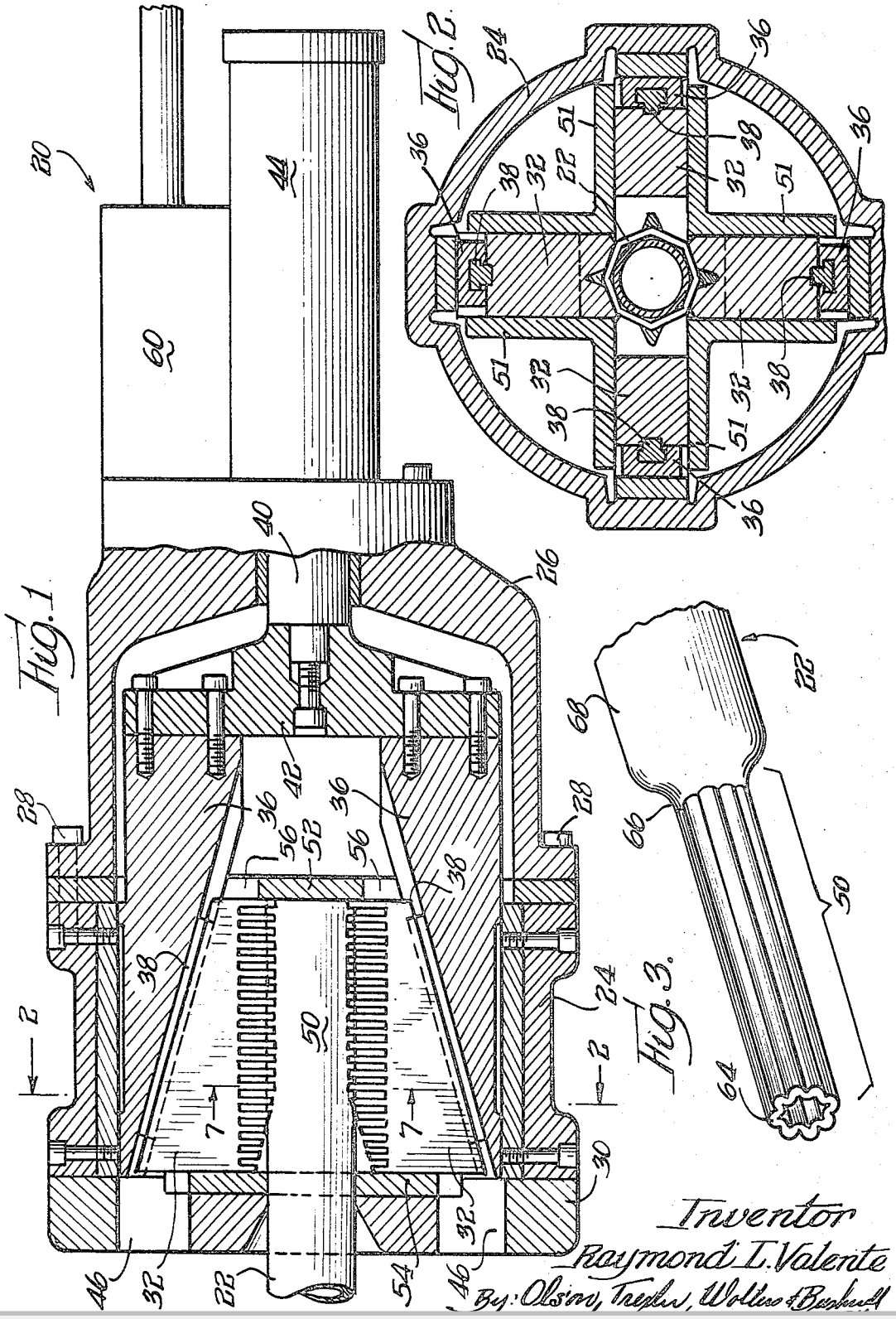
Dec. 24, 1968 R. L. VALENTE 3,417,598

APPARATUS FOR POINTING WORK PIECES

Filed Aug. 19, 1966 3 Sheets-Sheet 1



Dec. 24, 1968 R. L. VALENTE 3,417,598

APPARATUS FOR POINTING WORK PIECES

Filed Aug. 19, 1966 3 Sheets-Sheet 2

Fig. 4.

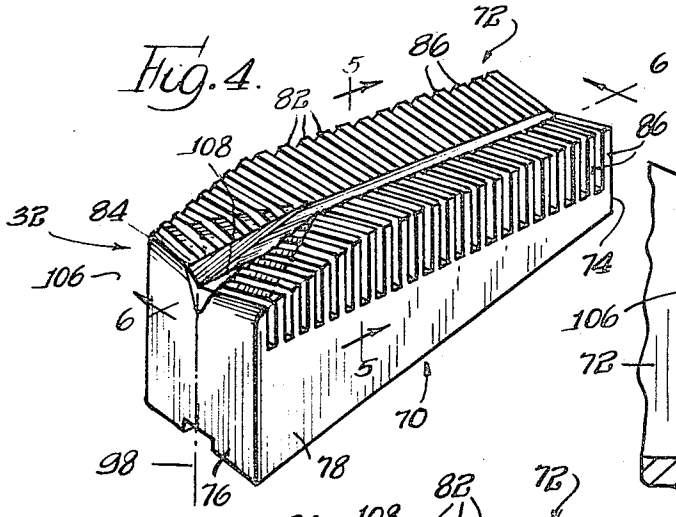


Fig. 5.

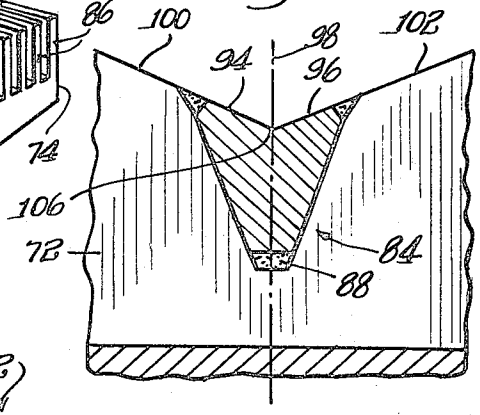


Fig. 6.

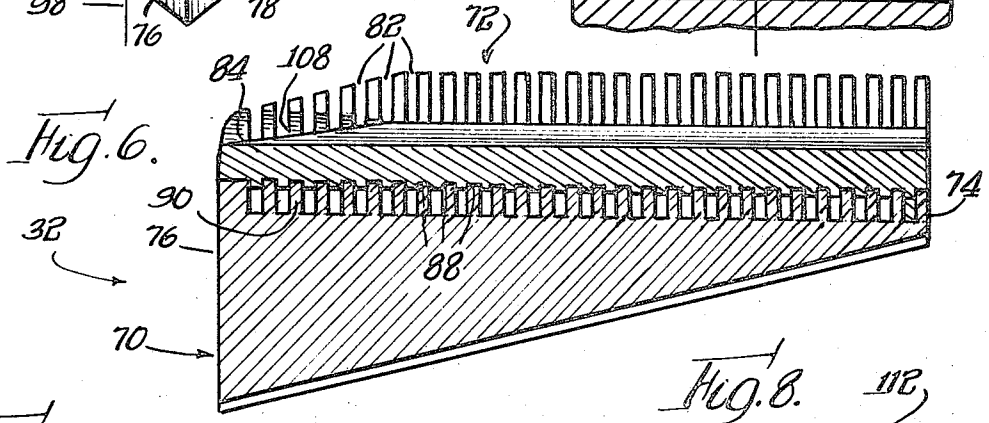


Fig. 7.

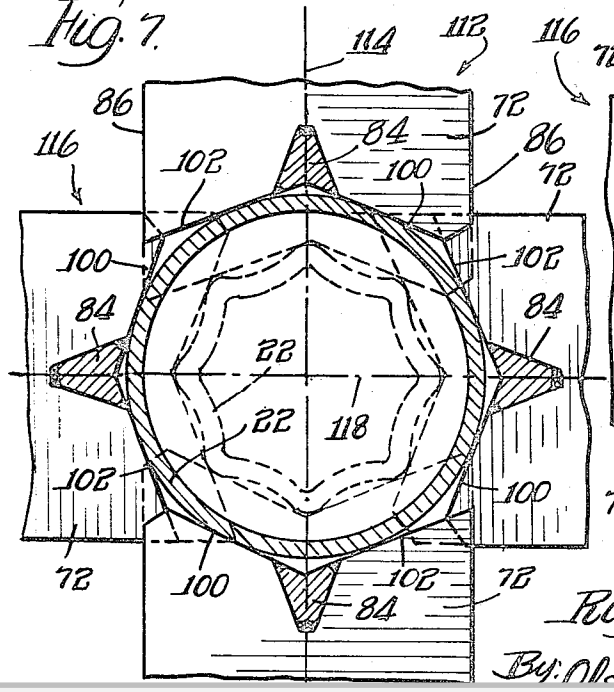
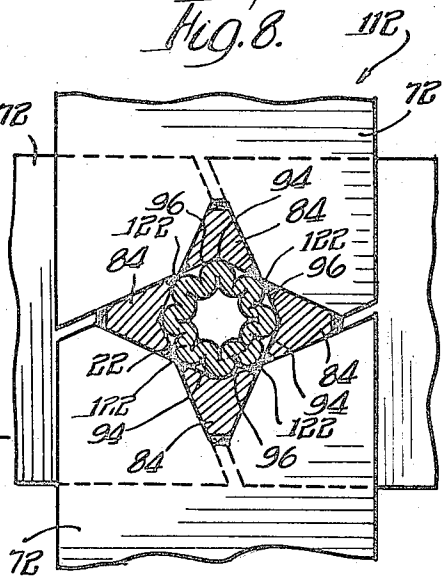


Fig. 8.



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APPARATUS FOR POINTING WORK PIECES

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Fig. 9.

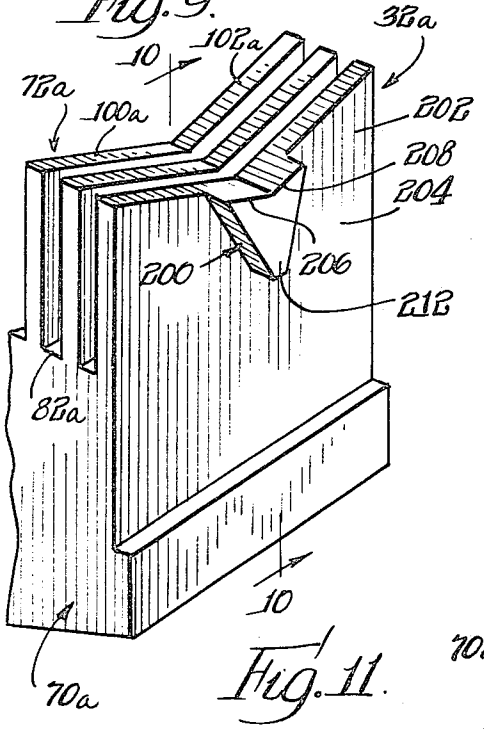


Fig. 10.

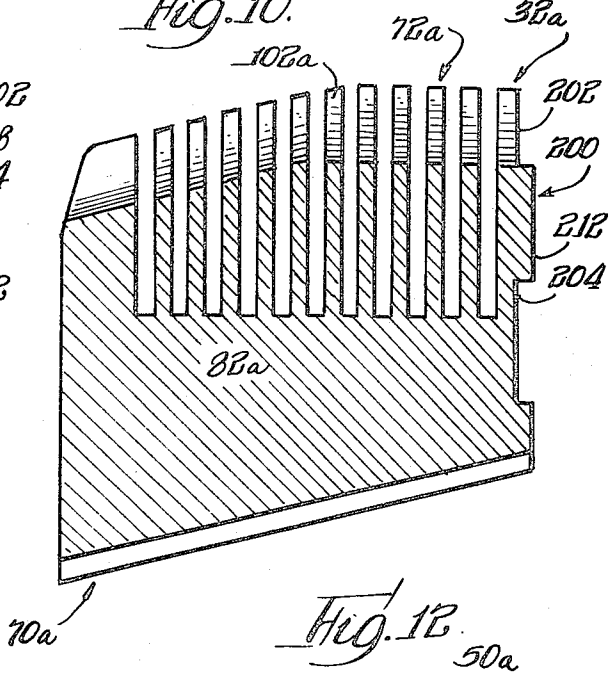


Fig. 11.

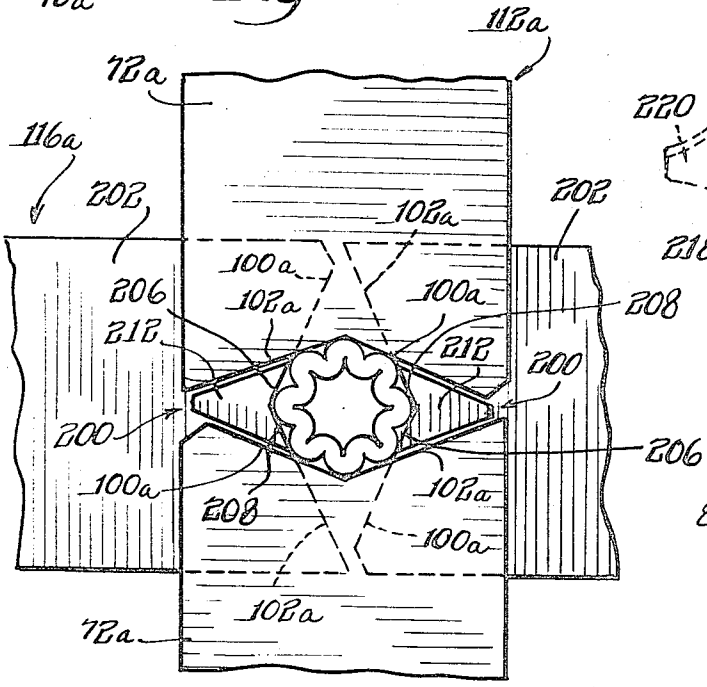


Fig. 12.

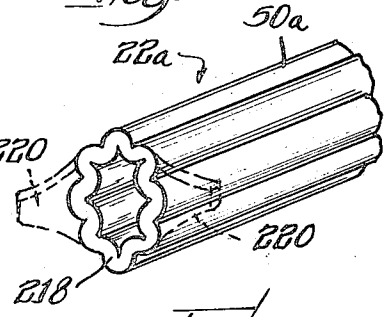
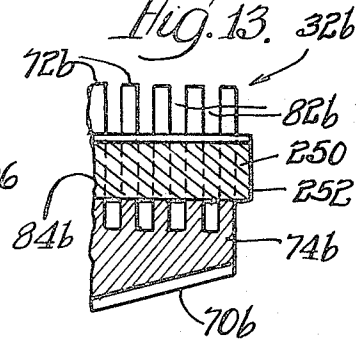


Fig. 13.



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United States Patent Office

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APPARATUS FOR POINTING WORK PIECES

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Filed Aug. 19, 1966, Ser. No. 573,650
17 Claims. (Cl. 72—383)

This invention relates generally to a workpiece shaping machine and more particularly to a die for a tube pointing machine.

The fabricators of tubes often reduce the diameter of the tube by forcing the tube through a drawing machine. It is a common practice to facilitate inserting the tube in the drawing machine by first pointing or reducing the diameter of an end portion of the tube. Tube pointing machines generally use a plurality of relatively movable forming dies to reduce the diameter of an end portion of a tube. These forming dies are mounted with work engaging ribs or blades in an interleaved arrangement. The diameter of the tube is reduced by moving the dies radially inwardly relative to the tube while increasing the interleaved relationship between the outwardly projecting workpiece engaging die ribs or blades.

The widespread industrial usage of such pointing machines clearly indicates their generally satisfactory performance. However, difficulty is frequently encountered in using the machines due to relative movement between the outwardly extending blades of a die. The relative movement between the work-engaging blades of a die is caused by the extrusion of small ridges of metal between the blades of the die as the end portion of the tube is compressed. Since the tube tends to elongate slightly in an axial direction as the end portion is compressed, the ribs are stretched and deflected axially by the ridges of metal. This deflection often, after a period of use, breaks the die blades necessitating the replacement of the relatively expensive dies.

Another problem which is frequently encountered in using prior art tube pointing machines is the formation of nibs or flashes at an outermost end portion of a tube, due to the interleaved or intermeshing arrangement of the forming dies. The nip or flash is formed between the two outermost ribs or blades and the adjacent laterally inwardly displaced intermeshing blades of the adjacent dies. Since these nibs or flashes tend to catch on the dies of a drawing machine when the end portion of a tube is inserted in the drawing machine, these nibs or flashes impede rapid insertion of a tube member into a forming machine.

Therefore, it is an object of this invention to provide a tube pointing machine die which eliminates nibs or flashes at the end of a pointed tube and which has a relatively long service life.

Another object of this invention is to provide a pointing machine die which is constructed to prevent metal from being extruded between load engaging ribs or blades of the die.

Another object of this invention is to provide a tube pointing die having load engaging blades which are not deflected when a tube is compressed.

Another object of this invention is to provide an interleaved tube pointing die assembly which circumscribes an outermost end portion of a tube to eliminate the formation of flashes or nibs when the tube is shaped.

These and other objects and features of the invention will become more apparent upon a reading of the following detailed description taken in connection with the accompanying drawings, wherein:

FIG. 1 is a partial sectional view of a tube shaping

FIG. 2 is a sectional view, along the line **2—2** of FIG. 1, illustrating the inter-relationship of a plurality of pairs of relatively movable tube shaping dies for forming a point on a tube;

FIG. 3 is an enlarged perspective view of a tube member which has been pointed or shaped by the machine of FIG. 1;

FIG. 4 is an enlarged perspective view of a tube shaping die utilized in the machine of FIG. 1;

FIG. 5 is an enlarged sectional view, taken along the line **5—5** of FIG. 4, illustrating the relationship of a longitudinally extending bar member to a vertically extending blade of a die;

FIG. 6 is an enlarged sectional view, taken along the line **6—6** of FIG. 4, illustrating the relationship of the longitudinally extending bar to the die;

FIG. 7 is an enlarged sectional view, taken along the line **7—7** of FIG. 1, illustrating in solid lines the initial relationship of a plurality of pairs of tube forming or pointing dies to a tube member and, in dashed lines, the relationship of the dies to the tube member as the tube is radially compressed by the dies;

FIG. 8 is an enlarged sectional view illustrating the relationship of the dies of FIG. 7 to each other and a tube member at the completion of a tube shaping or forming process;

FIG. 9 is an enlarged perspective view of a tube forming or pointing die illustrating a second embodiment of the invention;

FIG. 10 is an enlarged sectional view, taken along the line **10—10** of FIG. 9, illustrating the construction of the die of FIG. 9;

FIG. 11 is an enlarged view of a pair of dies, similar to the die of FIG. 9, at the completion of a tube forming and pointing operation;

FIG. 12 is a perspective view of a forwardmost end portion of a tube member shaped or pointed by the dies of FIG. 11; and

FIG. 13 is an enlarged sectional view of a die illustrating a third embodiment of the invention.

Referring now to the drawings in greater detail, there is shown in FIG. 1 a tube shaping machine **20** for pointing or otherwise shaping a cylindrical tube **22**. The machine **20** includes a cylindrical outer housing or frame **24** to which an end housing **26** is connected by bolts **28**. A face plate **30** is mounted on a rear or tube receiving end of the housing **24**. A plurality of forming or pointing dies **32** are mounted in sliding engagement with a longitudinally rearwardly extending wedge members **36**. The wedge members **36** are connected to the dies by means of a suitable key and slot arrangement **38** (see FIG. 2 also). The wedges **36** are moved rearwardly toward the face plate **30**, by means of a ram **40** which is formed with a head **42** for engaging a forwardmost end portion of the wedges **36**. The ram **40** is moved rearwardly by means of fluid pressure in a hydraulic cylinder **44**.

As the wedges **36** are moved rearwardly, they extend through apertures **46** formed in the face plate **30**. During this rearward movement, the dies **32** slide on the key and slot structure **38** and contemporaneously therewith move radially inwardly relative to the tube **22** to compress a forwardmost end section **50** of the tube. Radially inwardly extending guide walls **51** are provided for guiding the dies **32** radially inwardly (see FIG. 2). The dies **32** are retained in the longitudinal position shown in FIG. 1 by a forward positioning wall **52** and a rear plate **54** against which opposite end portions of the dies **32** are placed in an abutting relationship. The positioning wall **52** is formed with a plurality of suitably shaped

is regulated by a control assembly **60**. Tube shaping machines similar to the one illustrated are well known to those skilled in the art, and, therefore, it is believed that a further disclosure of the structural details of the machine is not necessitated at this time. However, United States Patent No. 3,154,978 to Baker is herein incorporated by this reference as setting forth in some detail the structure of such a tube shaping machine.

The structure of a tube member **22** which has been shaped or pointed by the machine **20** is illustrated in FIG. 3. A shaped or pointed end portion **50** of the tube **22** is of a substantially reduced diameter. The end portion **50** includes a plurality of acruate ridges **64** which are formed in the end portion **50** by the dies **32**. The arcuate ridges **64** extend longitudinally rearwardly of the tube until an arcuate radially outwardly extending shoulder **66** is encountered which separates the pointed end portion **50** of the tube from a larger body section **68**. The pointed or shaped tube **22** can be readily inserted in a forming machine by inserting the foremost end or pointed portion **50** into the drawing machine and pulling the relatively large diameter body section **68** of the tube through dies in the drawing machine.

Referring now to FIG. 4, taken in conjunction with FIGS. 5 and 6, it can be seen that the dies **32** include a truncated base block **70** from which a plurality of spaced-apart parallel work-engaging blades or ribs **72** extend. The die **32** has a vertically extending forward end surface **74** which engages the positioning wall **52** (FIG. 1) of the tube shaping machine **20** and a vertically extending rectangular rear surface **76** which engages the rear plate **54** (FIG. 1) of the tube shaping machine **20**. This engagement of the forward and rear surfaces **74** and **76** of the die **32** positions the die longitudinally in the tube shaping machine **20**. The die is positioned for radial movement relative to a tube by sliding engagement of trapezoidal side surfaces **78** (only one of which is shown in FIG. 4) of the die with the guide walls **51**.

The fins or blades **72** are integrally formed with the base block **70** and extend radially inwardly from the base block to engage a cylindrical outer surface of a tube which is to be shaped. The blades **72** are spaced apart by transversely extending slots **82** which have a width of the same dimension as the thickness of the blades **72**. The blades **72** are interconnected by a longitudinally extending bar member **84** which is centrally positioned intermediate outer edge surfaces **86** of the blades **72**. The bar member **84** has a series of transversely extending slots **88** (see FIG. 6) which engage a base section **90** of the outwardly extending blades **72** to securely interconnect the blades.

The longitudinally extending bar member, as is perhaps seen in FIG. 5, has a substantially triangular cross-section. A base of the triangle is formed with a pair of inwardly converging work engaging surfaces **94** and **96** which intersect at a central axis **98** of the die **32**. The blades **72** are formed with a pair of inwardly converging work engaging surfaces **100** and **102** which are substantially coplanar with the surfaces **94** and **96** of the bar member **84**. The inwardly converging surfaces **94, 96, 100** and **102** form a generally V-shaped outer work engaging surface of the die **32**. This V-shaped outer work engaging surface of the die **32** (as is best seen in FIG. 7) engages an outer surface of a tube member **22** which is to be formed to position the tube member with its longitudinally extending axis in substantial alignment with the central axis **98** of the die **32**. It should be noted that a line of intersection **106** of the work engaging surfaces **94** and **96** is coincident with a line of intersection of the work engaging surfaces **100** and **102** of the blades **72**. As is perhaps best seen in FIGS. 4 and 6, a rearward end surface **108** of the bar **84** is sloped longitudinally outwardly in a forward direction to form the shoulder **68** on a tube.

22. Two sets of blades are associated with a vertical pair of dies **112** which are movable radially inwardly toward each other along a central axis **114** which is coincident with the central axis **98** of the dies. The two remaining sets of blades are associated with a second pair of dies **116**. The dies **116** are mounted for radial inwardly movement along a horizontally extending axis **118**. The work engaging surfaces **100** and **102** of the two pairs of dies **112** and **116** position the tube **22** with its central longitudinally extending axis coincident with the intersection of the vertical axis **114** and horizontal axis **118** of the dies. The vertical pair of dies **112** are mounted in a longitudinally forwardly offset relationship relative to the horizontal pair of dies **116**. The vertical pair of dies **112** is offset relative to the horizontal pair of dies **116** by a distance equal to the thickness of a single blade or rib **72**. Blades **72** of the longitudinally offset dies **112** are, therefore, mounted in an intermeshing or interleaved relationship juxtaposed with the blades of the horizontal dies **116**. The blades of the dies **116** are located in an interleaved relationship rearwardly of the blades of the dies **112**. This interleaved or intermeshing relationship between the pairs of dies **112** and **116** results in the two pairs of dies substantially circumscribing or surrounding the tube **22**. As the dies **112** and **116** are moved simultaneously radially inwardly by the wedge members **36** (see FIG. 1), the tube **22** is deformed from the position indicated in solid lines in FIG. 7 toward the position indicated in dashed lines in FIG. 7.

As the radially inwardly movement of the dies is continued, the tube **22** is gradually compressed by the two pairs of dies to the position indicated in FIG. 8. The radially inward movement of the pairs of dies **112** and **116** is limited by the bar members **84**. As is apparent from an inspection of FIG. 8, the outer upper edges of the bar member **84** just engage each other at a longitudinally extending line of intersection **122** to limit the inward movement of the pairs of dies. At the limit of inward movement of the pairs of dies **112** and **116**, the tube **22** is circumscribed by the longitudinally extending, inwardly converging, outer surfaces **94** and **96** of the bar members **84**. Since the outer surfaces **94** and **96** extend for substantially the entire length of the die, the tube **22** is not extruded between the juxtaposed blades of the dies to form ridges on the tube which engage and deflect the blades **72**. Therefore, the longitudinally extending bar members increase the structural rigidity of the dies **32** by interconnecting the blades **72** to prevent relative movement between the blades and by preventing the tube member **22** from being extruded between juxtaposed intermeshing blades as the tube is shaped or pointed. It will also be apparent that a tube which is shaped or pointed, by the dies **32**, has a relatively smooth longitudinally extending outer surface which is substantially free from transversely extending ridges of tube material.

Referring now to FIGS. 9 through 13 in which several modified embodiment of the invention are illustrated. In these modified forms of the invention, like numerals have been used to designate like parts, with the suffix letter *a* being employed to distinguish the elements associated with FIGS. 9 through 12, and the suffix letter *b* being used to distinguish the elements associated with FIG. 13.

Referring now to FIG. 9, in which a second embodiment of the forming or pointing die **32***a* is illustrated, the die **32***a* includes a longitudinally extending base block **70***a* from which a plurality of work engaging blades or ribs **72***a* extend. As in the embodiment of the invention illustrated in FIGS. 1 through 8, the blades are separated by slots and have inwardly converging work engaging surfaces **100***a* and **102***a*. However, from an inspection of FIGS. 9 and 10, it can be seen that the blades **72***a* are not interconnected by a bar member, as are the blades of the embodiment of FIGS. 1 through 8. Since

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