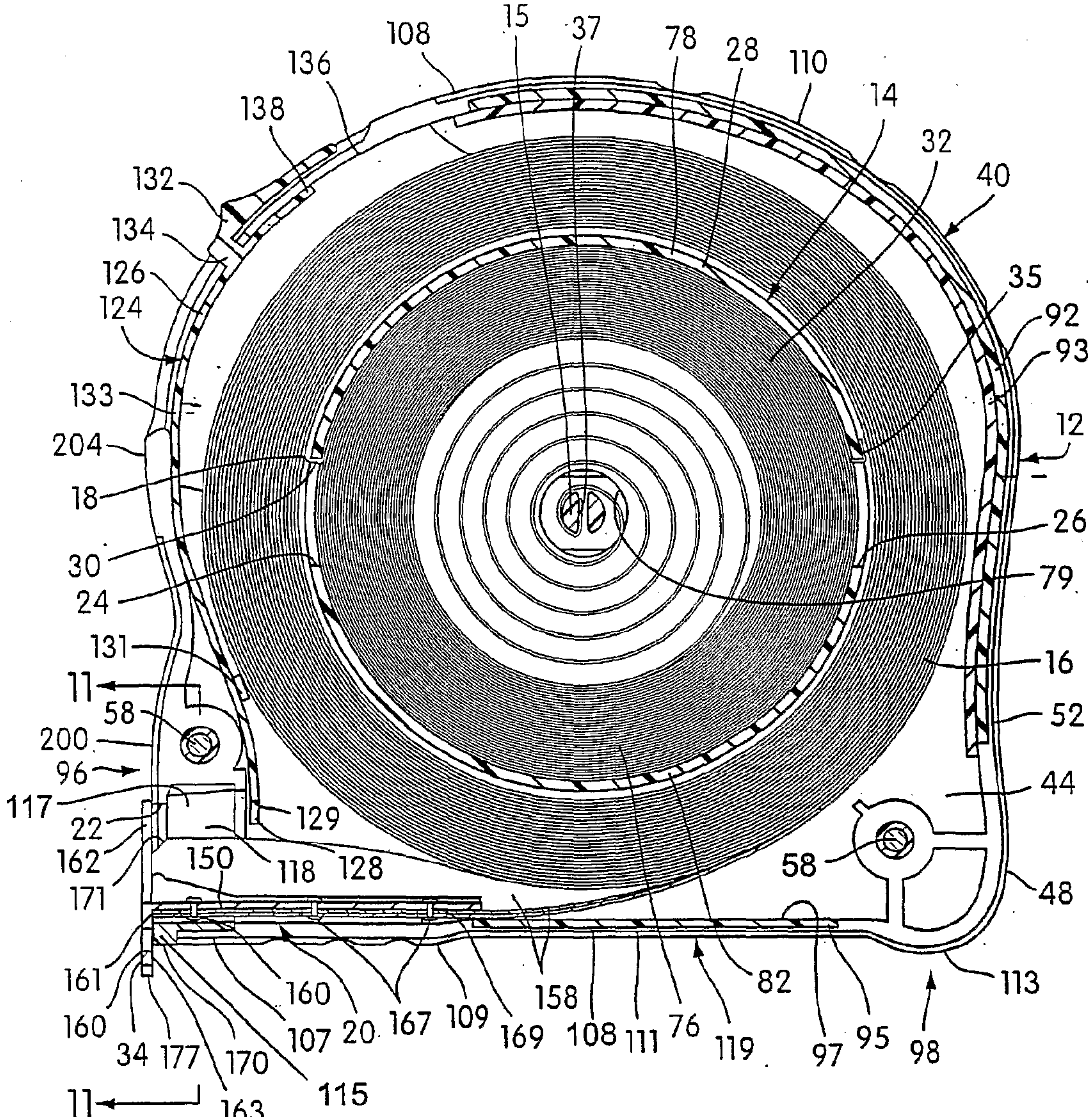
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FIG. 4

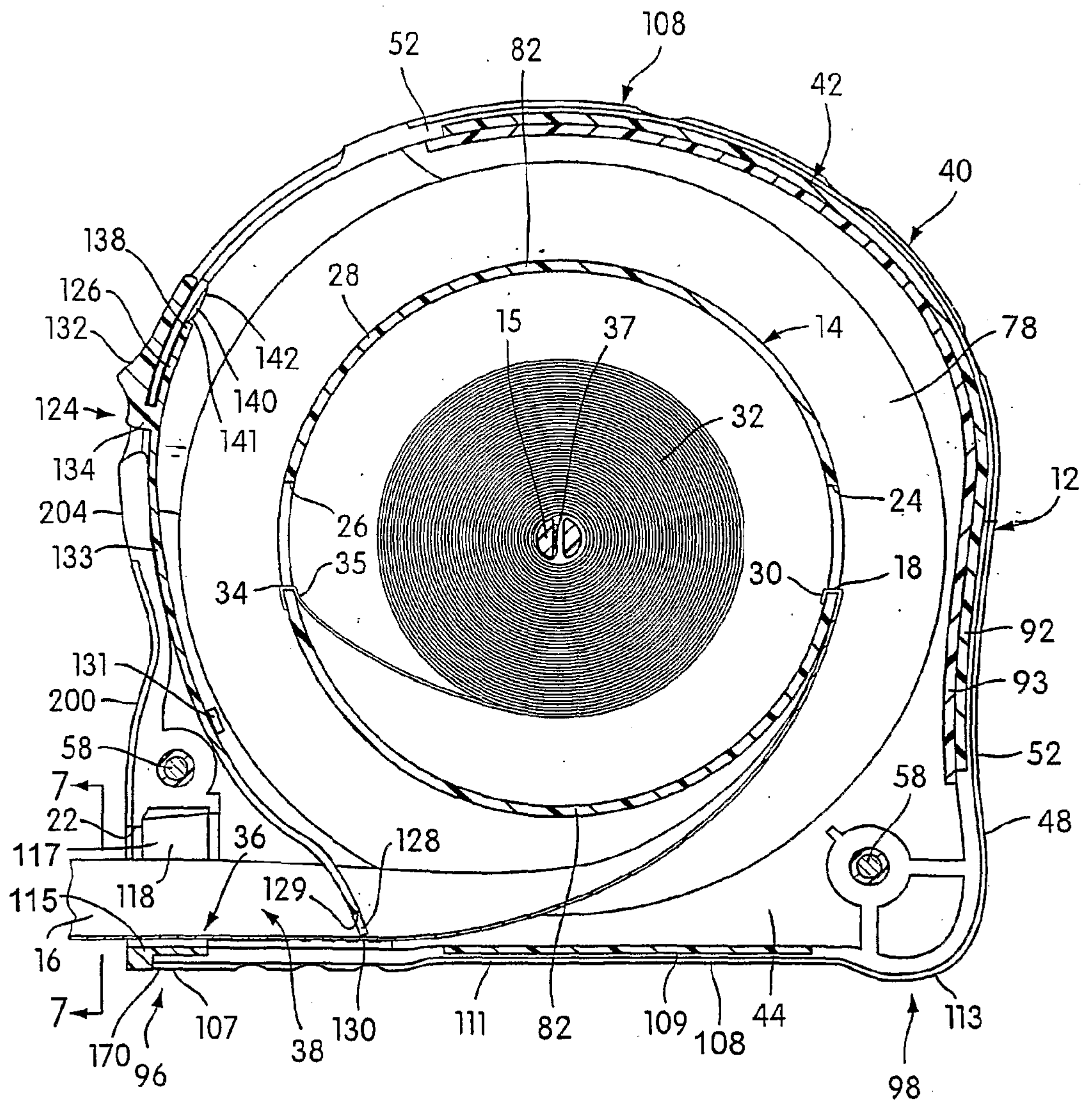
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FIG. 5

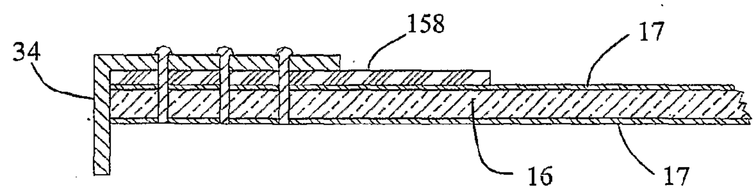

FIG. 5a

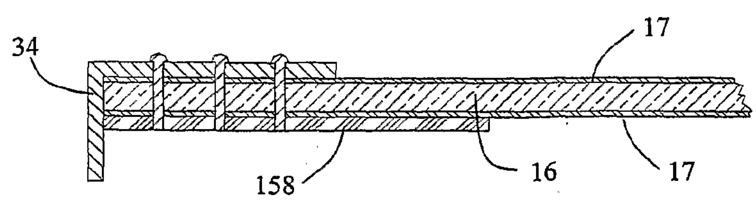

FIG. 5b

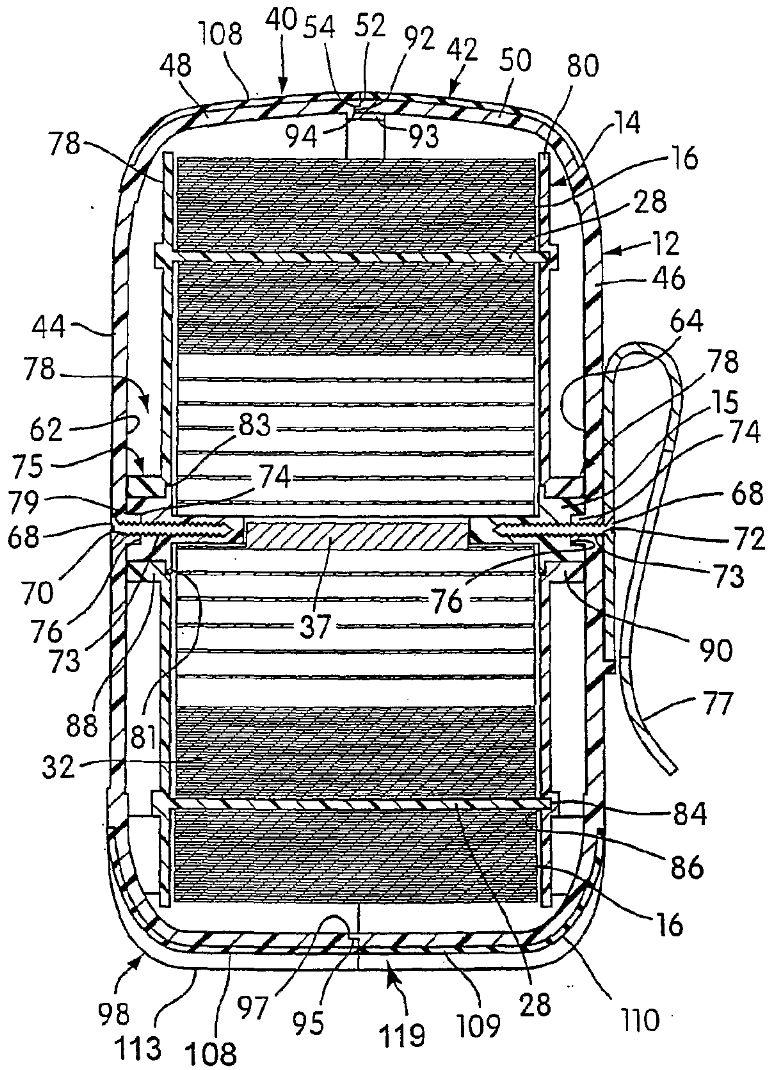
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FIG. 6

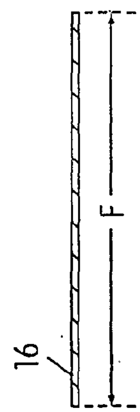

FIG. 8

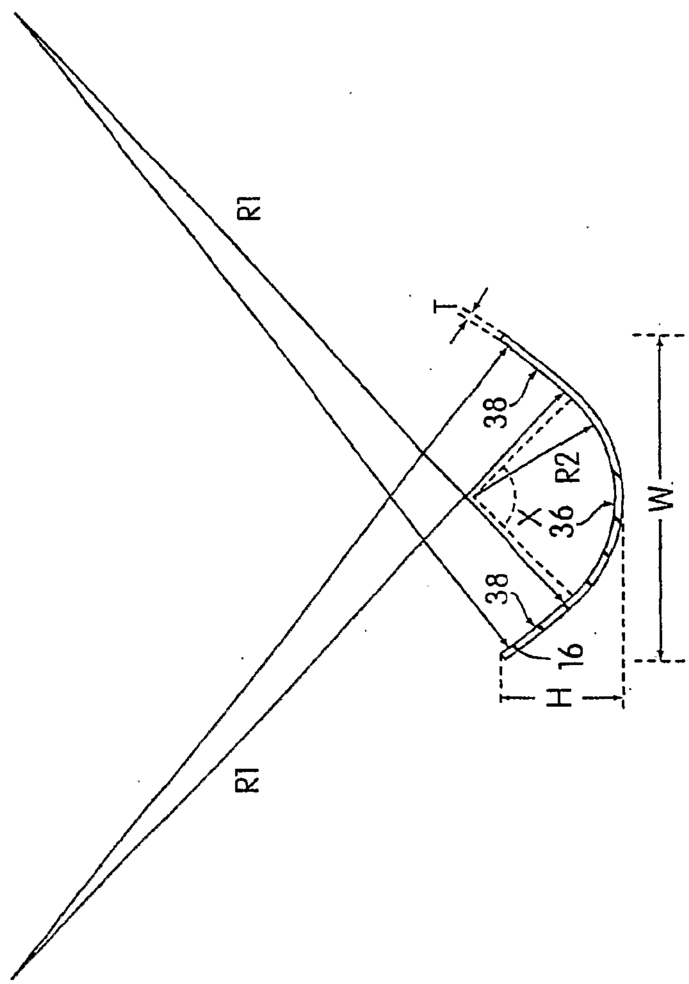

FIG. 7

	*BLADE / SPRING WIDTH (IN)	*BLADE / SPRING THICKNESS (IN)	"ARCUATE" LENGTH-OUT "C" (IN / FT) [RANGE +/- 6 (IN)]	***LINEAR LENGTH-OUT "B" (IN) [RANGE +/- 3%]	TAPE RULE REQUIRED HEIGHT TO ACHIEVE FULL BLADE EXTENSION "A" (IN) [RANGE +/- 3%]	PERCENT LINEAR TO ARCUATE LEGNTH-OUT	**** MAXIMUM TAPE RULE ROTATION ANGLE "D" AT FULL EXTENSION (DEGREES)
PRIOR ART	1.000 / 0.875	0.0045 / 0.0051	84 / 7 FT	79	23	94%	>45
PRIOR ART	1.000 / 0.875	0.0051 / 0.0056	84 / 7 FT	80	22	95%	>45
PRIOR ART	1.000 / 0.875	0.0051 / 0.0056	96 / 8 FT	86	40	90%	>45
PRIOR ART	1.000 / 0.875	0.0056 / 0.0060	84 / 7 FT	81	18	96%	>45
PRIOR ART	1.000 / 0.875	0.0056 / 0.0060	96 / 8 FT	91	31	95%	=/<35
PRIOR ART	1.000 / 0.875	0.0056 / 0.0060	108 / 9 FT	93	53	86%	=/<25
	1.250 / 1.250	0.0051 / 0.0051	84 / 7 FT	83	5	99%	>45
	1.250 / 1.250	0.0051 / 0.0051	96 / 8 FT	95	8	99%	>45
	1.250 / 1.250	0.0051 / 0.0051	108 / 9 FT	107	17	99%	>45
	1.250 / 1.250	0.0051 / 0.0051	120 / 10 FT	119	30	99%	>45
	1.250 / 1.250	0.0051 / 0.0051	132 / 11 FT	129	38	98%	>45

* BLADE WIDTH MEASURED IN FLAT FORM OR ARCUATE PERIMETER OF THE CROSS SECTION

** RAW STEEL THICKNESS WITHOUT COATING(S)

*** ACTUAL UTILITY OF TAPE BLADE STANDOUT

**** ROTATION ANGLE REQUIRED WHEN MEASURING VERTICAL POINTS ABOVE HORIZONTAL PLANE OF BLADE TIP

FIG. 9

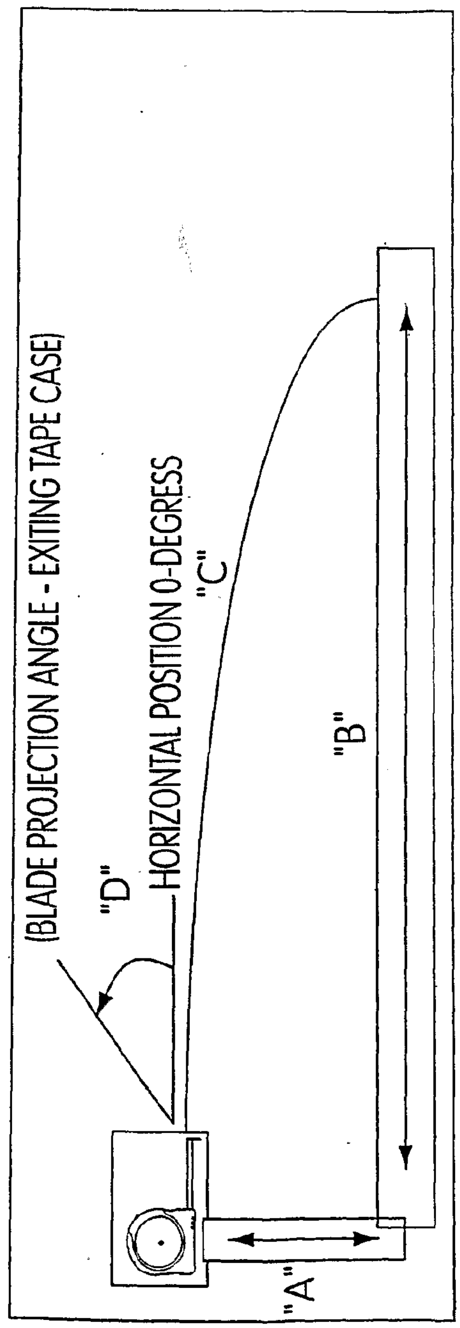
(BLADE PROJECTION ANGLE - EXITING TAPE CASE)
"D"
HORIZONTAL POSITION 0-DEGRESS
"C"
"B"
"A"

FIG. 10

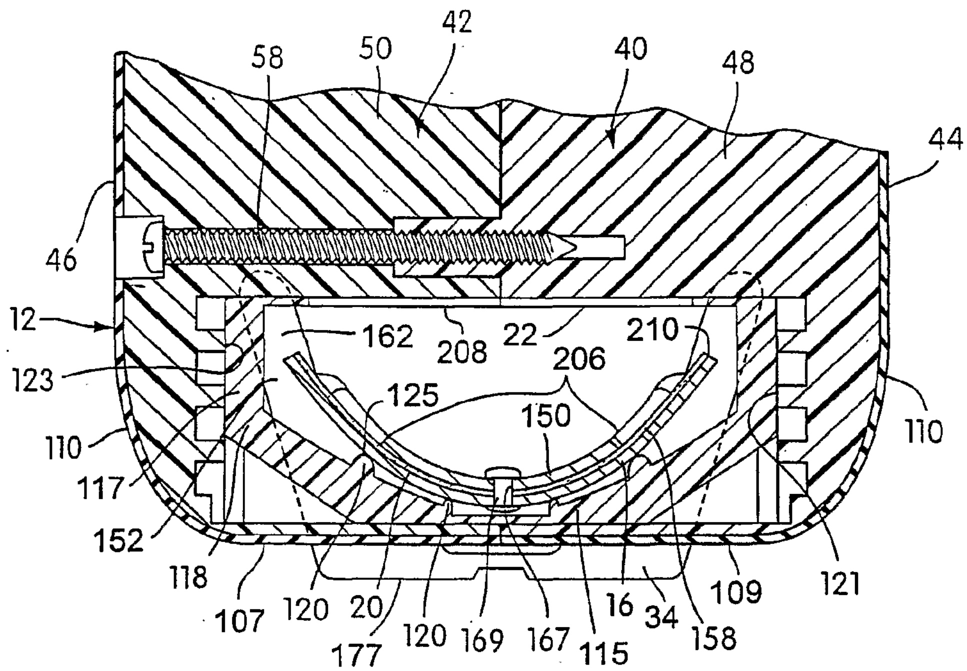
58
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FIG. 11

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US02/26616

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : G01B 3/10
US CL : 33/771
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 33/771,755,757,759,760

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	DE 3621368 A1 (KAUFMANN) 26 June 1986 (26.06.1986), figures 1-7.	1,2,13-21 --- 1-21
X --- Y	US 5,544,420 A (CHOI) 13 August 1996 (13.08.1996), figures 1, 3, 5.	1,2,13-21 --- 1-21
X --- Y	US 4,900,392 A (BRADSHAW et al) 13 Feburary 1990, column 4, lines 27-39.	1,2,13-21 --- 3-6
X --- Y	US 2,994,958 A (BEEBER) 8 August 1961 (08.08.1961), figure 4.	1,2,13-21 --- 1-21

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search 20 September 2002 (20.09.2002)	Date of mailing of the international search report 07 NOV 2002
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703)305-3230	Authorized officer Diego Gutierrez [signature] Telephone No. (703) 308-0956

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT	PCT/US02/26616

C. (Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US 1,303,756 A (BALLOU) 13 May 1919 (13.05.1919) figure 1.	3-6 --- 7-12
A	US 3,409,988 A (ZELNICK) 12 November 1968 (12.11.1968).	
A	US 4,429,462 A (RUTTY et al) 7 February 1984 (07.02.1984).	
A	US 4,459,753 A (NAGASAWA et al) 17 July 1984 (17.07.1984).	
A	US 5,581,901 A (TAKAHASHI) 10 December 1996 (10.12.1996).	
A	US 5,738,743 A (LEE) 14 April 1998 (14.04.1998).	
A	US 5,979,238 A (BOEGE et al) 9 November 1999 (11.09.1999).	
A	EP 0100138 A2 (FISHER et al) 08 Febuary 1984 (02.08.1984).	
A	DE 3621368 A1 (KAUFMANN et al) 14 January 1988 (14.01.1988).	
A	JP 404054401 A (NAKAI) 21 Febuary 1992 (21.02.1992).	
A	JP404089501 A (KOBAYASHI et al) 23 March 1992 (23.03.1992)	
A	JP357128801 A (NISHIKAWA) 10 August 1982 (10.08.1982).	

Form PCT/ISA/210 (second sheet) (July 1998)

Electronic Acknowledgement Receipt

EFS ID:	36415785
Application Number:	16113695
International Application Number:	
Confirmation Number:	3697
Title of Invention:	Tape Measure with Tape Blade Profile Increasing Tape Standout
First Named Inventor/Applicant Name:	Jonathan F. Vitas
Customer Number:	142078
Filer:	James D. Borchardt/Andrea Dietzel
Filer Authorized By:	James D. Borchardt
Attorney Docket Number:	066749-1484
Receipt Date:	26-JUN-2019
Filing Date:	27-AUG-2018
Time Stamp:	15:00:39
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	066749-1484_Transmittal.pdf	83850 d7e4114bdaec6f59a45be6d880fff3a46e13d000	no	2

Warnings:

Information:					
2	Information Disclosure Statement (IDS) Form (SB08)	066749-1484_SB08.pdf	102685 254f6c8f242a417dd82a2b8a67c30022919bab29	no	2
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
3	Foreign Reference	CN202066436U.pdf	385247 fdea73583a566ce90855b7db487012511471bac7	no	5
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Information:					
4	Foreign Reference	CN202432942U.pdf	561315 1f7f0b5c6d7181c7d6553446a5e3623e50bca9ca	no	6
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5	Foreign Reference	CN202757538U.pdf	922160 9a17ef538b9cab8242e61c1b166feb88ad0cff86	no	7
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Information:					
6	Foreign Reference	CN204612629U.pdf	972455 fe19df808c0bc04cceca5fd0ba335b2e54a3764c	no	7
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7	Foreign Reference	CN205482653U.pdf	854385 c48dcf978e4bbe100b695f0b831e334322f91e8f	no	6
Warnings:					
Information:					
8	Foreign Reference	CN2705772Y.pdf	1967983 f45166aead0267417b5e9cae869c98a59cd4cd93	no	12
Warnings:					
Information:					

9	Foreign Reference	DE19628318C1.pdf	1274545 60689077c7e952a746f861ff6bc53337b2848446	no	5
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10	Foreign Reference	EP0100138A2.pdf	1677271 b3adcea6fab2bb4ad12e5b7040f807dee50d84da	no	13
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11	Foreign Reference	EP1411319A1.pdf	372256 2b06e1ec652a5ab7e1f894cbbae03b3ae20a45a2	no	9
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12	Foreign Reference	EP1647797A1.pdf	7053491 1f554916ebd80481c6eeca5e7bc1ceb93843b273	no	32
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13	Foreign Reference	EP2400258A1.pdf	1479932 a46b11dc410db8232b7fb06237979c6119434181	no	34
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14	Foreign Reference	WO02057710A2.pdf	991613 74a960583730888bb288996b7189cb1649989cb5	no	20
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15	Foreign Reference	WO03031903A1.pdf	2669104 87b44daae38c19df7a8f79dc5dca1083551c9573	no	54
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16	Foreign Reference	WO2004063659A1.pdf	844868 c095b4b27abce4b14fec7da6764f614e67e32fcb	no	29
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17	Foreign Reference	WO2017172683A2.pdf	897843 e8bce6b34a14cc94a76c3c7312493e2a4e476348	no	19
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18	Foreign Reference	EP1444479.pdf	10133387 cba0ca28203b5c7120e372234a03a93960b2ac12	no	55
Warnings:					
Information:					
		Total Files Size (in bytes):	33244390		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Atty. Dkt. No. 066749-1484

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Milwaukee Electric Tool Corporation
Title:	Tape Measure with Tape Blade Profile Increasing Tape Standout
Appl. No.:	16/113,695
Filing Date:	August 27, 2018
Examiner:	CAPUTO, LISA M
Art Unit:	2855
Confirmation Number:	3697

INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR §1.56

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Submitted herewith on Form PTO/SB/08 is a listing of the documents known to Applicant in order to comply with Applicant's duty of disclosure pursuant to 37 CFR § 1.56.

Please note that Applicant identified that the Information Disclosure Statement filed on November 27, 2018 included foreign patent documents listed on the accompanying SB08. However, copies thereof were not submitted with that filing, and the IDS transmittal did not reference the non-English documents. This IDS is being filed to supplement the November 27, 2018 Information Disclosure Statement by providing copies of the identified foreign patent documents and update the IDS transmittal.

A copy of each non-U.S. patent document and each non-patent document is being submitted to comply with the provisions of 37 CFR § 1.97 and §1.98.

The submission of any document herewith, which is not a statutory bar, is not intended as an admission that such document constitutes prior art against the claims of the present application or that such document is considered material to patentability as defined in 37 CFR §1.56(b). Applicants do not waive any rights to take any action which would be appropriate to antedate or otherwise remove as a competent reference any document which is determined to be a *prima facie* art reference against the claims of the present application.

TIMING OF THE DISCLOSURE

The listed documents are being submitted in compliance with 37 CFR §1.97(b)(3), before the mailing date of the first Office action on the merits.

RELEVANCE OF EACH DOCUMENT

The relevance of the foreign-language document is shown in the figures of foreign-language documents and/or are described in the English-language abstract submitted herewith, where available. An English translation of the foreign-language document is not readily available. However, the absence of such translation does not relieve the PTO from its duty to consider the submitted foreign language document (37 CFR §1.98 and MPEP §609)

Although Applicant believes that no fee is required for this Request, the Commissioner is hereby authorized to charge any additional fees which may be required for this Request to Deposit Account No. 18-0882.

Respectfully submitted,

Date June 26, 2019

By /James D. Borchardt/

James D. Borchardt
Attorney for Applicant
Registration No. 62,025

Reinhart Boerner Van Deuren s.c.
Customer Number: 142078
Telephone: (414) 298-8160
Facsimile: (414) 298-8097

PTO/SB/08 (09-06)
Approved for use through 03/31/2007. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Substitute for form 1449/PTO				Complete if Known	
INFORMATION DISCLOSURE STATEMENT BY APPLICANT				**Application Number**	16/113,695
				Filing Date	August 27, 2018
Date Submitted: August 21, 2019				**First Named Inventor**	Jonathan F. Vitas
				Art Unit	2855
(use as many sheets as necessary)				Examiner Name	CAPUTO, LISA M
Sheet	1	of	1	Attorney Docket Number	066749-1484

U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Document Number Number-Kind Code[2] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
	A1	6,367,161	04-09-2002	Murray et al.	
	A2	6,473,986	11-05-2002	Sun	
	A3	6,662,463	12-16-2003	Lee	
	A4	7,107,698	09-19-2006	Liao	
	A5	7,395,608	07-08-2008	Liao	
	A6	RE39719	07-10-2007	Murray	
	A7	2013/0133215	05-30-2013	Bridges et al.	
	A8	2018/0195847	07-12-2018	Khangar et al.	
	A9	2019/0063893	02-28-2019	Vitas et al.	

UNPUBLISHED U.S. PATENT APPLICATION DOCUMENTS

Examiner Initials*	Cite No.[1]	U.S. Patent Application Document Serial Number-Kind Code[2] *(if known)*	Filing Date of Cited Document MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear

FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No.[1]	Foreign Patent Document Country Code[3]-Number[4]-Kind Code[5] *(if known)*	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Documents	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T[6]

NON PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No.[1]	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc.) date, page(s), volume-issue number(s), publisher, city and/or country where published.	T[6]

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. 1 Applicant's unique citation designation number (optional). 2 See Kinds Codes of USPTO Patent Documents at www.uspto.gov or MPEP 901.04. 3 Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). 4 For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. 5 Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. 6 Applicant is to place a check mark here if English language Translation is attached.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Milwaukee Electric Tool Corporation
Title:	Tape Measure with Tape Blade Profile Increasing Tape Standout
Appl. No.:	16/113,695
Filing Date:	August 27, 2018
Examiner:	CAPUTO, LISA M
Art Unit:	2855
Confirmation Number:	3697

INFORMATION DISCLOSURE STATEMENT UNDER 37 CFR §1.56

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Submitted herewith on Form PTO/SB/08 is a listing of the documents known to Applicants in order to comply with Applicants' duty of disclosure pursuant to 37 CFR § 1.56.

The submission of any document herewith, which is not a statutory bar, is not intended as an admission that such document constitutes prior art against the claims of the present application or that such document is considered material to patentability as defined in 37 CFR §1.56(b). Applicants do not waive any rights to take any action which would be appropriate to antedate or otherwise remove as a competent reference any document which is determined to be a *prima facie* art reference against the claims of the present application.

TIMING OF THE DISCLOSURE

The listed documents are being submitted in compliance with 37 CFR §1.97(b)(3), before the mailing date of the first Office action on the merits.

RELEVANCE OF EACH DOCUMENT

All of the documents are in English.

Applicants respectfully request that each listed document be considered by the Examiner and be made of record in the present application and that an initialed copy of Form PTO/SB/08 be returned in accordance with MPEP §609.

Although Applicant believes that no fee is required for this Request, the Commissioner is hereby authorized to charge any additional fees which may be required for this Request to Deposit Account No. 18-0882.

Respectfully submitted,

Date August 21, 2019

By /James D. Borchardt/

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Electronic Acknowledgement Receipt

EFS ID:	36937165
Application Number:	16113695
International Application Number:	
Confirmation Number:	3697
Title of Invention:	Tape Measure with Tape Blade Profile Increasing Tape Standout
First Named Inventor/Applicant Name:	Jonathan F. Vitas
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Filer:	James D. Borchardt/Andrea Dietzel
Filer Authorized By:	James D. Borchardt
Attorney Docket Number:	066749-1484
Receipt Date:	21-AUG-2019
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Application Type:	Utility under 35 USC 111(a)

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Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	066749-1484_SB08.pdf	88389 fc519a60544dbccacdd0b8787986f8768a016d53	no	1

Warnings:

Information:					
This is not an USPTO supplied IDS fillable form					
2	Transmittal Letter	066749-1484_Transmittal.pdf	82287 c4d8237d496bb08ccab5c91cc14ebff52041fd61	no	2
Warnings:					
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		Total Files Size (in bytes):	170676		

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

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