IW 7546480

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September 17, 2015

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APPLICATION NUMBER: ***09/786,852***
FILING DATE: ***May 03, 2001***
PATENT NUMBER: ***6,836,926***
ISSUE DATE: ***January 04, 2005***

By Authority of the
Under Secretary of Commerce for Intellectual Property
and Director of the United States Patent and Trademark Office

R GLOVER
Certifying Officer

UNITED STATES PATENT AND TRADEMARK OFFICE
DEPARTMENT OF COMMERCE

09/786852

ISSUE SLIP STAPLE AREA (for additional cross references)

POSITION	INITIALS	ID NO.	DATE
FEE DETERMINATION			
O.I.P.E. CLASSIFIER			
FORMALITY REVIEW			
RESPONSE FORMALITY REVIEW			

INDEX OF CLAIMS

✓ .... Rejected
= .... Allowed
— (Through numeral)... Canceled
÷ .... Restricted
N .... Non-elected
I .... Interference
A .... Appeal
O .... Objected

Claim Final	Claim Original	Date 9-7-03	Date	Date	Date	Date	Date	Date	Date	Date	Date
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JC13 Rec'd PCT/PTO 09 MAR 2001

FORM PTO-1390 (Modified) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE
(REV 10-95)

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER 1524		
U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 09/786852		
INTERNATIONAL APPLICATION NO. **PCT/DE 00/02168**	INTERNATIONAL FILING DATE **JULY 6, 2000**	PRIORITY DATE CLAIMED **JULY 9, 1999**

TITLE OF INVENTION
WIPER BLADE FOR WINDSHIELDS, ESPECIALLY OF MOTOR VEHICLES, AND METHOD FOR PRDUCING SUCH A WIPER BLADE

APPLICANT(S) FOR DO/EO/US
Peter DE BLOCK

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 18 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
    A **SECOND** or **SUBSEQUENT** preliminary amendment.
16. ☐ A substitute specification.
17. ☐ A change of power of attorney and/or address letter.
18. ☒ Certificate of Mailing by Express Mail
19. ☐ Other items or information:

EF 215953499 US

Costco Exhibit 1002, p. 3

JC02 Rec'd PCT/PTO 09 MAR 2001

U.S. APPLICATION NO. (IF KNOWN, [illegible] 7 CFR 09/786852	INTERNATIONAL APPLICATION NO. PCT/DE 00/02168	ATTORNEY'S DOCKET NUMBER 1524

20. The following fees are submitted:.

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

		CALCULATIONS	PTO USE ONLY
☐ Search Report has been prepared by the EPO or JPO	**$930.00**		
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482)	**$720.00**		
☐ No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))	**$790.00**		
☒ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO	**$1,070.00**		
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)	**$98.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =		**$1,000.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).		**$0.00**	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	18 - 20 =	0	x $18.00	**$0.00**	
Independent claims	7 - 3 =	4	x $80.00	**$320.00**	
Multiple Dependent Claims **(check if applicable)**.			☐	**$0.00**	
	TOTAL OF ABOVE CALCULATIONS		=	**$1,320.00**	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) **(check if applicable).**			☐	**$0.00**	
	SUBTOTAL		=	**$1,320.00**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).			+	**$0.00**	
	TOTAL NATIONAL FEE		=	**$1,320.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).**			☐	**$0.00**	
	TOTAL FEES ENCLOSED		=	**$1,320.00**	
				Amount to be: refunded	$
				charged	$

☐ A check in the amount of to cover the above fees is enclosed.

☒ Please charge my Deposit Account No. **19-4675** in the amount of **$1,320.00** to cover the above fees. A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **19-4675** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

STRIKER, STRIKER & STENBY
103 EAST NECK ROAD
HUNTINGTON, NEW YORK 11743

SIGNATURE

MICHAEL J. STRIKER
NAME

27233
REGISTRATION NUMBER

MARCH 9, 2001
DATE

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09/786852

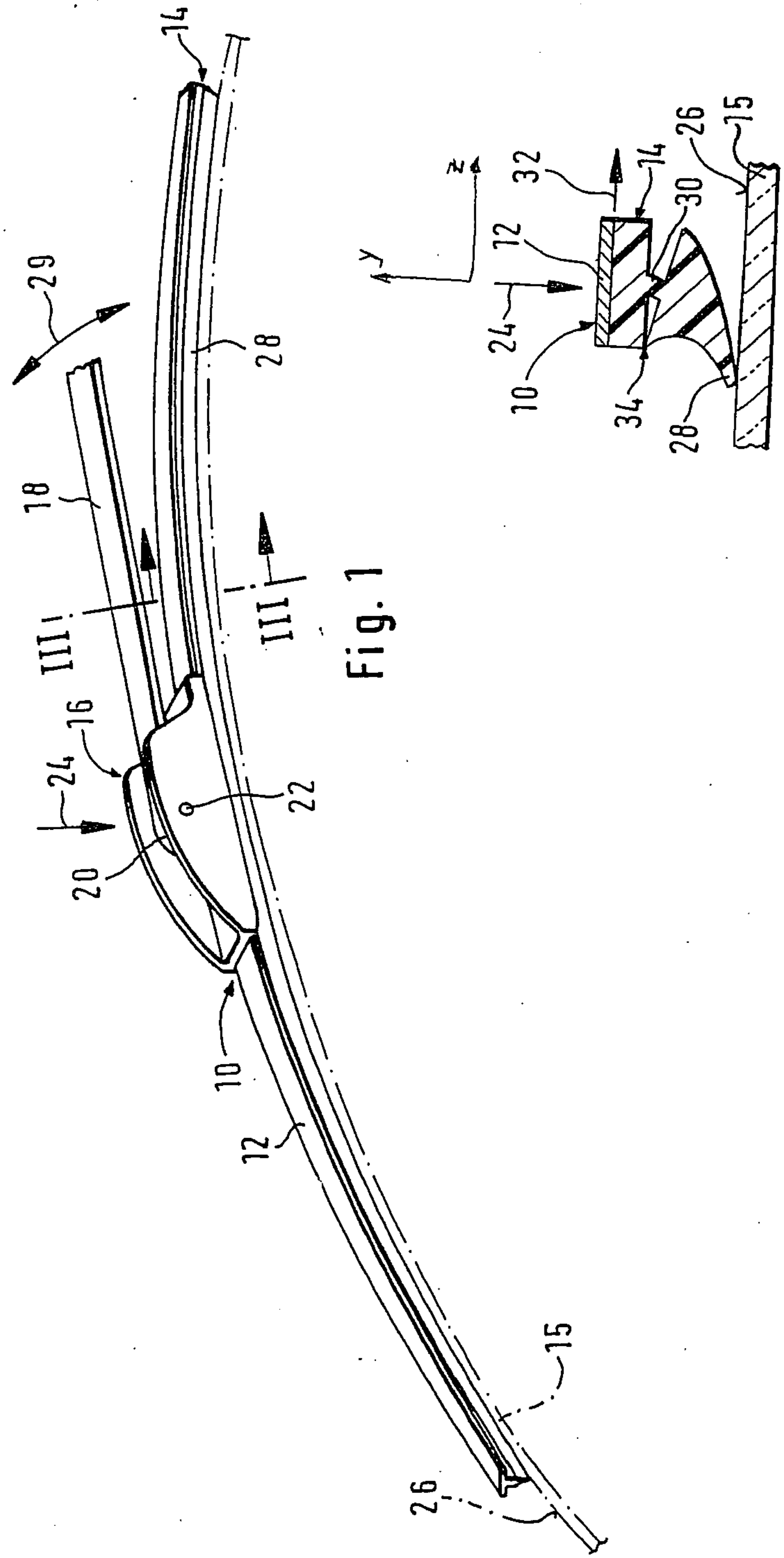

Fig. 1

Fig. 3

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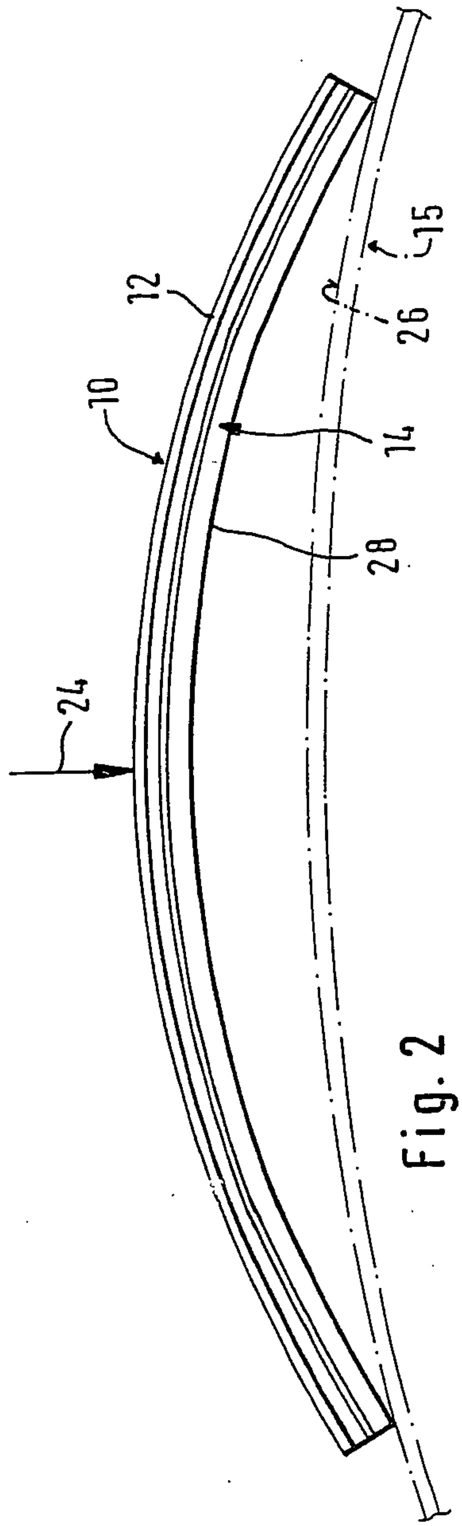

Fig. 2

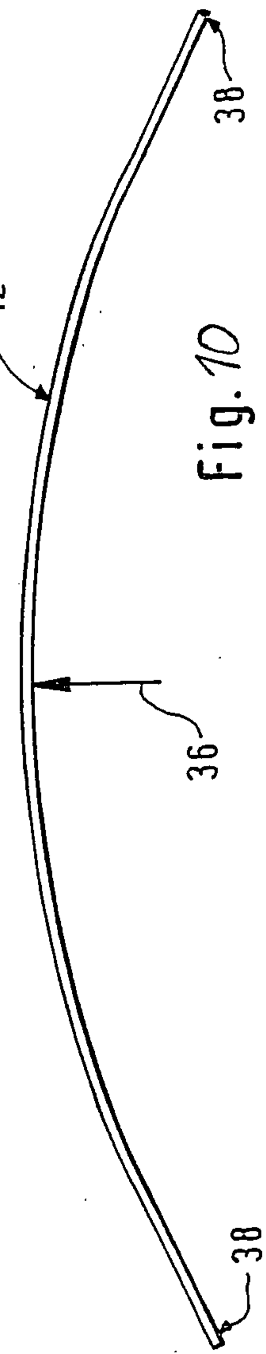

Fig. 10

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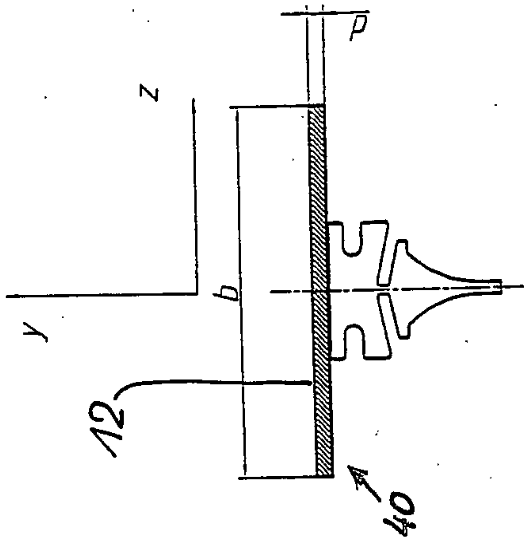

Fig. 4

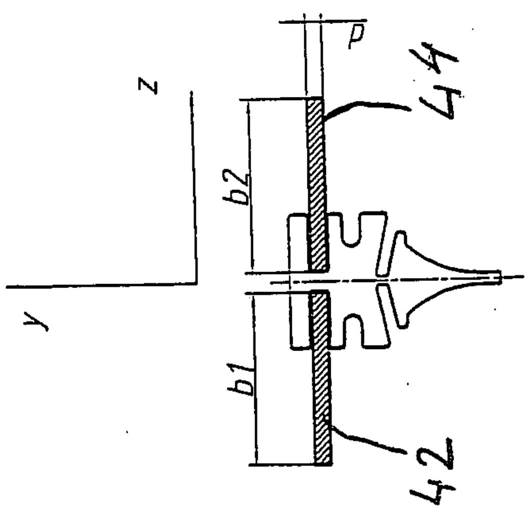

Fig. 5

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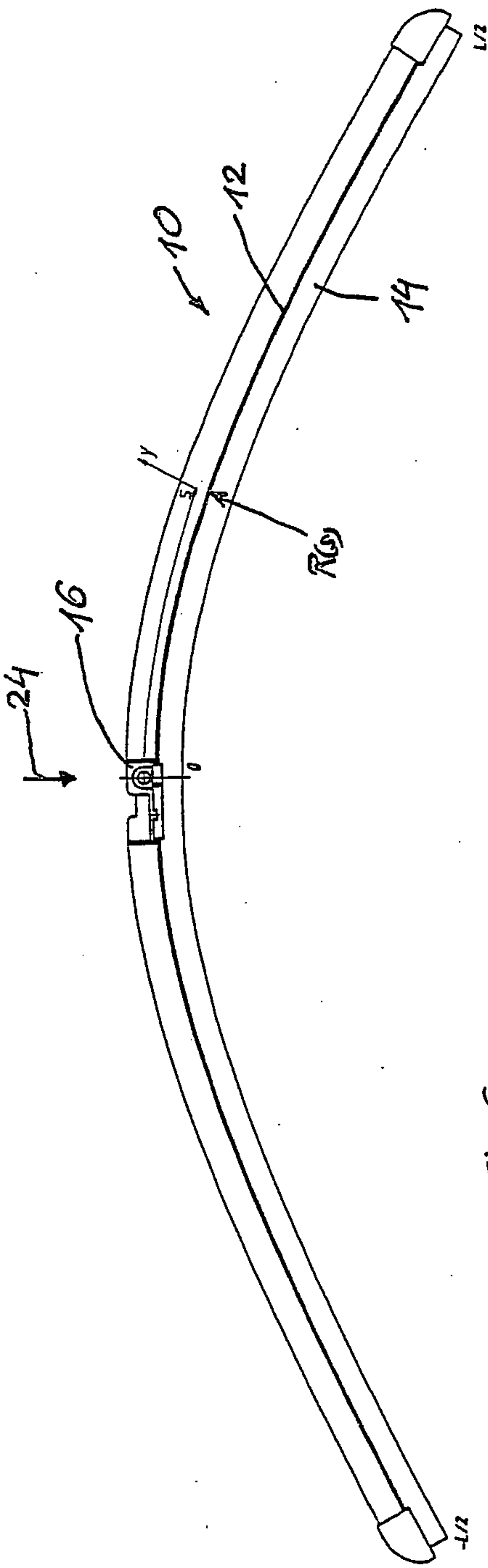

Fig.6

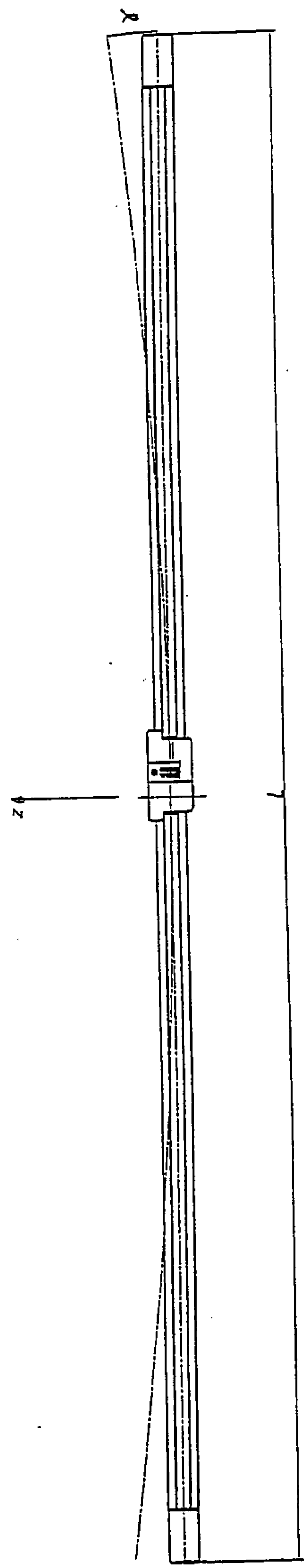

Fig.7

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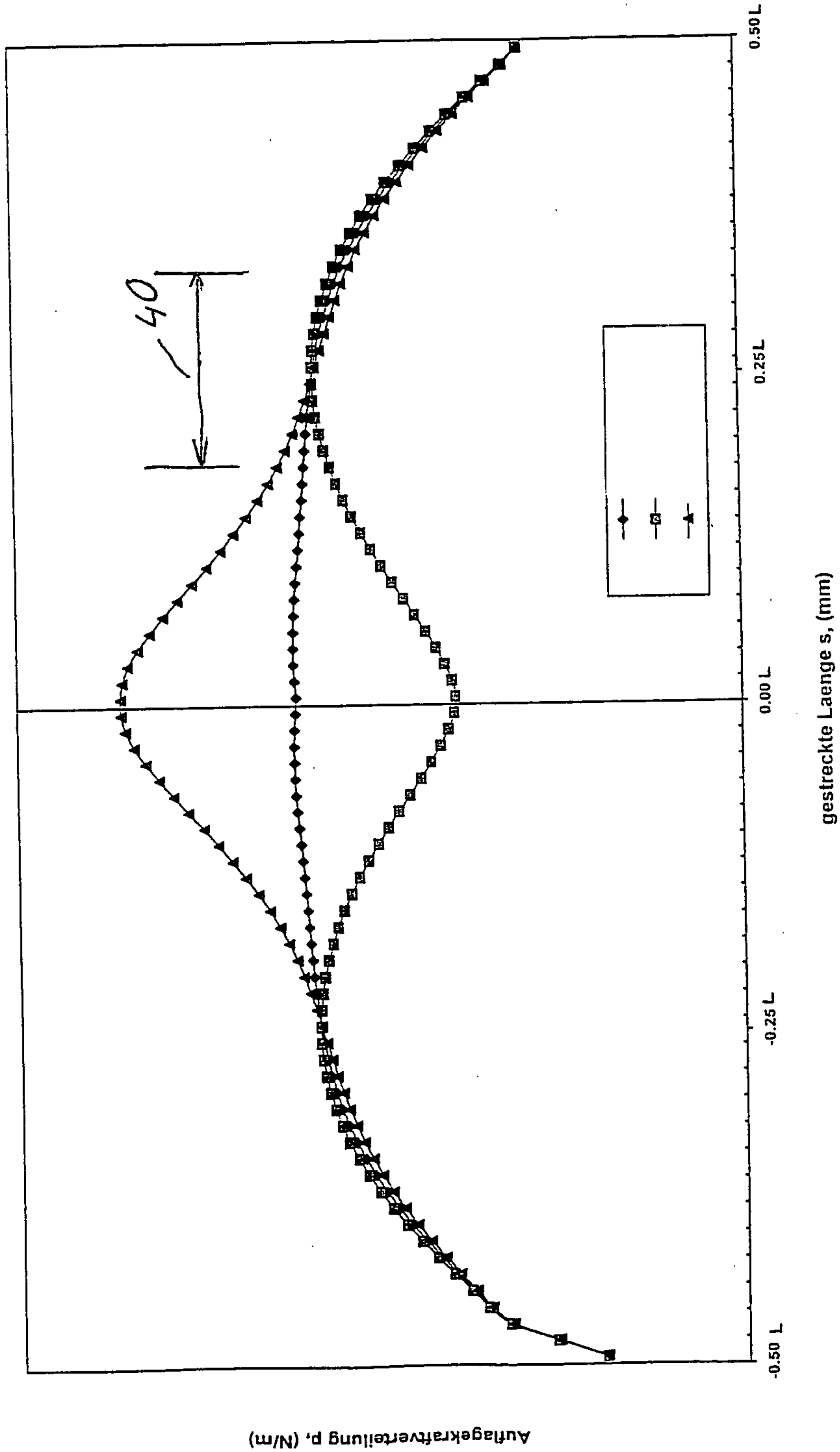

Fig. 8

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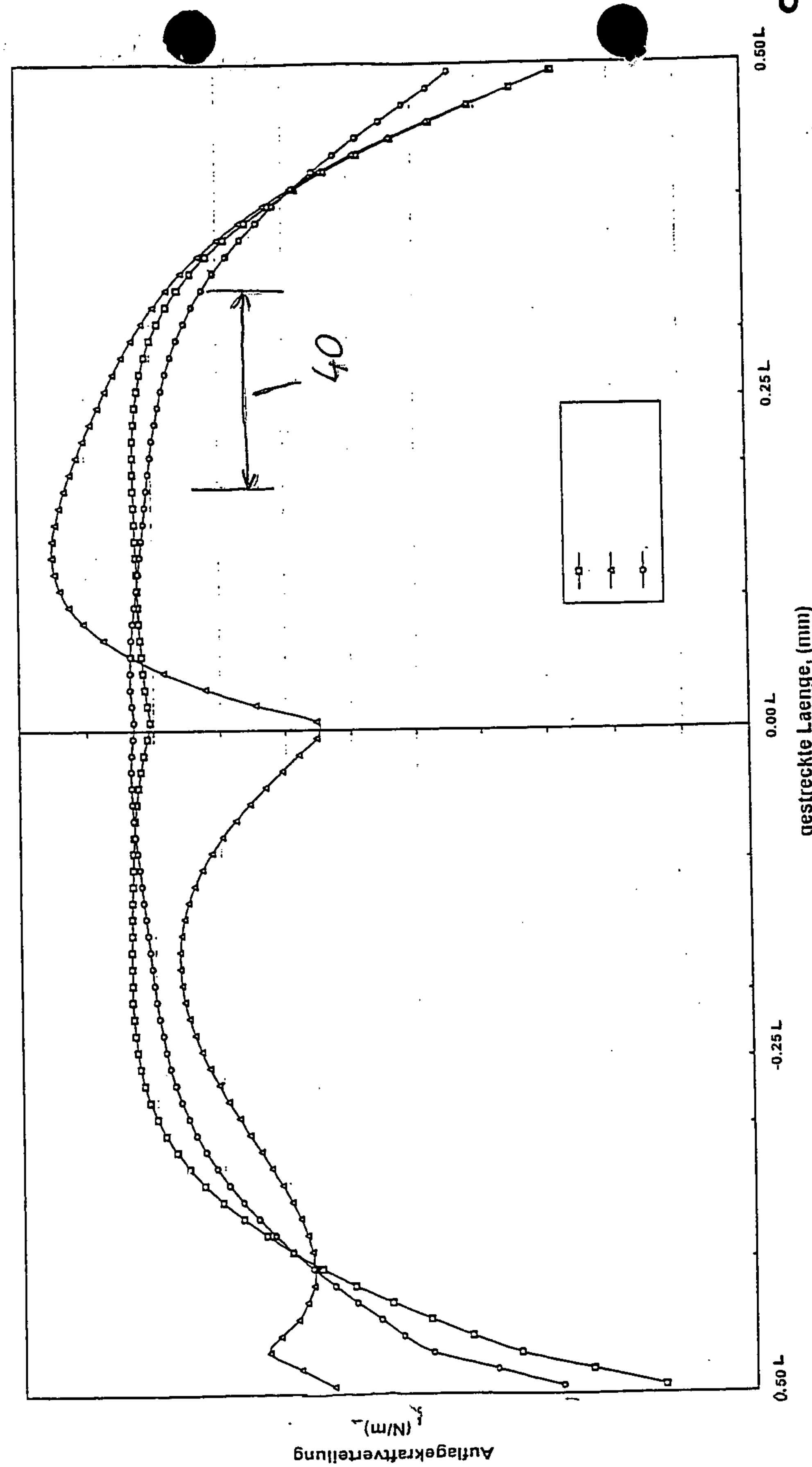

Fig.9

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Wiper Blade for Windshields, Especially of Motor Vehicles, and Method for Producing Such a Wiper Blade

Prior Art

In wiper blades of the type described in the preamble to claim 1, the support element should assure a predetermined distribution of the wiper blade pressing force - often also called pressure - applied by the wiper arm against the window, over the entire wiping zone that the wiper blade sweeps across. Through an appropriate curvature of the unstressed support element - i.e. when the wiper blade is not resting against the window - the ends of the wiper strip, which is placed completely against the window during the operation of the wiper blade, are loaded in the direction of the window by the support element, which is then under stress, even when the curvature radii of spherically curved vehicle windows change in every wiper blade position. The curvature of the wiper blade must therefore be slightly sharper than the sharpest curvature measured in the wiping zone of the window to be wiped. The support element thus replaces the costly support bracket design that has two spring strips disposed in the wiper strip, which is the kind used in conventional wiper blades (DE-OS 15 05 357).

The invention is based on a wiper blade as generically defined by the independent claims. In a known wiper blade of this type (DE-PS 12 47 161), a number of embodiments of the support elements are provided as a solution to the problem of producing the most uniform possible pressure load of the wiper blade over its entire length against a flat window.

In another known wiper blade of this generic type (EP 0 528 643 B1), in order to produce a uniform pressure load of the wiper blade against spherically curved windows, the pressure load increases significantly in the two end sections when the wiper blade is pressed against a flat window.

The uniform pressure distribution over the entire wiper blade length that is sought in both cases, however, leads to an abrupt flipping over of the wiper lip, which belongs to the wiper blade and performs the actual wiping function, over its entire length, from its one drag position into its other drag position when the wiper blade reverses its working direction. This drag position is essential for an effective, quiet operation of the wiper system. The abrupt flipping over of the wiper lip, however, - which is inevitably connected with an up and down motion of the wiper blade - generates an undesirable tapping noise. In addition, the matching of the support element tension to the desired pressure distribution, which differs from case to case, is problematic with spherically curved windows.

EP 0 594 451 describes flat bar wiper blades with a varying profile, which should not to exceed a particular lateral deflection when a test force is applied to them. To that end, an extremely complex interrelationship among internal parameters that characterize the spring bar are used to determine a quantity which should not exceed a certain threshold value. The equation given permits only complex and incomplete conclusions to be reached regarding the actual quantities to be entered. The other data relate to an unstressed wiper blade so that it is hardly possible to draw conclusions as to the quality of a wiper blade during operation.

In addition, putting the teaching of the known prior art to use turns out to be difficult since the available parameters cannot be applied directly to wiper blades to be newly manufactured.

Advantages of the Invention

The wiper blade according to the invention, with the features of the main claim, has the advantage of an entirely favorable wiping quality because among other things, a rattling of the wiper blade across the window - the so-called slip-stick effect - is prevented. This results from the knowledge that for the slip-stick effect, attention must be paid particularly to the lateral deflection angle and less so to the absolute lag, i.e. the absolute deflection of the tips under stress. It is therefore advantageous if the wiper blade is designed so that the lateral deflection of the ends of the wiper blades, which lag behind during operation, does not exceed a lateral deflection angle of a particular magnitude. From the quantity discovered for this angle, important parameters can then be derived for the wiper blade, which have a simple relation to one another and which, in this relation, should not exceed an upper limit of 0.009. With the aid of this relation and the upper limit indicated, cross sectional profiles for the support element can be very simply determined, which then produce a favorable wiping result. In particular, wiper blades with a constant cross section over their lengths are particularly easy to produce in this manner.

Costco Exhibit 1002, p. 13

Advantageous improvements and embodiments of the wiper blade according to the invention are possible by means of the measures disclosed in the remaining claims.

The wiping quality increases further if the proportion of the product of the contact force and the square of the length to the product of 48 times the elasticity modulus of the support element and the I_{zz} moment of inertia does not exceed an upper limit of 0.005.

Particularly useful cross sectional profiles are rectangular in design and have an essentially constant width and an essentially constant thickness over the length of the wiper blade. The support element can also be comprised of individual bars which are disposed laterally next to one another or one on top of another and their overall width or their overall thickness are respectively added together to produce an overall width and/or an overall thickness. With such a rectangular cross sectional profile, the moment of inertia I_{zz} can be entered as $d*b^3/12$, where the overall thickness and the overall width are entered as d and b, respectively. This produces an easy-to-apply relation via which the support element can be optimized for the wiper blades if the given upper limits of 0.009 and particularly 0.005 are not exceeded.

Particularly if more complex cross sectional profiles are chosen for the support element, which vary, for example, over the length of the wiper blade or have a ladder-type structure or the like, a favorable wiping quality can nevertheless be achieved if consideration is given to the fact that the lateral deflection angle γ does not exceed a magnitude of 0.5° and in particular 0.3° during operation of the wiper blade. These specifications apply for an average friction value μ of 1 and must be correspondingly increased or decreased when there are higher or lower friction values.

The lateral deflection angle γ is the angle at which the tangent to the support element end intersects the axis extending in the longitudinal direction of the support element. In a first approximation, this angle can also be understood to be the angle enclosed by the axis extending in the longitudinal span direction of the support element and a straight line passing through a support element end and the fulcrum point of the wiper arm on the support element.

Very good wiping results can be achieved if the width b and the thickness d remain in a definite proportion to the overall length of the support element. In particular, the product of the width and the square of the thickness should not exceed 40 times the square of the length and should not be less than 20 times the square of the length. The widths and/or the thicknesses of combined support elements are respectively added together to produce an overall width and overall thickness, which is then taken into consideration.

The wiper blade according to the invention, with the features of claim 10, has the advantage that only one parameter has to be varied in order to adjust the outwardly decreasing contact force distribution. The curvature or the curvature progression along the support element can be preset in freely programmable bending machines. As a result, short trial runs can also be carried out to optimize the contact force distribution and therefore the curvature progression rapidly and without a great deal of expense. It is particularly advantageous if the coordinate that governs the curvature progression extends along the inertial element. This eliminates the need for complex reverse calculations in a Cartesian coordinate system in which each change in a position x requires a shifting of the subsequent "x values".

The mathematical association between the second derivative of the curvature as a function of the adapted coordinate and the contact force progression likewise as a function of the adapted coordinate is particularly simple if the elasticity modulus of the support element material and the surface moment of inertia of the support element are constant over its length. With a preset contact pressure distribution, the curvature can then be directly calculated through double integration or also numerically.

An optimal adaptation of such a wiper blade to windows with a complex curvature progression is also possible if the curvature of the window is subtracted from the curvature of the support element or the second derivative of the curvature of the window is subtracted from the second derivative of the curvature of the support element. In this instance, a contact force distribution can be preset in the same way that is desirable for a wiper blade that is pressed against a flat window. The difference between the second derivatives of the respective curvatures is then once more proportional to this contact force distribution.

A wiper blade according to the invention, with the features of claim 15, excels in that without special adaptation, an excellent wiping result is achieved for average window types. The very simple steps taken result in the fact that the contact force distribution fulfills the requirements in most cases. The support points mentioned above are sufficiently precise to use as the basis for a curvature progression to be maintained.

A wiper blade according to claim 15 is optimized through the steps taken in claim 16. Even with complex window curvature progressions, the wiping quality can be increased by presetting the contact force distribution to particular support points. It is nevertheless possible to design the wiper blade without complex calculations. The curvature progression can be essentially predetermined and can be optimized by means of simple trials. An excellent wiping quality is assured as long as the prerequisites are met that the contact force distribution that prevails when the wiper blade is pressed against the window to be wiped is greater in a region approximately halfway between the center and the end of the wiper blade than it is at the end of the wiper blade.

In a method according to the invention for producing such a wiper blade, the individual parameters are selected in accordance with the teaching according to the invention and the support element is pre-curved so that its curvature progression fulfills at least one of the conditions mentioned above. As a result, it is particularly favorable to bend the support element first and then to put it together with the wiper strip and the connecting element. However, it is also possible to attach the connecting element to the support element first and then to add the wiper strip.

Costco Exhibit 1002, p. 17

Drawings

Fig. 1 is a perspective representation of a wiper blade that is placed against the window and is connected to a wiper arm which is loaded toward the window,

Fig. 2 is a schematic side view of a wiper blade, which is placed in an unstressed state against the window, in a reduced scale compared to Fig. 1,

Fig. 3 shows the sectional plane of an enlarged section through the wiper blade according to Fig. 1, along the line III - III,

Figs. 4 and 5 show a variant of Fig. 3,

Figs. 6 and 7 show a wiper blade in a different embodiment, with a coordinate system sketched in,

Figs. 8 and 9 respectively show calculated and measured values for the contact force distribution plotted over the length of the wiper blade, and

Fig. 10 is a schematic side view, not to scale, of a support element belonging to the wiper blade.

Description of the Exemplary Embodiment

A wiper blade 10 shown in Fig. 1 has an elongated, spring elastic support element 12, which is also referred to as a flat bar, for a wiper strip 14, which is shown separately in Fig. 10. As shown in Figs. 1, 3, and 4, the support element 12 and the wiper strip 14 are connected to each other with their longitudinal axes parallel. On the top side of the support element 12 remote from the window 15 to be wiped - shown with dot-and-dash lines in Fig. 1 -, there is a connecting mechanism in the form of a connecting device 16 which can detachably connect the wiper blade 10 to a driven wiper arm 18 that is guided on the body of the motor vehicle. The elongated rubber elastic wiper strip 14 is disposed on the underside of the support element 12 oriented toward the window 15.

A hook, which serves as a counterpart connection means, is formed onto the free end 20 of the wiper arm 18 and engages a pivot bolt 22 that is part of the connecting device 16 of the wiper blade 10. The securing between the wiper arm 18 and the wiper blade 10 is achieved by an intrinsically known securing mechanism, which is not shown in detail and is embodied in the form of an adapter.

The wiper arm 18, and therefore also its hook ends 20, is loaded in the direction of the arrow 24 toward the window 15 to be wiped, whose surface to be wiped is indicated with a dot-and-dash line 26 in Figs. 1 and 2. The contact force F_{wf} (arrow 24) places the wiper blade 10 with its entire length against the surface 26 of the window 15 to be wiped.

Costco Exhibit 1002, p. 19

Since the dot-and-dash line 26 shown in Fig. 2 is intended to represent the sharpest curvature of the window surface in the vicinity of the wiping zone, it is clear that the curvature of the wiper blade 10, which is as yet unstressed and rests with its two ends against the window, is sharper than the maximal curvature of the spherically curved window 15. When the contact force F_{wf} (arrow 24) is applied, the wiper blade 10 rests with its wiper lip 28, which is part of the wiper strip 14, over its entire length against the window surface 26. This produces a tension in the band-like, spring elastic support element 12, which ensures a proper contact of the wiper strip 14 or rather the wiper lip 28 over its entire length against the vehicle window 15. During wiper operation, the wiper arm 18 moves the wiper blade 10 lateral to its longitudinal span, across the window 15. In Fig. 1, this wiping or working motion is indicated by the double arrow 29.

The particular embodiment of the wiper blade according to the invention will now be discussed in detail below. As shown in Fig. 3, not to scale, the wiper strip 14 is disposed on the lower band surface of the support element 12, oriented toward the window 15. Spaced apart from the support element 12, the wiper strip 14 is indented on its two longitudinal sides so that a tilting hinge 30 remains in its longitudinal center region, which extends over the entire length of the wiper strip 14. The tilting hinge 30 transitions into the wiper lip 28, which has an essentially wedge-shaped cross section. The contact force (arrow 24) presses the wiper blade or rather the wiper lip 28 against the surface 26 of the window 15 to be wiped, and as a result of the wiping motion - of which Fig. 3 particularly shows the one of the two opposite wiping motions (double arrow 29) indicated by the direction arrow 32 - the wiper lip 28 tilts into a so-called drag position, in which the wiper lip is supported along its entire length against the part of the wiper strip 14 that is secured to the support element 12. This support, which is indicated with the arrow 34 in Fig. 3, always takes place - depending on the respective wiping direction (double arrow 29 and arrow 32, respectively) - against the upper edge of the wiper lip 28 disposed toward the rear in the respective wiping direction so that the wiper lip 28 is always guided across the window in a so-called drag position. This drag position is required for an effective, quiet operation of the wiper device. The reversal of the drag position takes place at the so-called reversal position of the wiper blade 10, when the blade changes its wiping direction (double arrow 29). As a result, the wiper blade executes an up and down motion which is necessitated by the tilting over of the wiper lip 28. The upward motion occurs counter to the direction of the arrow 24 and consequently also counter to the contact force. In the opposite wiping direction from the arrow 32, a mirror image of Fig. 3 is consequently produced.

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Fig. 4, which is an enlarged depiction in comparison to the wiper blade in Fig. 1, shows a cross sectional profile 40 that has a rectangular sectional plane with a width b and a thickness d. In addition, a coordinate system is shown above the support element 12. An s-coordinate, which follows the curvature of the support element 12, is shown as a 3rd coordinate in Fig. 6 and the y- and z-coordinates are perpendicular to it. If the wiper blade 10 is now pressed with a force F_{wf} (arrow 24) against a window 26, particularly by the wiper arm 18, a certain force distribution p(s) is produced, which produces a moment M(s) that is maximal in the center of the support element 12. For a constant contact force distribution

force distrib.

$$p = \frac{F_{wf}}{L}$$

which is favorable for the wiping operation, the moment is

$$M(s) = p * \frac{\left(\frac{L}{2} - s\right)^2}{2}$$

and consequently,

$$M(s) = F_{wf} * \frac{\left(\frac{L}{2} - s\right)^2}{2L}$$

For an outwardly decreasing contact force distribution, which is particularly suitable for tilting wiper lips over, the moment M(s) over its entire length is somewhat less than the moment calculated for a constant force distribution:

$$M(s) < p * \frac{\left(\frac{L}{2} - s\right)^2}{2}$$

If one then assumes that a friction value μ for a dry window is approximately 1, the lateral moment during operation is equal to the bending moment M(s), which in particular is a result of the preset force distribution p(s).

Based on the lateral bending moment, a lateral deflection angle γ can be inferred, which can be calculated by integration of the individual deflections from the fulcrum point of the wiper arm on the wiper blade to the wiper blade end. In the case of a centrally disposed connecting device 16, the deflection angle is calculated according to the equation:

$$\gamma = \int_0^{L/2} \frac{M(s)}{E*I_{zz}} ds$$

In view of the relation of the moment for a constant contact force distribution, a simple estimate for the angle γ is obtained by:

$$\gamma < \int_0^{L/2} \frac{p(s)\left(\frac{L}{2}-s\right)}{2*E*I_{zz}} ds$$

Integration yields the equation:

$$\gamma < \frac{p*L^3}{48*E*I_{zz}} = \frac{F_{wf}*L^2}{48*E*I_{zz}}$$

Among other things, the invention is based on the knowledge that a favorable wiping quality, particularly due to rattle prevention, is achieved if the angle γ does not exceed the value 0.5° (=0.009 rad) and in particular, 0.3° (=0.005 rad). As a result, a simple relation can be deduced between the contact force and the geometric dimensions of the wiper blade, according to which

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0.009 ,$$

in particular < 0.005.

For the most frequently occurring case of a rectangular profile 40, as shown in Fig. 3, the moment of inertia is determined by:

$$I_{zz} = \frac{d * b^3}{12}$$

where d = thickness of the support element
b = width of the support element.

The width b and the thickness d must therefore be selected so that

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0.009 ,$$

in particular < 0.005.

If the support element 12 is divided into two separate spring bars 42 and 44, as shown in Fig. 4, 5 then in the above considerations in the first approximation, the width b can be assumed to be the sum of the individual widths b1 and b2: $b = b_1 + b_2$. Hence simple relations between the width and thickness of a support element can also be deduced for systems of this kind.

For the case in which a rectangular cross sectional profile is not selected, it is then necessary to determine the moment of inertia I_{zz} and to correspondingly insert it into the relations mentioned above. Likewise, cross sectional changes over the length of the wiper blade or a non-central fulcrum point of the wiper arm on the wiper blade must also be correspondingly taken into account in the above considerations.

In order to achieve the quietest possible tilting over of the wiper lip 28 from its one drag position into its other drag position, the support element 12 that is used to distribute the contact force (arrow 24) is designed so that the contact force of the wiper strip 24, or rather the wiper lip 28, against the window surface 26 is greater in its middle section 36 (Fig. 11) that in at least one of the two end sections 38.

The distribution of the contact force over the support element occurs as a function of various parameters of the support element such as the cross sectional profile, the cross sectional progression over the length of the support element, or also the radius progression R(s) along the support element. An optimization of the support element in the direction of a predetermined contact force distribution p(s) is therefore very complex. The invention is based on the knowledge that in a support element with an essentially constant, in particular rectangular cross section over the length of the support element, the contact force distribution p(s) can be established by predetermining the curvature K along a coordinate s, which coordinate s extends along the support element. The curvature K(s) is equal to the inverse radius as a function of s:

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$$K(s) = \frac{1}{R(s)}$$

In the support element, there is a relation between the bending moment M, the radius R of the support element, its elasticity modulus E, and the surface moment of inertia I prevailing at the respective location. The relation is particularly simple when it is related to the coordinate s, which adapts along with the support elements:

$$K(s) = \frac{M(s)}{E*I}$$

Double differentiation as a function of the location s yields the relation:

$$\frac{d^2K(s)}{ds^2} = \frac{d^2M(s)/ds^2}{E*I}$$

Since the second derivative of the bending moment M as a function of the adaptive coordinate s is equal to the contact force distribution d along the coordinate s, which arises when the support element is pressed against a window, then it follows from this that the second derivative of the curvature K as a function of the adaptive coordinate s coincides with this contact force distribution p against a flat window, with the exception of a constant. The constant depends on the elasticity modulus E as well as on the surface moment of inertia I which for its part, is very simple if the cross section in question is rectangular. When there is a preset, outwardly decreasing contact force distribution p, the curvature profile K(s) can be determined mathematically or by simple experimentation. The geometry

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and therefore the parameters of the support element that are required for manufacture are therefore easy for a specialist to determine.

In order to take into account the shape of the window for which the wiper blade should be used, the above relation should be adjusted such that based on the contact force distribution p along the coordinate s - which distribution is predetermined for a flat window, decreases toward the outside, and is also divided by the elasticity modulus E and the surface moment of inertia I -, the second derivative of the curvature K_{window} of the window as a function of the coordinate s must be added to it:

$$\frac{d^2K(s)}{ds^2} = \frac{p(s)}{E*I} + \frac{d^2K_{window}(s)}{ds^2}$$

By means of this, it is also easy for the specialist to configure a support element for a particular window:

- determination of the length L and the cross sectional profile, particularly the width b and the thickness d by means of experimental values,
- determination of a contact force F_{wf} and a contact force distribution p for a flat window, which assures a favorable wiping quality, likewise by means of experimental values,
- measurement of the curvature progression K_{window} of the window,
- double derivation of this curvature progression K_{window} of the window as a function of a coordinate that adapts along with the curvature,

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- calculation of the second derivative of the curvature progression K(s) of the support element according to the above relation,
- double integration yields the desired curvature progression K(s) of the support element.

It has turned out that favorable wiping results can be achieved if the curvature K along the adaptive coordinate s is such that the contact force distribution, which prevails when the wiper blade is pressed against a flat window, is greater in a region approximately halfway between the center and the end of the wiper blade than it is at the end of the wiper blade. Figs. 8 and 9 show this region 40 for one side. The invention is based on the knowledge that the progression of the contact force distribution p in the region 40 is of less significance than the relation between the contact force distribution p in the region 40 to the contact force distribution p at the ends of the wiper blade. The overall length L of a wiper blade is plotted in Figs. 8 and 9, respectively, in which the connecting element 16 is disposed in the center of the wiper blade so that the wiper blade ends each occupy the value 0.5 L.

Very favorable wiping results are achieved if the curvature K along a coordinate s that follows the longitudinal span of the support element 12 has values such that the contact force distribution p that prevails when the wiper blade is pressed against the window to be wiped is greater in the region approximately halfway between the center and the end of the wiper blade than it is at the end of the wiper blade. Although taking into account the window shape for which the wiper blade is provided does in fact limit the blade's general suitability for arbitrary window

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types, it also results in the fact that the selected window is wiped in an optimal manner.

Fig. 10 depicts a possible curvature progression K of the support element 12, which can produce a contact force distribution p of the wiper lip 28 against the window 15, which decreases toward the wiper blade end. With this spring elastic support element 12 which, when unstressed, has a sharper hollow curvature toward the window than this window has in the vicinity of the wiping zone swept by the wiper blade, the curvature progression K is designed so that it is sharper in the middle section 36 of the support element 12 than in its end sections 38.

Reducing the contact force of the wiper lip 28 against the window surface 26 in the vicinity of one wiper blade end or at both wiper blade ends prevents the wiper lip 28 from abruptly flipping over or snapping over as it moves from its one drag position into its other drag position. On the contrary, with the wiper blade according to the invention the wiper lip turns over in a comparatively gentle manner, starting from the end of the wiper blade, moving to the center of the wiper lip, and continuing on to the other end of the wiper lip. In combination with Fig. 1, Fig. 3 shows that even with spherically curved windows, the less intensely stressed end sections of the wiper lip 28 still rest against the window surface in an effective manner.

It is common to all of the exemplary embodiments that the contact force (arrow 24) of the wiper strip 14 against the window 15 is greater in its middle section 36 than in at least one of its two end sections 38. This is also the case when - in contrast to the wiper blade 10 graphically

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represented, with a one-piece support element 12 depicted as a spring strip - the support element is embodied as having several parts. In certain circumstances, however, it can also be necessary to preset other contact force distributions. But even then, wiper blades which produce excellent wiping results can be designed using the relations demonstrated.

As has already been indicated above, with the method according to the invention for producing a wiper blade, first the contour and the curvature progression K are determined and then the support element 12 is put together with the wiper strip 14 and the connecting element 16. If the support element is comprised of two parallel, flat bars, these can preferably be pre-curved with each other, i.e. directly next to each other, which assures a very symmetrical and therefore torsionally stable design of the wiper blade. Later in the process, the two support element halves must then be further processed in order to prevent an inadvertent separation. After the support element has been curved, either the wiper blade is first mounted, for example by means of being glued in place or vulcanized in place, or in particular, when there are two support element halves, by means of insertion of the support element halves into longitudinal grooves of the wiper strip, and then the connecting element is mounted. In particular, if the connecting element is welded on, the wiper strip must only be attached afterward in order to avoid thermal damage to the wiper rubber.

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Claims

1. A wiper blade for windows, in particular of motor vehicles, with at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, characterized in that the support element (12) has a cross sectional profile in which

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0.009 ,$$

where F_{wf} is the contact force exerted on the wiper blade by the wiper arm (18) or is the contact force for which the wiper blade was originally designed, L is the length of the support element (12), E is the elasticity modulus of the support element (12), and I_{zz} is the moment of inertia of the cross sectional profile around the z-axis perpendicular to an s-axis, which adapts along with the support element (12), and perpendicular to a y-axis.

2. The wiper blade according to claim 1, characterized in that

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0.005 .$$

3. The wiper blade according to claim 1 or 2, characterized in that the support element (12) has an essentially rectangular cross sectional profile (40), with

an essentially constant width b and an essentially constant thickness d.

4. The wiper blade according to one of the preceding claims, characterized in that the support element (12) is comprised of at least two individual bars (42, 44) and that the widths (b1, b2) of the individual bars (42, 44) add up to a total width b.

5. The wiper blade according to one of the preceding claims, characterized in that the width b and the thickness d of the support element (12) are selected so that

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0.009 .$$

6. The wiper blade according to one of claims 1 to 4, characterized in that the width b and the thickness d of the flat bar are selected so that

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0.005 .$$

7. A wiper blade for windows, in particular of motor vehicles, with at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, in particular according to one of the preceding claims, characterized in that the support element (12) has a cross sectional profile (40) which produces a

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lateral deflection angle of at least one of the support element ends in relation to the longitudinal span of the support element of $\gamma < 0.5°$, in particular $< 0.3°$ against the window (26), when the wiper blade is moved on the window (26) lateral to its longitudinal span, and the friction coefficient between the window (26) and the wiper strip (14) is approximately 1.

8. A wiper blade for windows, in particular of motor vehicles, with at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, in particular according to one of the preceding claims, characterized in that the support element has a length L, a width b, and a thickness d such that

$$20L^2 < bd^2 < 40L^2$$

in which L is given in meters and b and d are given in millimeters.

9. The wiper blade according to claim 8, characterized in that the support element is comprised of two spring bars whose widths are added to each other.

10. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the

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wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), has values such that the second derivative of the curvature as a function of this coordinate (s) is essentially proportional to a contact force distribution p (s), which is produced when the wiper blade (10) is pressed against a flat window (15), and that the contact force distribution decreases toward at least one end.

11. The wiper blade according to claim 10, characterized in that

$$\frac{d^2K(s)}{ds^2} = \frac{d^2M(s)}{ds^2} * E * I = \frac{p(s)}{E*I}$$

s = coordinate along the support element
K(s) = curvature of the support element
M(s) = bending moment
E = elasticity modulus
I = surface moment of inertia of the support element in relation to the neutral axis
p(s) = specific force per unit length = contact force distribution.

12. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against

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the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), has values such that the second derivative of the curvature as a function of this coordinate (s) ~~minus~~ the second derivative of the curvature of the window (15) decreases from a middle region (40) toward the ends.

13. The wiper blade according to claim 12, characterized in that the middle region (40) is the location of the connecting device (16).

14. The wiper blade according to one of claims 12 or 13, characterized in that

$$\frac{d^2K(s)}{ds^2} = \frac{p(s)}{E*I} + \frac{d^2K_{window}(s)}{ds^2}$$

s = coordinate along the support element

K(s) = curvature of the support element

M(s) = bending moment

E = elasticity modulus

I = surface moment of inertia of the support element in relation to the neutral axis

p(s) = specific force per unit length = contact force distribution.

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15. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), has values such that the contact force distribution p (s), which prevails when the wiper blade (10) is pressed against a flat window (15) is greater in a region (40) approximately halfway between the center and the end of the wiper blade (10) than it is at the end of the wiper blade (10).

16. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), has values such that the contact force distribution p (s), which prevails when the wiper blade (10) is pressed against the window (15) to be wiped, is greater in a region (40) approximately halfway between the center

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and the end of the wiper blade (10) than it is at the end of the wiper blade (10).

17. A method for producing a wiper blade according to one of the preceding claims, characterized by means of the following process steps:
determination of the length L and adapted contact force F_{wf} required for the window to be wiped,
determination of the width b and the thickness d,
determination of the curvature progression K(s),
bending ~~of~~ the support element,
connection of the support element, wiper strip, and connecting device.

18. The method according to claim 17, characterized by means of the following process steps:

- determination of the length L and the cross sectional profile, particularly the width b and the thickness d by means of experimental values,
- determination of a contact force F_{wf} and a contact force distribution p for a flat window, which assures a favorable wiping quality, likewise by means of experimental values,
- measurement of the curvature progression K_{window} of the window,
- double derivation of this curvature progression K_{window} of the window as a function of a coordinate that adapts along with the curvature,
- calculation of the second derivative of the curvature progression K(s) of the support element according to the above relation,
- double integration yields the desired curvature progression K(s) of the support element.

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Abstract

The invention relates to a wiper blade for windows, in particular of motor vehicles, with at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18). The support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached. It is proposed that the flat bar have a cross sectional profile (40) in which F_{wf} * L^2 / 48 * E * I_{zz} < 0.009, where F_{wf} is the contact force exerted on the wiper blade or is the contact force for which the wiper blade was originally designed, L is the length of the wiper blade, E is the elasticity modulus of the flat bar material, and I_{zz} is the moment of inertia of the cross sectional profile around the z-axis (perpendicular to an s-axis, which adapts along with the flat bar, and perpendicular to a y-axis).

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DECLARATION AND POWER OF ATTORNEY FOR NATIONAL STAGE OF PCT PATENT APPLICATION

As a below-named inventor, I hereby declare that:

Peter DE BLOCK

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **WIPER BLADE FOR WINDSHIELDS, ESPECIALLY OF MOTOR VEHICLES, AND METHOD FOR PRODUCING SUCH A WIPER BLADE** the specification of which was filed as PCT International Application number PCT/DE 00/02168 on July 6, 2000.

I hereby state that I believe the named inventor or inventors in this Declaration to be the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

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

Prior foreign application(s):			Priority claimed:	
199 31 858.1	GERMANY	JULY 9 , 1999	X	
(Number)	(Country)	(Date filed)	Yes	No
199 31 856.5	GERMANY	JULY 9, 1999	X	
(Number)	(Country)	(Date filed)	Yes	No
199 31 857.3	GERMANY	JULY 9, 1999	X	
(Number)	(Country)	(Date filed)	Yes	No

As a named inventor, I hereby appoint the following attorney to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Michael J. Striker, Reg. No. 27233

Direct all telephone calls to Striker, Striker & Stenby at telephone no.: (631) 549 4700 and address and all correspondence to:

STRIKER, STRIKER & STENBY
103 East Neck Road
Huntington, New York 11743
U.S.A.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment,

or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statement may jeopardize the validity of the application or any patent issued thereon.

Signature:	Date:	Residence and Full Postal Address: Pandputweg 5 B-3545 Halen Belgium
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Signature:	Date:	Residence and Full Postal Address:
Full Name of Second Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Third Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Fourth Inventor:	Citizenship:	
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Full Name of Fifth Inventor:	Citizenship:	
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Signature:	Date:	Residence and Full Postal Address:
Full Name of Eighth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Ninth Inventor:	Citizenship:	

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patent application serial no.

Department of Commerce
Patent and Trademark Office
fee record

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01 FC:960 1000.00 CH
02 FC:964 320.00 CH

PATENT APPLICATION FEE DETERMINATION RECORD Effective October 1, 2000	Application or Docket Number 786852

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS		
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	1 minus 20=	* —
INDEPENDENT CLAIMS	1 minus 3 =	* —
MULTIPLE DEPENDENT CLAIM PRESENT		☐

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

SMALL ENTITY TYPE ☐ OR OTHER THAN SMALL ENTITY

RATE	FEE		RATE	FEE
BASIC FEE		OR	BASIC FEE	$1000
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL		OR	TOTAL	$1000

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY OR OTHER THAN SMALL ENTITY

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. 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 number found in the appropriate box in column 1.

FORM PTO-875
(Rev. 8/00)

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

MULTIPLE DEPENDENT CLAIM
FEE CALCULATION SHEET
(FOR USE WITH FORM PTO-875)

SERIAL NO.	FILING DATE
786852	
APPLICANT(S)	

CLAIMS

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
1	1		—	—		
2		1	—	—		
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TOTAL DEP.	16					
TOTAL CLAIMS	18		1			

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100						
TOTAL IND.						
TOTAL DEP.						
TOTAL CLAIMS						

PTO-1360 (3-78)

**MAY BE USED FOR ADDITIONAL CLAIMS OR AMENDMENTS*

U.S. DEPARTMENT of COMMERCE
Patent and Trademark Office

SEARCHED

Class	Sub.	Date	Exmr.
15	250.43	8/28/03	LCC
	250.44		LCC
	250.451		LCC
	250.48		LCC
	250.361		LCC
	250.202		LCC
	250.33		LCC

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.

SEARCH NOTES
(INCLUDING SEARCH STRATEGY)

	Date	Exmr.
Spoke to G. Graham Class 15	8/28/03	LCC

(RIGHT OUTSIDE)

09/786852

Class	Subclass

ISSUE CLASSIFICATION

FILED UNDER 35 U.S.C. 371

PATENT NUMBER

U.S. **UTILITY** Patent Application

O.I.P.E.	PATENT DATE
MR SCANNED 115 Q.A. Am	

APPLICATION NO.	CONT/PRIOR	CLASS	SUBCLASS	ART UNIT	EXAMINER
09/786852	D F	015	250.43	1744	GRAHAM Cole

APPLICANTS: Peter De Block

TITLE: Wiper blade for windshields, especially automobile windshields, and method for the production thereof

PTO-2040 12/99

ISSUING CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)						
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)					
INTERNATIONAL CLASSIFICATION								
			☐ Continued on Issue Slip Inside File Jacket					

☐ TERMINAL DISCLAIMER	DRAWINGS			CLAIMS ALLOWED	
	Sheets Drwg.	Figs. Drwg.	Print Fig.	Total Claims	Print Claim for O.G.
☐ The term of this patent subsequent to ________ (date) has been disclaimed.	(Assistant Examiner) (Date)			NOTICE OF ALLOWANCE MAILED	
☐ The term of this patent shall not extend beyond the expiration date of U.S Patent. No. ________	(Primary Examiner) (Date)			ISSUE FEE	
				Amount Due	Date Paid
☐ The terminal ____ months of this patent have been disclaimed.	(Legal Instruments Examiner) (Date)			ISSUE BATCH NUMBER	

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Form PTO-436A (Rev. 6/99)

FILED WITH: ☐ DISK (CRF) ☐ FICHE ☐ CD-ROM
(Attached in pocket on right inside flap)

(FACE)

Consideration and allowance of the present application is most respectfully requested.

Respectfully submitted,

Michael J. Striker
Attorney for Applicant(s)
Reg. No. 27233

19. A wiper blade for windows, in particular of motor vehicles, with at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, characterized in that the support element (12) has a cross sectional profile in which

deflection angle

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0.009,$$

unit rad

where F_{wf} is the contact force exerted on the wiper blade by the wiper arm (18) or is the contact force for which the wiper blade was originally designed, L is the length of the support element (12), E is the elasticity modulus of the support element (12), and I_{zz} is the moment of inertia of the cross sectional profile around the z-axis perpendicular to an s-axis, which adapts along with the support element (12), and perpendicular to a y-axis.

20. The wiper blade according to claim 19, characterized in that

deflection

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0.005.$$

unit

A' cont

21. The wiper blade according to claim 19, characterized in that the support element (12) has an essentially rectangular cross sectional profile (40), with an essentially constant width b and an essentially constant thickness d.

22. The wiper blade according to claim 19, characterized in that the support element (12) is comprised of at least two individual bars (42, 44) and that the widths (b1, b2) of the individual bars (42, 44) add up to a total width b.

23. The wiper blade according to claim 19, characterized in that the width b and the thickness d of the support element (12) are selected so that

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0.009 .$$

same as 21?

24. The wiper blade according to claim 19, characterized in that the width b and the thickness d of the flat bar are selected so that

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0.005 .$$

same as 24?

25. A wiper blade for windows, in particular of motor vehicles, with at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated,

flat bar to which the wiper strip (14) and the connecting device (16) are attached, in particular according to one of the preceding claims, characterized in that the support element (12) has a cross sectional profile (40) which produces a lateral deflection angle of at least one of the support element ends in relation to the longitudinal span of the support element of $\gamma < 0.5°$, in particular $< 0.3°$ against the window (26), when the wiper blade is moved on the window (26) lateral to its longitudinal span, and the friction coefficient between the window (26) and the wiper strip (14) is approximately 1.

26. A wiper blade for windows, in particular of motor vehicles, with at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, in particular according to one of the preceding claims, characterized in that the support element has a length L, a width b, and a thickness d such that

3.876 7744

$$20L^2 < bd^2 < 40L^2$$

4.05 8.1

in which L is given in meters and b and d are given in millimeters.

27. The wiper blade according to claim 26, characterized in that the support element is comprised of two spring bars whose widths are added to each other.

A1 cont

28. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), curv has values such that the second derivative of the curvature as a function of this coordinate (s) is essentially proportional to a contact force distribution p (s), which is produced when the wiper blade (10) is pressed against a flat window (15), and that the contact force distribution decreases toward at least one end.

29. The wiper blade according to claim 28, characterized in that

$$\frac{d^2K(s)}{ds^2} = \frac{d^2M(s)}{ds^2} * E * I = \frac{p(s)}{E*I}$$

$\frac{dM}{ds} = F(s) \cdot EI$ $\quad$ $p(s) = F(s)$

s = coordinate along the support element

K(s) = curvature of the support element

M(s) = bending moment

E = elasticity modulus

I = surface moment of inertia of the support element in relation to the neutral axis

p(s) = specific force per unit length = contact force distribution.

A1 cont

30. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), has values such that the second derivative of the curvature as a function of this coordinate (s) minus the second derivative of the curvature of the window (15) decreases from a middle region (40) toward the ends.

31. The wiper blade according to claim 30, characterized in that the middle region (40) is the location of the connecting device (16).

32. The wiper blade according to one of claim 30, characterized in that

$$\frac{d^2K(s)}{ds^2} = \frac{p(s)}{E*I} + \frac{d^2K_{window}(s)}{ds^2}$$ further limit?

s = coordinate along the support element

K(s) = curvature of the support element

M(s) = bending moment

E = elasticity modulus

I = surface moment of inertia of the support element in relation to the neutral axis

p(s) = specific force per unit length = contact force distribution.

A' cont

33. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature ~~along a coordinate (s)~~, which follows the longitudinal span of the support element (12), has values such that the contact force distribution p (s), which prevails when the wiper blade (10) is pressed against a flat window (15) is greater in a region (40) approximately halfway between the center and the end of the wiper blade (10) than it is at the end of the wiper blade (10).

34. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the

support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), has values such that the contact force distribution p (s), which prevails when the wiper blade (10) is pressed against the window (15) to be wiped, is greater in a region (40) approximately halfway between the center and the end of the wiper blade (10) than it is at the end of the wiper blade (10).

A1 cont

35. A method for producing a wiper blade according to claim 19, characterized by means of the following process steps:
determination of the length L and adapted contact force F_{wf} required for the window to be wiped,
determination of the width b and the thickness d,
determination of the curvature progression K(s),
bending of the support element,
connection of the support element, wiper strip, and connecting device.

36. The method according to claim 35, characterized by means of the following process steps:

- determination of the length L and the cross sectional profile, particularly the width b and the thickness d by means of experimental values,
- determination of a contact force F_{wf} and a contact force distribution p for a flat window, which assures a favorable wiping quality, likewise by means of experimental values,

- measurement of the curvature progression K_{window} of the window,
- double derivation of this curvature progression K_{window}. of the window as a function of a coordinate that adapts along with the curvature,
- calculation of the second derivative of the curvature progression K(s) of the support element according to the above relation,
- double integration yields the desired curvature progression K(s) of the support element.

VERTRAG ÜBER DIE INTERNATIONALE ZUSAMMENARBEIT AUF DEM GEBIET DES PATENTWESENS

PCT

INTERNATIONALER RECHERCHENBERICHT

(Artikel 18 sowie Regeln 43 und 44 PCT)

Aktenzeichen des Anmelders oder Anwalts R. 36343-1 Km/Mi	**WEITERES VORGEHEN**	siehe Mitteilung über die Übermittlung des internationalen Recherchenberichts (Formblatt PCT/ISA/220) sowie, soweit zutreffend, nachstehender Punkt 5
Internationales Aktenzeichen PCT/DE 00/02168	Internationales Anmeldedatum *(Tag/Monat/Jahr)* 06/07/2000	(Frühestes) Prioritätsdatum *(Tag/Monat/Jahr)* 09/07/1999
Anmelder ROBERT BOSCH GMBH et al.		

Dieser internationale Recherchenbericht wurde von der Internationalen Recherchenbehörde erstellt und wird dem Anmelder gemäß Artikel 18 übermittelt. Eine Kopie wird dem Internationalen Büro übermittelt.

Dieser internationale Recherchenbericht umfaßt insgesamt 3 Blätter.

[X] Darüber hinaus liegt ihm jeweils eine Kopie der in diesem Bericht genannten Unterlagen zum Stand der Technik bei.

1. **Grundlage des Berichts**

   a. Hinsichtlich der **Sprache** ist die internationale Recherche auf der Grundlage der internationalen Anmeldung in der Sprache durchgeführt worden, in der sie eingereicht wurde, sofern unter diesem Punkt nichts anderes angegeben ist.

   [ ] Die internationale Recherche ist auf der Grundlage einer bei der Behörde eingereichten Übersetzung der internationalen Anmeldung (Regel 23.1 b)) durchgeführt worden.

   b. Hinsichtlich der in der internationalen Anmeldung offenbarten **Nucleotid- und/oder Aminosäuresequenz** ist die internationale Recherche auf der Grundlage des Sequenzprotokolls durchgeführt worden, das

   [ ] in der internationalen Anmeldung in Schriftlicher Form enthalten ist.

   [ ] zusammen mit der internationalen Anmeldung in computerlesbarer Form eingereicht worden ist.

   [ ] bei der Behörde nachträglich in schriftlicher Form eingereicht worden ist.

   [ ] bei der Behörde nachträglich in computerlesbarer Form eingereicht worden ist.

   [ ] Die Erklärung, daß das nachträglich eingereichte schriftliche Sequenzprotokoll nicht über den Offenbarungsgehalt der internationalen Anmeldung im Anmeldezeitpunkt hinausgeht, wurde vorgelegt.

   [ ] Die Erklärung, daß die in computerlesbarer Form erfaßten Informationen dem schriftlichen Sequenzprotokoll entsprechen, wurde vorgelegt.

2. [ ] **Bestimmte Ansprüche haben sich als nicht recherchierbar erwiesen** (siehe Feld I).

3. [ ] **Mangelnde Einheitlichkeit der Erfindung** (siehe Feld II).

4. Hinsichtlich der **Bezeichnung der Erfindung**

   [X] wird der vom Anmelder eingereichte Wortlaut genehmigt.

   [ ] wurde der Wortlaut von der Behörde wie folgt festgesetzt:

5. Hinsichtlich der **Zusammenfassung**

   [X] wird der vom Anmelder eingereichte Wortlaut genehmigt.

   [ ] wurde der Wortlaut nach Regel 38.2b) in der in Feld III angegebenen Fassung von der Behörde festgesetzt. Der Anmelder kann der Behörde innerhalb eines Monats nach dem Datum der Absendung dieses internationalen Recherchenberichts eine Stellungnahme vorlegen.

6. Folgende Abbildung der **Zeichnungen** ist mit der Zusammenfassung zu veröffentlichen: Abb. Nr. 1

   [X] wie vom Anmelder vorgeschlagen

   [ ] keine der Abb.

   [ ] weil der Anmelder selbst keine Abbildung vorgeschlagen hat.

   [ ] weil diese Abbildung die Erfindung besser kennzeichnet.

INTERNATIONALER RECHERCHENBERICHT

Internationales Aktenzeichen
PCT/DE 00/02168

A. KLASSIFIZIERUNG DES ANMELDUNGSGEGENSTANDES
IPK 7 B60S1/38

Nach der Internationalen Patentklassifikation (IPK) oder nach der nationalen Klassifikation und der IPK

B. RECHERCHIERTE GEBIETE

Recherchierter Mindestprüfstoff (Klassifikationssystem und Klassifikationssymbole)
IPK 7 B60S

Recherchierte aber nicht zum Mindestprüfstoff gehörende Veröffentlichungen, soweit diese unter die recherchierten Gebiete fallen

Während der internationalen Recherche konsultierte elektronische Datenbank (Name der Datenbank und evtl. verwendete Suchbegriffe)

EPO-Internal, WPI Data, PAJ

C. ALS WESENTLICH ANGESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	EP 0 594 451 A (ANGLO AMERICAN IND CORP LTD) 27. April 1994 (1994-04-27) in der Anmeldung erwähnt Zusammenfassung; Abbildungen 1-5 Seite 1, Zeile 1 -Seite 2, Zeile 50 ---	1,7,8, 10,12, 15-17
A	EP 0 528 643 A (ANGLO AMERICAN IND CORP LTD) 24. Februar 1993 (1993-02-24) in der Anmeldung erwähnt das ganze Dokument ---	1,7,8, 10,12, 15-17
P,A	DE 198 14 610 A (BOSCH GMBH ROBERT) 7. Oktober 1999 (1999-10-07) Zusammenfassung; Abbildungen 2,5-7 Spalte 1, Zeile 54 -Spalte 2, Zeile 20 --- -/--	1,7,8, 10,12, 15-17

[X] Weitere Veröffentlichungen sind der Fortsetzung von Feld C zu entnehmen

[X] Siehe Anhang Patentfamilie

° Besondere Kategorien von angegebenen Veröffentlichungen :

"A" Veröffentlichung, die den allgemeinen Stand der Technik definiert, aber nicht als besonders bedeutsam anzusehen ist

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"O" Veröffentlichung, die sich auf eine mündliche Offenbarung, eine Benutzung, eine Ausstellung oder andere Maßnahmen bezieht

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"X" Veröffentlichung von besonderer Bedeutung; die beanspruchte Erfindung kann allein aufgrund dieser Veröffentlichung nicht als neu oder auf erfinderischer Tätigkeit beruhend betrachtet werden

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"&" Veröffentlichung, die Mitglied derselben Patentfamilie ist

Datum des Abschlusses der internationalen Recherche	Absendedatum des internationalen Recherchenberichts
15. November 2000	22/11/2000

Name und Postanschrift der Internationalen Recherchenbehörde	Bevollmächtigter Bediensteter
Europäisches Patentamt, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Beckman, T

1

Formblatt PCT/ISA/210 (Blatt 2) (Juli 1992)

Costco Exhibit 1002, p. 56

Internationales Aktenzeichen
PCT/DE 00/02168

C.(Fortsetzung) ALS WESENTL[illegible]GESEHENE UNTERLAGEN

Kategorie°	Bezeichnung der Veröffentlichung, soweit erforderlich unter Angabe der in Betracht kommenden Teile	Betr. Anspruch Nr.
A	DE 12 47 161 B (WAQLTER D APPEL) 10. August 1967 (1967-08-10) in der Anmeldung erwähnt das ganze Dokument -----	1,7,8, 10,12, 15-17

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/DE 00/02168

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0594451 A	27-04-1994	DE 69303250 D	25-07-1996
		DE 69303250 T	07-11-1996
		ES 2088236 T	01-08-1996
		JP 2812651 B	22-10-1998
		JP 6340249 A	13-12-1994
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		ZA 9307792 A	16-05-1994
EP 0528643 A	24-02-1993	AU 651237 B	14-07-1994
		AU 2108092 A	25-02-1993
		BR 9203129 A	30-03-1993
		CA 2076268 A	17-02-1993
		DE 69203303 D	10-08-1995
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		JP 3011252 B	21-02-2000
		JP 5254399 A	05-10-1993
		MX 9204682 A	31-05-1994
		RU 2091257 C	27-09-1997
		US 5325564 A	05-07-1994
		KR 229404 B	01-11-1999
		ZA 9206186 A	01-03-1993
DE 19814610 A	07-10-1999	WO 9951470 A	14-10-1999
		EP 0986496 A	22-03-2000
DE 1247161 B		NONE	

6|PRTS

09/786852
JC02 Rec'd PCT/PTO 09 MAR 2001

VERIFICATION OF TRANSLATION

I, DAVID CLAYBERG

of 948 15th St., Ste. 4
Santa Monica, CA 90403-3134

declare that I am a certified translator well acquainted with both the German and English languages, and that the attached is an accurate translation, to the best of my knowledge and ability, of the attached German-language document.

Signature ____________________ Date March 9, 2001
David Clayberg

INTERNATIONAL SEARCH REPORT

ional Application No
PCT/DE 00/02168

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B60S1/38

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 B60S

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 594 451 A (ANGLO AMERICAN IND CORP LTD) 27 April 1994 (1994-04-27) cited in the application abstract; figures 1-5 page 1, line 1 -page 2, line 50	1,7,8, 10,12, 15-17
A	EP 0 528 643 A (ANGLO AMERICAN IND CORP LTD) 24 February 1993 (1993-02-24) cited in the application the whole document	1,7,8, 10,12, 15-17
P,A	DE 198 14 610 A (BOSCH GMBH ROBERT) 7 October 1999 (1999-10-07) abstract; figures 2,5-7 column 1, line 54 -column 2, line 20	1,7,8, 10,12, 15-17

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in 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 document 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
15 November 2000	22/11/2000

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	Beckman, T

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Form PCT/ISA/210 (second sheet) (July 1992)

Int tion application No
PCT/D. 0/02168

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	DE 12 47 161 B (WAQLTER D APPEL) 10 August 1967 (1967-08-10) cited in the application the whole document	1,7,8, 10,12, 15-17

1

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
EP 0594451	A	27-04-1994	DE	69303250	D	25-07-1996
			DE	69303250	T	07-11-1996
			ES	2088236	T	01-08-1996
			JP	2812651	B	22-10-1998
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			AU	2108092	A	25-02-1993
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			DE	69203303	D	10-08-1995
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			KR	229404	B	01-11-1999
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DE 19814610	A	07-10-1999	WO	9951470	A	14-10-1999
			EP	0986496	A	22-03-2000
DE 1247161	B		NONE			

(12) NACH DEM V. ...AG ÜBER DIE INTERNATIONALE ZUSA... ENARBEIT AUF DEM GEBIET DES PATEN... ...ESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
18. Januar 2001 (18.01.2001)

PCT

(10) Internationale Veröffentlichungsnummer
WO 01/03982 A1

(51) Internationale Patentklassifikation[7]: B60S 1/38

(21) Internationales Aktenzeichen: PCT/DE00/02168

(22) Internationales Anmeldedatum: 6. Juli 2000 (06.07.2000)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:

199 31 858.1	9. Juli 1999 (09.07.1999)	DE
199 31 856.5	9. Juli 1999 (09.07.1999)	DE
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100 32 048.1	5. Juli 2000 (05.07.2000)	DE

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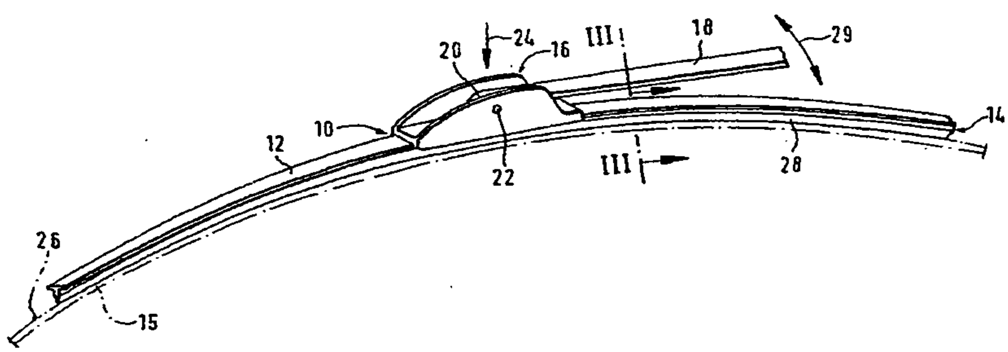
(54) Title: WIPER BLADE FOR WINDSHIELDS, ESPECIALLY AUTOMOBILE WINDSHIELDS, AND METHOD FOR THE PRODUCTION THEREOF

(54) Bezeichnung: WISCHBLATT FÜR SCHEIBEN, INSBESONDERE VON KRAFTFAHRZEUGEN, SOWIE VERFAHREN ZUM HERSTELLEN EINES SOLCHEN



(57) Abstract: The invention relates to a wiper blade for windshields, especially automobile windshields, comprising at least one support element, a support element (12), a wiper strip (14) and connecting means (16) for a wiper arm (18). The support element (12) is a long flat rod to which the wiper strip (14) and the connecting means (16) are fixed. According to the invention, the flat rod has a cross-sectional profile (40), whereby $F_{wf} * L^2 / 48 * E * I_{zz} < 0.009$ when F_{wf} is the pressure force exerted on the wiper blade or the pressure force for which the wiper blade was originally intended, L represents the length of the wiper blade, E stands for the elasticity module of the flat rod material and I_{zz} is the moment of inertia of the cross-sectional profile around the z axis (perpendicular to an s axis associated with the flat rod and perpendicular to the y axis).

(57) Zusammenfassung: Die Erfindung betrifft ein Wischblatt für Scheiben, insbesondere von Kraftfahrzeugen, mit mindestens einem Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18). Das Tragelement (12) ist ein langgestreckter Flachbalken, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind. Es wird vorgeschlagen, dass der Flachbalken ein Querschnittsprofil (40) aufweist, bei dem $F_{wf} * L^2 / 48 * E * I_{zz} <0{,}009$ sind, wenn F_{wf} die auf das Wischblatt ausgeübte Auflagekraft oder die Auflagekraft ist, für die das Wischblatt ursprünglich ausgelegt wurde, L die Länge des Wischblatts, E der Elastizitätsmodul des Flachbalkenwerkstoffs und I_{zz}

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WO 01/03982 A1

Wischblatt für Scheiben, insbesondere von Kraftfahrzeugen, sowie Verfahren zum Herstellen eines solchen

Stand der Technik

Bei Wischblättern der im Oberbegriff des Anspruchs 1 bezeichneten Art soll das Tragelement über das gesamte vom Wischblatt bestrichene Wischfeld eine vorbestimmte Verteilung der vom Wischerarm ausgehenden Wischblatt-Anpresskraft - oft auch als Anpreßdruck bezeichnet - an der Scheibe gewährleisten. Durch eine entsprechende Krümmung des unbelasteten Tragelements - also wenn das Wischblatt nicht an der Scheibe anliegt - werden die Enden der im Betrieb des Wischblatts vollständig an der Scheibe angelegten Wischleiste durch das dann gespannte Tragelement zur Scheibe belastet, auch wenn sich die Krümmungsradien von sphärisch gekrümmten Fahrzeugscheiben bei jeder Wischblattposition ändern. Die Krümmung des Wischblatts muß also etwas stärker sein als die im Wischfeld an der zu wischenden Scheibe gemessene stärkste Krümmung. Das Tragelement ersetzt somit die aufwendige Tragbügelkonstruktion mit zwei in der Wischleiste angeordneten Federschienen, wie sie bei herkömmlichen Wischblättern praktiziert wird (DE-OS 15 05 357).

Die Erfindung geht aus von einem Wischblatt nach der Gattung der unabhängigen Ansprüche. Bei einem bekannten Wischblatt dieser Art (DE-PS 12 47 161) sind zur Erzielung einer möglichst gleichmäßigen Druckbelastung des Wischblatts an einer ebenen Scheibe über seine gesamte Länge mehrere Ausgestaltungen des Tragelements als Problemlösung vorgesehen.

Bei einem anderen bekannten Wischblatt dieser Gattung (EP 0 528 643 B1) nimmt - zur Erzielung einer gleichmäßigen Druckbelastung des Wischblatts an sphärisch gekrümmten Scheiben - die Druckbelastung an den beiden Endabschnitten wesentlich zu, wenn das Wischblatt auf eine ebene Scheibe gepreßt wird.

Die in beiden Fällen angestrebte gleichmäßige Druckverteilung über die gesamte Wischblattlänge führt jedoch zu einem schlagartigen Umspringen der zum Wischblatt gehörenden, die eigentliche Wischarbeit ausführenden Wischlippe über deren gesamte Länge aus ihrer einen in ihre andere Schlepplage, wenn das Wischblatt seine Arbeitsrichtung umkehrt. Diese Schlepplage ist unabdingbar für einen effektiven und geräuscharmen Betrieb der Wischanlage. Das schlagartige Umspringen der Wischlippe - welches zwangsläufig mit einer Auf- und Abbewegung des Wischblatts verbunden ist - erzeugt jedoch unerwünschte Klopfgeräusche. Auch ist die Abstimmung der Tragelementspannung auf die gewünschte, von Fall zu Fall andersartige Druckverteilung bei sphärisch gekrümmten Scheiben problematisch.

In der EP 0 594 451 werden Flachbalkenwischblätter mit variierendem Profil beschrieben, die beim Anlegen einer Prüfkraft eine bestimmte seitliche Auslenkung nicht überschreiten sollen. Dazu wird über einen äußerst komplexen Zusammenhang innerer, den Federbalken bestimmender Parameter eine Größe angegeben, die einen bestimmten Grenzwert nicht überschreiten soll. Aus der angegebenen Gleichung können nur schwierig und unvollständig Aussagen über die tatsächlich einzusetzenden Größen abgeleitet werden. Die weiteren Angaben betreffen ein unbelastetes Wischblatt, so dass Aussagen über die Qualität eines Wischblatts im Betrieb kaum möglich sind.

Außerdem erweist sich die Umsetzung der Lehren des bekannten Standes der Technik als schwierig, da die zur Verfügung stehenden Parameter nicht direkt auf neu herzustellende Wischblätter anwendbar sind.

Vorteile der Erfindung

Das erfindungsgemäße Wischblatt mit den Merkmalen des Hauptanspruchs hat den Vorteil einer durchweg guten Wischqualität, weil unter anderem ein Rattern des Wischblatts über der Scheibe - der sogenannte slip-stick-Effekt - vermieden ist. Dies resultiert aus der Erkenntnis, dass insbesondere der seitliche Auslenkungswinkel und weniger das absolute Nacheilen, also die absolute Auslenkung der Spitzen unter Belastung für den slip-stick-Effekt zu beachten ist. Es ist demnach von Vorteil, wenn das Wischblatt so ausgelegt wird, dass die seitliche Auslenkung der im Betrieb nacheilenden Enden des Wischblatts einen seitlichen Auslenkungswinkel einer bestimmten Größe nicht überschreiten. Aus der gefundenen Größe für diese Winkel können dann für das Wischblatt wichtige Parameter abgeleitet werden, die zueinander in einer einfachen Beziehung stehen und in dieser Beziehung eine obere Grenze von 0,009 nicht überschreiten sollen. Mit Hilfe dieser Beziehung und der angegebenen Obergrenze lassen sich sehr einfach Querschnittsprofile für das Tragelement bestimmen, die dann zu einem guten Wischergebnis führen. Insbesondere Wischblätter mit über ihre Länge konstantem Querschnitt sind auf diese Weise besonders einfach herzustellen.

Durch die in den weiteren Ansprüchen angegebenen Maßnahmen sind vorteilhafte Weiterbildungen und Ausgestaltungen des erfindungsgemäßen Wischblatts möglich.

Die Wischqualität steigt weiter, wenn das Verhältnis aus dem Produkt aus der Auflagekraft und dem Quadrat der Länge zu dem Produkt aus dem 48-fachen des Elastizitätsmoduls des Tragelements und dem I_{zz}-Trägheitsmoment eine obere Grenze von 0,005 nicht übersteigt.

Besonders gut anwendbare Querschnittsprofile sind von rechteckiger Gestalt und weisen über die Länge des Wischblatts eine im wesentlichen konstante Breite und eine im wesentlichen konstante Dicke auf. Das Tragelement kann dabei auch aus Einzelbalken bestehen, die seitlich nebeneinander oder übereinander angeordnet sind und deren Gesamtbreite bzw. deren Gesamtdicke sich jeweils zu einer Gesamtbreite und/oder zu einer Gesamtdicke addieren. Bei einem solchen rechteckigen Querschnittsprofil kann das Trägheitsmoment I_{zz} als $d*b^3/12$ eingesetzt werden, wobei für d und b jeweils die Gesamtdicke bzw. die Gesamtbreite einzusetzen ist. Auf diese Weise erhält man eine sehr einfach handhabbare Beziehung, über die das Tragelement für die Wischblätter optimiert werden kann, wenn die angegebenen Obergrenzen von 0,009 und insbesondere von 0,005 nicht überschritten werden.

Insbesondere wenn komplexere Querschnittsprofile für das Tragelement gewählt werden, die beispielsweise über die Länge des Wischblatts variieren oder eine leiterartige Struktur oder dergleichen aufweisen, kann eine gute Wischqualität dennoch erreicht werden, wenn berücksichtigt wird, dass der seitliche Auslenkungswinkel γ während des Betriebs des Wischblatts eine Größe von 0,5° insbesondere von 0,3° nicht überschreiten. Diese Angaben gelten für einen mittleren

Reibwert μ von 1 und sind bei größeren oder kleineren Reibwerten entsprechend zu vergrößern bzw. zu verkleinern.

Der seitliche Auslenkungswinkel γ ist der Winkel unter dem die Tangente an das Tragelementende die in Richtung der Längserstreckung des Tragelements verlaufende Achse schneidet. In einer ersten Näherung kann darunter auch der von der Achse in Längserstreckungsrichtung des Tragelements und einer Geraden durch den Angriffspunkt des Wischerarms am Tragelement und durch ein Tragelelementende eingeschlossene Winkel verstanden werden.

Sehr gute Wischergebnisse lassen sich erzielen, wenn die Breite b und die Dicke d zur Gesamtlänge des Tragelements in einem bestimmten Verhältnis stehen. Insbesondere soll das Produkt aus der Breite und dem Quadrat der Dicke das 40-fache des Quadrats der Länge nicht über und das 20-fache des Quadrats der Länge nicht unterschreiten. Die Breiten und/oder die Dicken von zusammengesetzten Tragelementen addieren sich jeweils zu einer Gesamtbreite bzw. Gesamtdicke, die dann berücksichtigt wird.

Das erfindungsgemäße Wischblatt mit den Merkmalen des Anspruchs 10 hat den Vorteil, dass lediglich ein Parameter zur Einstellung der nach außen abfallenden Auflagekraftverteilung variiert werden muß. Die Krümmung bzw. der Krümmungsverlauf entlang des Tragelements kann in frei programmierbaren Biegemaschinen voreingestellt werden. Dadurch können auch kurze Versuchsreihen zur Optimierung der Auflagekraftverteilung und damit des Krümmungsverlaufs schnell und ohne großen Aufwand durchgeführt werden. Insbesondere ist es von Vorteil, wenn die den Krümmungsverlauf beherrschende Koordinate entlang des Trägheitselements verläuft. Damit sind aufwendige Rückrechnungen auf ein kartesisches Koordinatensystem, bei dem jede Änderung an einer Position x eine Verschiebung der nachfolgenden „x-Werte" bedingt, vermieden.

Der mathematische Zusammenhang zwischen der zweiten Ableitung der Krümmung nach der angepaßten Koordinate und dem Auflagekraftverlauf ebenfalls nach der angepaßten Koordinate wird besonders einfach, wenn der Elastizitätsmodul des Tragelementwerkstoffs sowie das Flächenträgheitsmoment des Tragelements über dessen Länge konstant sind. Bei vorgegebener Auflagekraftverteilung kann dann durch zweifaches Integrieren oder auch nummerisch die Krümmung direkt ausgerechnet werden.

Eine optimale Anpassung eines solchen Wischblattes auch an Scheiben mit komplizierterem Krümmungsverlauf ist möglich, wenn die Krümmung der Scheibe von der Krümmung des Tragelements bzw. die zweite Ableitung der Krümmung der Scheibe von der zweiten Ableitung der Krümmung des Tragelements abgezogen wird. In diesem Fall kann eine Auflagekraftverteilung vorgegeben werden, wie sie für ein Wischblatt, das auf eine ebene Scheibe aufgedrückt wird, erwünscht ist. Die Differenz der zweiten Ableitungen der jeweiligen Krümmungen ist dann wieder proportional dieser Auflagekraftverteilung.

Ein erfindungsgemäßes Wischblatt mit den Merkmalen des Anspruchs 15 zeichnet sich dadurch aus, dass ohne spezielle Anpassung für durchschnittliche Scheibentypen ein hervorragendes Wischergebnis erzielt wird. Durch die aufgeführte, sehr einfache Maßnahme wird erreicht, dass die Auflagekraftverteilung in den allermeisten Fällen den Anforderungen genügt. Die genannten Stützpunkte sind hinreichend genau, um daraufhin einen einzuhaltenden Krümmungsverlauf zu bestimmen.

Optimiert wird ein Wischblatt nach Anspruch 15 durch die Maßnahmen des Anspruchs 16. Auch bei komplexeren Scheibungskrümmungsverläufen kann durch die Vorgabe der Auflagekraftverteilung an bestimmten Stützpunkten die Wischqualität gesteigert werden. Trotzdem ist es möglich, das Wischblatt ohne aufwendige Berechnungen zu konstruieren. Der Krümmungsverlauf kann im wesentlichen vorbestimmt und durch einfache Versuche optimiert werden. Solange die Vorgabe, dass die Auflagekraftverteilung, die vorherrscht, wenn das Wischblatt auf die zu wischende Scheibe gedrückt ist, in einem Bereich ungefähr hälftig zwischen Mitte und Ende des Wischblatts höher ist als am Ende des Wischblatts eingehalten werden, ist eine hervorragende Wischqualität gewährleistet.

In einem erfindungsgemäßen Verfahren zur Herstellung eines solchen Wischblatts werden die einzelnen Parameter entsprechend der erfindungsgemäßen Lehre ausgewählt und wird das Tragelement so vorgebogen, dass sein Krümmungsverlauf mindestens eine der vorgenannten Bedingungen erfüllt. Dabei ist es besonders günstig, das Tragelement zuerst zu biegen und dann mit der Wischleiste und dem Verbindungselement zusammenzufügen. Es ist aber auch möglich, das Verbindungselement mit dem Tragelement zu verbinden und dann erst die Wischleiste hinzuzufügen.

Zeichnung

In der Zeichnung zeigen: Figur 1 eine perspektivische Darstellung eines an der Scheibe angelegten, mit einem zur Scheibe belasteten Wischerarm verbundenen Wischblatts, Figur 2 eine Prinzipdarstellung einer Seitenansicht eines unbelastet auf die Scheibe aufgesetzten Wischblatts, gegenüber Figur 1 verkleinert dargestellt, Figur 3 die Schnittfläche eines Schnitts durch das Wischblatt gemäß Figur 1, entlang der Linie III-III in vergrößerter Darstellung, die Figuren 4 und

5 eine Variante zu Figur 3, die Figuren 6 und 7 ein Wischblatt in einer anderen Ausführungsform mit einem eingezeichneten Koordinatensystem, die Figuren 8 und 9 jeweils berechnete und gemessene Werte für die Auflagekraftverteilung über der Länge des Wischblatts aufgetragen und Figur 10 eine unmaßstäbliche Prinzipdarstellung eines zum Wischblatt gehörenden Tragelements in Seitenansicht.

Beschreibung des Ausführungsbeispiels

Ein in Figur 1 dargestelltes Wischblatt 10 weist ein langgestrecktes, federelastisches, auch als Flachbalken zu bezeichnendes Tragelement 12 für eine Wischleiste 14 auf, das in Figur 10 separat dargestellt ist. Wie aus den Figuren 1, 3 und 4 ersichtlich ist, sind das Tragelement 12 und die Wischleiste 14 längsachsenparallel miteinander verbunden. An der von der zu wischenden Scheibe 15 - in Figur 1 strichpunktiert gezeichnet - abgewandten Oberseite des Tragelements 12 ist als Verbindungsmittel eine Anschlußvorrichtung 16 angeordnet, mit deren Hilfe das Wischblatt 10 mit einem an der Karosserie eines Kraftfahrzeugs geführten, angetriebenen Wischerarm 18 lösbar verbunden werden kann. An der der Scheibe 15 zugewandten Unterseite des Tragelements 12 ist die langgestreckte, gummielastische Wischleiste 14 angeordnet.

An dem freien Ende 20 des Wischarms 18 ist ein als Gegenanschlußmittel dienender Haken angeformt, welcher einen zur Anschlußvorrichtung 16 des Wischblatts 10 gehörenden Gelenkbolzen 22 umgreift. Die Sicherung zwischen dem Wischerarm 18 und dem Wischblatt 10 wird durch nicht näher dargestellte, an sich bekannte, als Adapter ausgebildete Sicherungsmittel übernommen.

Der Wischerarm 18 und damit auch dessen Hakenende 20 sind in Richtung des Pfeiles 24 zur zu wischenden Scheibe 15 belastet, deren zu wischende Oberfläche in den Figuren 1 und 2 durch eine strichpunktierte Linie 26 angedeutet ist. Die Auflagekraft F_{wf} (Pfeil 24) legt das Wischblatt 10 über dessen gesamte Länge an der Oberfläche 26 der zu wischenden Scheibe 15 an.

Da die in Figur 2 dargestellte strichpunktierte Linie 26 die stärkste Krümmung der Scheibenoberfläche im Bereich des Wischfeldes darstellen soll ist klar ersichtlich, daß die Krümmung des mit seinen beiden Enden an der Scheibe anliegenden, noch unbelasteten Wischblatts 10 stärker ist als die maximale Krümmung der sphärisch gekrümmten Scheibe 15. Unter der Auflagekraft F_{wf} (Pfeil 24) legt sich das Wischblatt 10 mit seiner zur Wischleiste 14 gehörenden Wischlippe 28 über seine gesamte Länge an der Scheibenoberfläche 26 an. Dabei baut sich im bandartigen federelastischen Tragelement 12 eine Spannung auf, welche für eine ordnungsgemäße Anlage der Wischleiste 14 bzw. der Wischlippe 28 über deren gesamte Länge an der Kraftfahrzeugscheibe 15 sorgt. Während des Wischbetriebs bewegt der Wischerarm 18 das Wischblatt 10 quer zu dessen Längserstreckung über die Scheibe 15. Diese Wisch- oder Arbeitsbewegung ist in Figur 1 mit dem Doppelpfeil 29 bezeichnet.

Im folgenden soll nun auf die besondere Ausgestaltung des erfindungsgemäßen Wischblatts näher eingegangen werden. Wie die unmaßstäblich dargestellte Figur 3 zeigt, ist die Wischleiste 14 an der unteren, der Scheibe 15 zugewandten Bandfläche des Tragelements 12 angeordnet. Mit Abstand von dem Tragelement 12 ist die Wischleiste 14 von ihren beiden Längsseiten her so eingeschnürt, daß in ihrem Längsmittelbereich ein Kippsteg 30 verbleibt, der sich über die gesamte Länge der Wischleiste 14 erstreckt. Der Kippsteg 30 geht in die Wischlippe 28 über, die einen im wesentlichen keilförmigen Querschnitt aufweist. Durch die Auflagekraft (Pfeil 24) wird das Wischblatt beziehungsweise die Wischlippe 28 gegen die zu wischende Oberfläche 26 der Scheibe 15 gedrückt, wobei sie unter dem Einfluß der Wischbewegung - von der in der Figur 3 speziell die eine der beiden gegenläufigen Wischbewegungen (Doppelpfeil 29) betrachtet wird und die durch den Richtungspfeil 32 angedeutet ist - in eine sogenannte Schlepplage kippt, in der sich die Wischlippe an dem am Tragelement 12 gehaltenen Teil der Wischleiste 14 über ihre gesamte Länge abstützt. Dieser Abstützung welche in der Figur 3 mit dem Pfeil 34 gekennzeichnet ist erfolgt stets - in Abhängigkeit von der jeweiligen Wischrichtung (Doppelpfeil 29 bzw. Pfeil 32) an der in der jeweiligen Wischrichtung hintenliegenden Oberkante der Wischlippe 28, sodaß diese stets in einer sogenannten Schlepplage über die Scheibe geführt wird. Diese Schlepplage ist für einen effektiven und geräuscharmen Betrieb der Wischvorrichtung notwendig. Die Umkehrung der Schlepplage erfolgte in der sogenannten Umkehrposition des Wischblatts 10, wenn dieses seine Wischbewegung (Doppelpfeil 29) umkehrt. Dabei führt das Wischblatt eine Auf- und Abbewegung aus, welche durch das Umkippen der Wischlippe 28 bedingt ist. Die Aufbewegung erfolgt entgegen Richtung des Pfeiles 24 und somit auch entgegen der Anlegekraft. In der entgegen dem Pfeil 32 gerichteten anderen Wischbewegung ergibt sich somit ein Spiegelbild der Figur 3.

In der gegenüber dem Wischblatt in Figur 1 vergrößert dargestellten Figur 4 ist ein Querschnittsprofil 40 gezeigt, mit einer rechteckigen Schnittfläche mit einer Breite b und einer Dicke d. Außerdem ist ein Koordinatensystem über das Tragelement 12 gezeichnet. In Figur 6 ist als 3. Koordinate eine der Krümmung des Tragelements 12 folgende s-Koordinate eingezeichnet, zu der die y- und z-Koordinaten senkrecht stehen.

Wird nun das Wischblatt 10 mit einer Kraft F_{wf} (Pfeil 24) insbesondere vom Wischarm 18 auf eine Scheibe 26 gepreßt, ergibt sich eine gewisse Kraftverteilung p(s), die zu einem Moment M(s) führt, das maximal in der Mitte des Tragelements 12 ist. Für eine, für den Wischbetrieb günstige konstante Auflagekraftverteilung

$$p = \frac{F_{wf}}{L}$$

ist das Moment

$$M(s) = p * \frac{(\frac{L}{2} - s)^2}{2}$$

und somit

$$M(s) = F_{wf} * \frac{(\frac{L}{2} - s)^2}{2L}$$

Für eine nach außen abnehmende Auflagekraftverteilung, die sich insbesondere zum Umlegen der Wischlippen eignet, ist das Moment M(s) über seine Gesamtlänge etwas kleiner als das für eine konstante Kraftverteilung berechnete Moment:

$$M(s) < p * \frac{(\frac{L}{2} - s)^2}{2}$$

Geht man nun davon aus, dass ein Reibwert μ für eine trokkene Scheibe ungefährt 1 ist, ist im Betrieb das seitliche Moment gleich dem Biegemoment M(s), was insbesondere aus der vorgegebenen Kraftverteilung p(s) folgt.

Aus dem seitlichen Biegemoment folgt ein seitlicher Auslenkungswinkel γ, der sich durch Integration der Einzelauslenkungen vom Angriffspunkt des Wischerarms am Wischblatt bis zum Wischblattende hin berechnen läßt. Im Falle einer mittig angeordneten Anschlußvorrichtung 16 berechnet sich der Auslenkungswinkel nach

$$\gamma = \int_0^{L/2} \frac{M(s)}{E * I_{zz}} ds$$

Unter Berücksichtigung der Beziehung des Momentes für eine konstante Auflagekraftverteilung erhält man eine einfache Abschätzung für den Winkel γ:

$$\gamma < \int_0^{L/2} \frac{p(s)(\frac{L}{2} - s)}{2 * E * I_{zz}} ds$$

Durch Integration erhält man

$$\gamma < \frac{p * L^3}{48 * E * I_{zz}} = \frac{F_{wf} * L^2}{48 * E * I_{zz}}$$

Der Erfindung liegt unter anderem die Erkenntnis zugrunde, dass eine gute Wischqualität insbesondere durch Vermeiden von Rattern dann erzielt wird, wenn der Winkel γ die Größe 0,5° (=0,009rad) insbesondere die Größe 0,3° (=0,005rad) nicht überschreitet. Damit läßt sich eine einfache Beziehung zwischen der Auflagekraft und den geometrischen Größen des Wischblatts herleiten, gemäß dem

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0{,}009$$

insbesondere < 0,005 ist.

Für dem am häufigsten auftretenden Fall eines rechteckigen Profils 40, wie in Figur 3 dargestellt, bestimmt sich das Trägheitsmoment zu:

$$I_{zz} = \frac{d * b^3}{12}$$

wobei d = Dicke des Tragelements
b = Breite des Tragelements ist.

Die Breite b und die Dicke d sind folglich so auszuwählen, dass

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0{,}009$$

insbesondere <0,005 sein soll.

Ist das Tragelement 12 in zwei einzelne Federbalken 42 und 44 aufgeteilt, wie das in Figur 4 dargestellt ist, so kann bei den obigen Überlegungen in erster Näherung die Breite b als Summe der Einzelbreiten b1 und b2 angenommen werden: $b=b_1+b_2$. Damit lassen sich auch für derartige Systeme einfache Beziehungen zwischen der Breite und der Dicke eines Tragelements herleiten.

Für den Fall, dass kein rechteckiges Querschnittsprofil gewählt werden soll, ist es notwendig, das Trägheitsmoment I_{zz} zu bestimmen und in die oben genannten Beziehungen entsprechend einzusetzen. Ebenso sind Querschnittsveränderungen über die Länge des Wischblatts oder ein nicht zentraler Angriffspunkt des Wischerarms am Wischblatt in den obigen Überlegungen entsprechend zu berücksichtigen.

Um ein möglichst geräuscharmes Umlegen der Wischlippe 28 aus ihrer einen Schlepplage in ihre andere Schlepplage zu erreichen, wird das zur Verteilung der Anlegekraft (Pfeil 24) dienende Tragelement 12 so ausgelegt, daß der Anlegedruck der Wischleiste 24 beziehungsweise der Wischlippe 28 an der Scheibenoberfläche 26 in deren Mittelabschnitt 36 (Figur 11) größer ist als an wenigsten einen der beiden Endabschnitten 38.

Die Verteilung der Anlagekraft über das Tragelement erfolgt in Abhängigkeit verschiedener Parameter des Tragelements wie beispielweise das Querschnittsprofil, der Querschnittsverlauf über die Länge des Tragelements oder auch der Radiusverlauf R(s) entlang des Tragelements. Eine Optimierung des Tragelements in Richtung auf eine vorgegebene Auflagekraftverteilung p (s) ist deshalb sehr aufwendig. Der Erfindung liegt nun die Erkenntnis zugrunde, dass bei einem Tragelement mit einem über die Länge des Tragelements im wesentlichen konstanten, insbesondere rechteckigen Querschnitt, die Auflagekraftverteilung p(s) über eine Vorgabe der Krümmung K entlang einer Koordinate s festgelegt werden kann, wobei die Koordinate s sich entlang des Tragelements erstreckt. Die Krümmung K(s) ist gleich dem inversen Radius in Abhängigkeit von s:

$$K(s) = \frac{1}{R(s)}$$

Bei dem Tragelement besteht eine Beziehung zwischen dem Biegemoment M, dem Radius R des Tragelements, dessen Elastizitätsmodul E sowie dem an dem jeweiligen Ort vorherrschenden Flächenträgheitsmoment I. Die Beziehung wird besonders einfach, wenn sie auf die mit den Tragelementen mitlaufenden Koordinate s bezogen wird:

$$K(s) = \frac{M(s)}{E*I}$$

Durch zweimaliges Differenzieren nach dem Ort s erhält man die Beziehung:

$$\frac{d^2K(s)}{ds^2} = \frac{d^2M(s)/ds^2}{E*I}$$

Da die zweite Ableitung des Biegemoments M nach der mitlaufenden Koordinate s gleich der Auflagekraftverteilung p entlang der Koordinate s entspricht, die entsteht, wenn man das Tragelement auf eine ebene Scheibe aufpreßt, folgt daraus, dass die zweite Ableitung der Krümmung K nach der mitlaufenden Koordinate s bis auf eine Konstante mit dieser Auflagekraftverteilung p auf einer ebenen Scheibe übereinstimmt. Die Konstante ist abhängig vom Elastizitätsmodul E sowie vom Flächenträgheitsmoment I, das seinerseits sehr einfach wird, wenn es sich um einen rechteckigen Querschnitt handelt. Bei vorgegebener, nach außen abfallender Auflagekraftverteilung p kann darüber rechnerisch oder in einfachen Versuchen das Krümmungsprofil K(s) ermittelt werden. Die äußere Gestalt und damit die für die Herstellung notwendigen Parameter des Tragelements sind damit vom Fachmann einfach zu ermitteln.

Um die Form der Scheibe zu berücksichtigen, für die das Wischblatt verwendet werden soll, ist die obige Beziehung dahingehend zu korrigieren, dass von der für eine ebene Scheibe vorgegebene, nach außen abfallenden Auflagekraftverteilung p entlang der Koordinate s, die noch durch den Elastizitätsmodul E und das Flächenträgheitsmoment I dividiert wird, die zweite Ableitung der Krümmung $K_{Scheibe}$ der Scheibe nach der Koordinate s dazu addiert werden muß:

$$\frac{d^2K(s)}{ds^2} = \frac{p(s)}{E*I} + \frac{d^2K_{Scheibe}(s)}{ds^2}$$

Auch hierüber ist es für den Fachmann einfach, ein Tragelement für eine bestimmte Scheibe zu konfigurieren:

- Festlegen der Länge L und des Querschnittprofils, insbesondere die Breite b und die Dicke d über Erfahrungswerte,
- Festlegen einer Auflagekraft F_{wf} bzw. einer Auflagekraftverteilung p für eine ebene Scheibe, die eine gute Wischqualität gewährleistet, ebenfalls über Erfahrungswerte,
- Ausmessen des Krümmungsverlaufes $K_{Scheibe}$ der Scheibe,
- Zweifaches Ableiten dieses Krümmungsverlaufes $K_{Scheibe}$ der Scheiben nach einer mit der Krümmung mitlaufenden Koordinate s,
- Berechnung der zweiten Ableitung des Krümmungsverlaufes K(s) des Tragelements nach obiger Beziehung,
- Zweifaches Integrieren ergibt den gesuchten Krümmungsverlauf K(s) des Tragelements.

Es hat sich gezeigt, dass gute Wischergebnisse dann erzielt werden können, wenn die Krümmung K entlang der mitlaufenden Koordinate s derart ist, dass die Auflagekraftverteilung, die vorherrscht, wenn das Wischblatt auf eine ebene Scheibe gedrückt ist, in einem Bereich ungefähr hälftig zwischen Mitte und Ende des Wischblatts höher ist als am Ende des Wischblatts. In den Figuren 8 und 9 ist dieser Bereich 40 für eine Seite angedeutet. Der Erfindung liegt die Erkenntnis zugrunde, dass der Verlauf der Auflagekraftverteilung p im Bereich 40 eine kleinere Bedeutung zukommt, als der Relation zwischen der Auflagekraftverteilung p im Bereich 40 zur Auflagekraftverteilung p an den Enden des Wischblatts. In den Figuren 8 und 9 ist jeweils die gesamte Länge L eines Wischblatts aufgetragen, wobei das Anschlußelement 16 in der

Mitte des Wischblatts angeordnet ist, so dass den Wischblattenden die Größe 0,50 L zukommt.

Sehr gute Wischergebnisse werden erzielt, wenn die Krümmung K entlang einer der Längserstreckung des Tragelements 12 folgenden Koordinate s solche Werte aufweist, dass die Auflagekraftverteilung p, die vorherrscht, wenn das Wischblatt auf die zu wischende Scheibe gedrückt ist, im Bereich ungefähr hälftig zwischen Mitte und Ende des Wischblatts höher ist als am Ende des Wischblatts. Durch die Berücksichtigung des Scheibenverlaufs, für den das Wischblatt vorgesehen ist, wird die allgemeine Eigung für beliebige Scheiben zwar eingeschränkt, die ausgewählte Scheibe jedoch optimal gewischt.

Figur 10 zeigt einen möglichen Krümmungsverlauf K des Tragelements 12, der eine Auflagekraftverteilung p der Wischlippe 28 an der Scheibe 15 ergeben kann, die zum Wischblattende hin abfällt. Bei diesem federelastischen Tragelement 12, das unbelastet eine stärkere Hohlkrümmung gegenüber der Scheibe aufweist als diese im Bereich des vom Wischblatt überstrichenen Wischfeldes gekrümmt ist, ist der Krümmungsverlauf K so ausgeführt, daß dieser im Mittelabschnitt 36 des Tragelements 12 stärker ist als an dessen Endabschnitten 38.

Durch die Verringerung der Auflagekraft der Wischlippe 28 an der Scheibenoberfläche 26 im Bereich eines Wischblattendes oder an beiden Wischblattenden wird ein schlagartiges Umspringen oder Umschnappen der Wischlippe 28 aus ihrer einen Schlepplage in ihre andere Schlepplage vermieden. Vielmehr erfolgt beim erfindungsgemäßen Wischblatt ein vergleichsweise sanftes Umlegen der Wischlippe vom Wischblattende aus fortschreitend zur Wischlippenmitte beziehungsweise bis zum anderen Wischlippenende. Die Figur 3 zeigt in Verbindung mit Figur 1, daß auch bei sphärisch gekrümmten Scheiben die geringer belasteten Endabschnitte der Wischlippe 28 noch wirksam an der Scheibenoberfläche anliegen.

Allen Ausführungsbeispielen ist gemeinsam, daß der Anlegedruck (Pfeil 24) der Wischleiste 14 an der Scheibe 15 in deren Mittelabschnitt 36 größer ist als an wenigstens einem ihrer beiden Endabschnitte 38. Dies gilt auch dann, wenn - abweichend vom gegenständlich gezeigten Wischblatt 10 mit einem einteiligen, als Federschiene dargestelltem Tragelement 12 - das Tragelement mehrteilig aufgebaut ist. Unter Umständen kann es jedoch nötig sein, auch andere Auflagekraftverteilungen vorzugeben. Mit den aufgezeigten Beziehungen können aber auch dann Wischblätter konzipiert werden, die hervorragende Wischergebnisse erzielen.

Bei dem erfindungsgemäßen Verfahren zur Herstellung eines Wischblatts wird wie bereits oben angegeben zuerst die Kontur und der Krümmungsverlauf K bestimmt und dann das Tragelement 12 mit der Wischleiste 14 und dem Verbindungselement 16 zusammengefügt. Ist das Tragelement aus zwei parallelen Flachbalken aufgebaut, können diese bevorzugt miteinander, d.h. direkt nebeneinander vorgebogen werden, was einen sehr symmetrischen und damit verwindungsstabilen Aufbau des Wischblatts gewährleistet. Die beiden Tragelementhälften sind dann im laufenden Verfahren gemeinsam weiter zu verarbeiten, um eine versehentliche Separation zu vermeiden. Nach dem das Tragelements gebogen ist, wird entweder zuerst die Wischleiste angebracht, beispielsweise durch Ankleben oder Anvulkanisieren, oder auch insbesondere bei zwei Tragelementhälften durch Einlegen der Tragelementhälften in Längsnuten der Wischleiste und dann das Verbindungselement aufgebracht. Insbesondere, wenn das Verbindungselement aufgeschweißt wird, ist die Wischleiste erst nachträglich anzubringen, um thermische Schäden am Wischgummi zu vermeiden.

Ansprüche

1. Wischblatt für Scheiben, insbesondere für Kraftfahrzeuge, mit mindestens einem Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18), wobei das Tragelement (12) ein langgestreckter Flachbalken ist, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind, dadurch gekennzeichnet, dass das Tragelement (12) ein Querschnittsprofil aufweist, bei dem

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0{,}009$$

sind, wenn F_{wf} die vom Wischerarm (18) auf das Wischblatt ausgeübte Auflagekraft oder die Auflagekraft ist, für die das Wischblatt ursprünglich ausgelegt wurde und L die Länge des Tragelements (12), E der Elastizitätsmodul des Tragelements (12), I_{zz} das Trägheitsmoment des Querschnittsprofils um die z-Achse senkrecht auf eine mit dem Tragelement (12) mitlaufende s-Achse sowie senkrecht auf eine y-Achse ist.

2. Wischblatt nach Anspruch 1, dadurch gekennzeichnet, dass

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0{,}005$$

ist.

3. Wischblatt nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass das Tragelement (12) ein im wesentlichen rechteckiges Querschnittsprofil (40) aufweist, mit einer im wesentlichen konstanten Breite b und einer im wesentlichen konstanten Dicke d.

4. Wischblatt nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass das Tragelement (12) aus mindestens zwei Einzelbalken (42, 44) besteht und dass sich die Breiten (b1, b2) der Einzelbalken (42, 44) zu einer Gesamtbreite b addieren.

5. Wischblatt nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Breite b und die Dicke d des Tragelements (12) so ausgewählt sind, dass

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0{,}009$$

ist.

6. Wischblatt nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, dass die Breite b und die Dicke d des Flachbalkens so ausgewählt sind, dass

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0{,}005$$

ist.

7. Wischblatt für Scheiben, insbesondere für Kraftfahrzeug, mit mindestens einem Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18), wobei das Tragelement (12) ein langgestreckter Flachbalken ist, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind, insbesondere nach ei-

nem der vorhergehenden Ansprüchen, dadurch gekennzeichnet, dass das Tragelement (12) ein Querschnittsprofil (40) aufweist, das einen seitlichen Auslenkungswinkel mindestens eines der Tragelementenden bezogen auf die Längserstreckung des Tragelements von $\gamma < 0{,}5°$ insbesondere $< 0{,}3°$ auf der Scheibe (26) erzeugt, wenn das Wischblatt auf der Scheibe (26) quer zu seiner Längserstreckung bewegt wird und der Reibungskoeffizient zwischen Scheibe (26) und Wischleiste (14) ungefähr 1 ist.

8. Wischblatt für Scheiben, insbesondere für Kraftfahrzeuge, mit mindestens einem Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18), wobei das Tragelement (12) ein langgestreckter Flachbalken ist, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind, insbesondere nach einem der vorhergehenden Ansprüche dadurch gekennzeichnet, dass das Tragelement eine Länge L, eine Breite b und eine Dicke d aufweist, derart, dass

$$20L^2 < bd^2 < 40L^2$$

wenn L in Meter und b und d in Millimeter angegeben werden.

9. Wischblatt nach Anspruch 8, dadurch gekennzeichnet, dass das Tragelement aus mindestens zwei Federbalken besteht, deren Breiten sich addieren.

10. Wischblatt für Scheiben (15) insbesondere für Kraftfahrzeuge, mit mindestens einem langgestreckten Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18), der in einer Betriebsstellung das Wischblatt (10) auf die Scheibe (15) drückt, wobei das Tragelement (12) ein langgestreckter Flachbal-

ken ist, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind und der in einer vom Wischerarm (18) unbelasteten Stellung eine Krümmung aufweist, insbesondere nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Krümmung entlang einer der Längserstreckung des Tragelements (12) folgenden Koordinate (s) solche Werte aufweist, dass die zweite Ableitung der Krümmung nach dieser Koordinate (s) im wesentlichen proportional zu einer Auflagekraftverteilung p (s) ist, die entsteht, wenn das Wischblatt (10) auf eine ebene Scheibe (15) gedrückt ist und dass die Auflagekraftverteilung zu mindestens zu einem Ende hin abnimmt.

11. Wischblatt nach Anspruch 10, dadurch gekennzeichnet, dass

$$\frac{d^2K(s)}{ds^2} = \frac{d^2M(s)}{ds^2} * E * I = \frac{p(s)}{E * I}$$

s = Koordinate entlang dem Tragelement
K(s) = Krümmung des Tragelements
M(s) = Biegemoment
E = Elastizitätsmodul
I = Flächenträgheitsmoment des Tragelements bezüglich der neutralen Achse
p(s) = spezifische Kraft pro Längeneinheit = Auflagekraftverteilung.

12. Wischblatt für Scheiben (15) insbesondere für Kraftfahrzeuge, mit mindestens einem langgestreckten Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18), der in einer Betriebsstellung das Wischblatt (10) auf die Scheibe (15) drückt, wobei das Tragelement (12) ein langgestreckter Flachbalken ist, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind und der in einer vom Wischer-

arm (18) unbelasteten Stellung eine Krümmung aufweist, insbesondere nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Krümmung entlang einer der Längserstreckung des Tragelements (12) folgenden Koordinate (s) solche Werte aufweist, dass die zweite Ableitung der Krümmung nach dieser Koordinate (s) minus der zweiten Ableitung der Krümmung der Scheibe (15) von einem mittleren Bereich (40) zu den Enden hin abnimmt.

13. Wischblatt nach Anspruch 12, dadurch gekennzeichnet, dass der mittlere Bereich (40) der Ort des Verbindungsmittels (16) ist.

14. Wischblatt nach einem der Ansprüche 12 oder 13, dadurch gekennzeichnet, dass

$$\frac{d^2K(s)}{ds^2} = \frac{p(s)}{E*I} + \frac{d^2K_{Scheibe}(s)}{ds^2}$$

s = Koordinate entlang dem Tragelement
K(s) = Krümmung des Tragelements
M(s) = Biegemoment
E = Elastizitätsmodul
I = Flächenträgheitsmoment des Tragelements bez. der neutralen Achse
p(s) = spezifische Kraft pro Längeneinheit = Auflagekraftverteilung

15. Wischblatt für Scheiben (15) insbesondere für Kraftfahrzeuge, mit mindestens einem langgestreckten Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18), der in einer Betriebsstellung das Wischblatt (10) auf die Scheibe (15) drückt, wobei das Tragelement (12) ein langgestreckter Flachbalken ist, an dem die Wischleiste (14) und das Verbindungs-

mittel (16) befestigt sind und der in einer vom Wischerarm (18) unbelasteten Stellung eine Krümmung aufweist, insbesondere nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Krümmung entlang einer der Längserstreckung des Tragelements (12) folgenden Koordinate (s) solche Werte aufweist, dass die Auflagekraftverteilung p(s), die vorherrscht, wenn das Wischblatt (10) auf eine ebene Scheibe (15) gedrückt ist, in einem Bereich (40) ungefähr hälftig zwischen Mitte und Ende des Wischblatts (10) höher ist als am Ende des Wischblatts (10).

16. Wischblatt für Scheiben (15) insbesondere für Kraftfahrzeuge, mit mindestens einem langgestreckten Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18), der in einer Betriebsstellung das Wischblatt (10) auf die Scheibe (15) drückt, wobei das Tragelement (12) ein langgestreckter Flachbalken ist, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind und der in einer vom Wischerarm (18) unbelasteten Stellung eine Krümmung aufweist, insbesondere nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Krümmung entlang einer der Längserstreckung des Tragelements (12) folgenden Koordinate (s) solche Werte aufweist, dass die Auflagekraftverteilung p(s), die vorherrscht, wenn das Wischblatt (10) auf die zu wischende Scheibe (15) gedrückt ist, in einem Bereich (40) ungefähr hälftig zwischen Mitte und Ende des Wischblatts (10) höher ist als am Ende des Wischblatts (10).

17. Verfahren zum Herstellen eines Wischblatts nach einem der vorhergehenden Ansprüchen, gekennzeichnet durch folgende Schritte:
Ermitteln der für die zu wischenden Scheibe notwendigen

Länge L und angepaßten Auflagekraft F_{wf},
Ermitteln der Breite b und der Dicke d,
Ermitteln des Krümmungsverlaufs K(s),
Biegen des Tragelements,
Verbinden von Tragelement, Wischleiste und Verbindungsmittel.

18. Verfahren nach Anspruch 17, gekennzeichnet durch folgende Schritte:
- Festlegen der Länge L und des Querschnittprofils, insbesondere die Breite b und die Dicke d über Erfahrungswerte,
- Festlegen einer Auflagekraft F_{wf} bzw. einer Auflagekraftverteilung p für eine ebene Scheibe, die eine gute Wischqualität gewährleistet, ebenfalls über Erfahrungswerte,
- Ausmessen des Krümmungsverlaufes $K_{Scheibe}$ der Scheibe,
- Zweifaches Ableiten dieses Krümmungsverlaufes $K_{Scheibe}$ der Scheiben nach einer mit der Krümmung mitlaufenden Koordinate s,
- Berechnung der zweiten Ableitung des Krümmungsverlaufes K(s) des Tragelements nach obiger Beziehung,
- Zweifaches Integrieren ergibt den gesuchten Krümmungsverlauf K(s) des Tragelements.

Zusammenfassung

Die Erfindung betrifft ein Wischblatt für Scheiben, insbesondere von Kraftfahrzeugen, mit mindestens einem Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18). Das Tragelement (12) ist ein langgestreckter Flachbalken, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind. Es wird vorgeschlagen, dass der Flachbalken ein Querschnittsprofil (40) aufweist, bei dem F_{wf} * L^2 / 48 * E * I_{zz} < 0,009 sind, wenn F_{wf} die auf das Wischblatt ausgeübte Auflagekraft oder die Auflagekraft ist, für die das Wischblatt ursprünglich ausgelegt wurde, L die Länge des Wischblatts, E der Elastizitätsmodul des Flachbalkenwerkstoffes und I_{zz} das Trägheitsmoment des Querschnittsprofils um die z-Achse (senkrecht auf eine mit dem Flachbalken mitlaufende s-Achse sowie senkrecht auf eine y-Achse) ist.

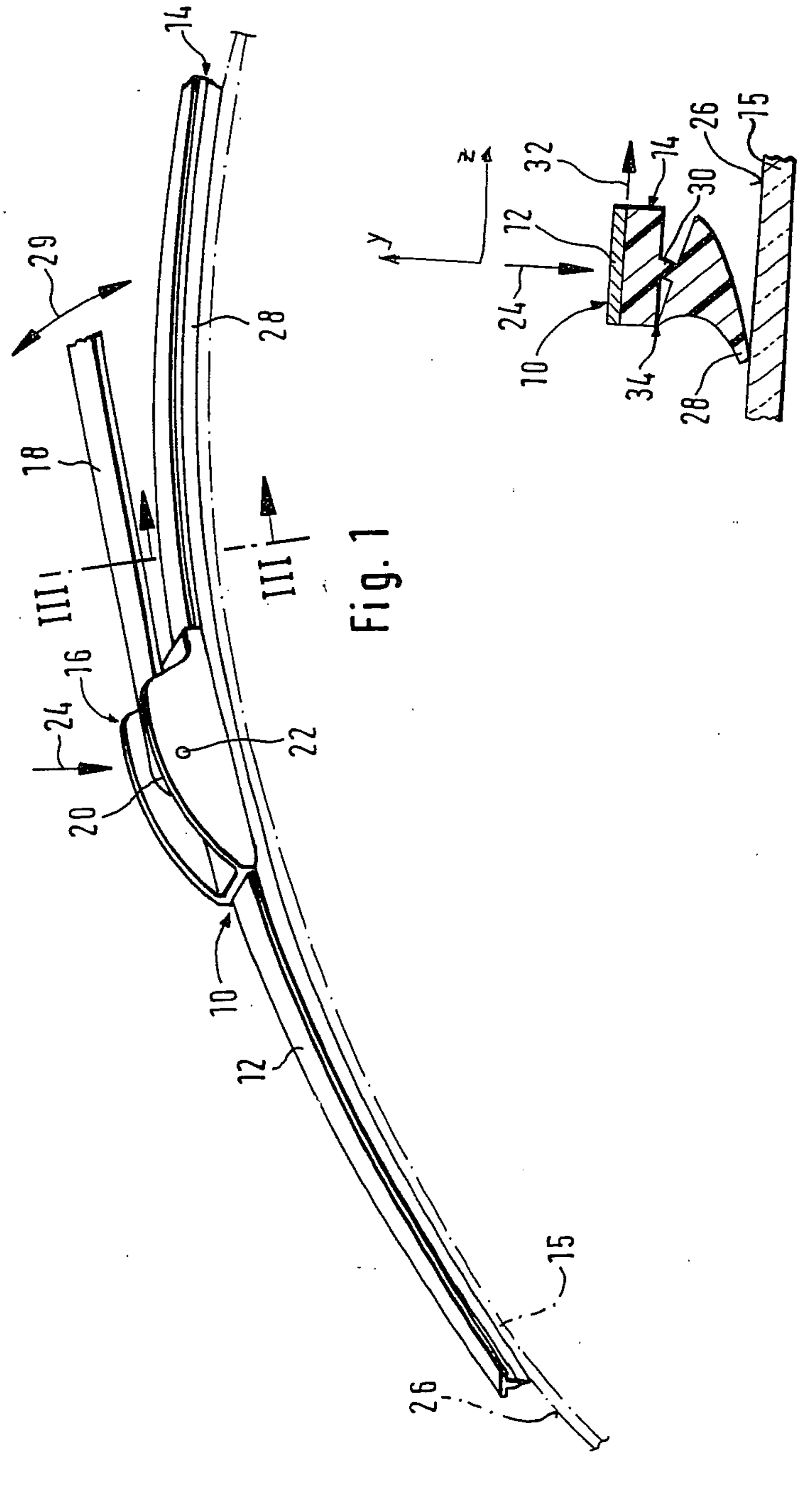

14
29
18
28
III
III
16
24
22
20
10
12
15
26

Fig. 1

z
y
32
14
12
24
10
34
30
26
15
28

Fig. 3

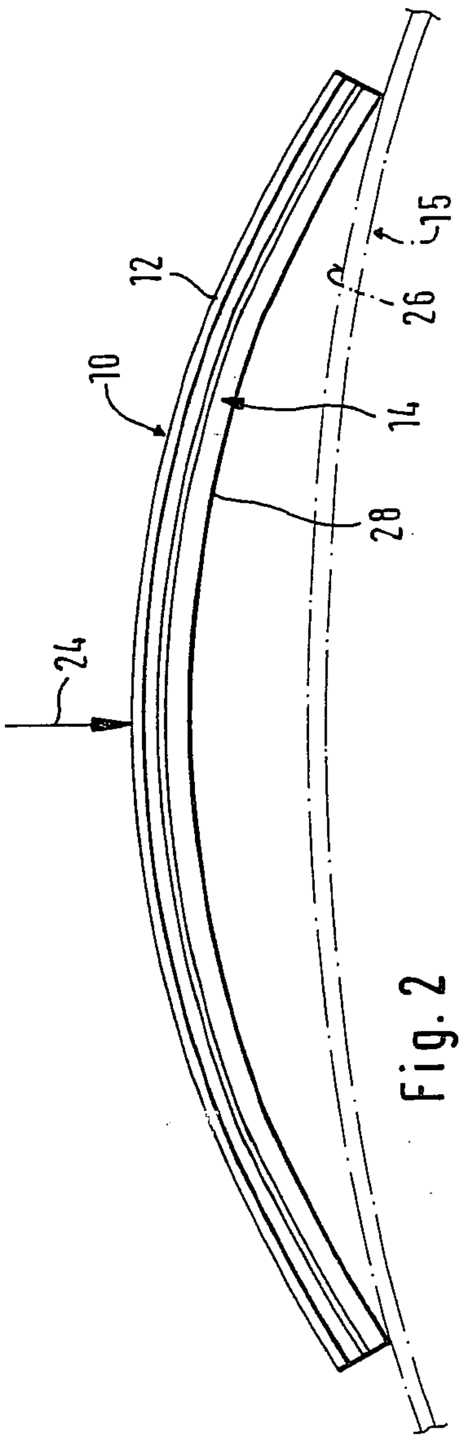


Fig. 2

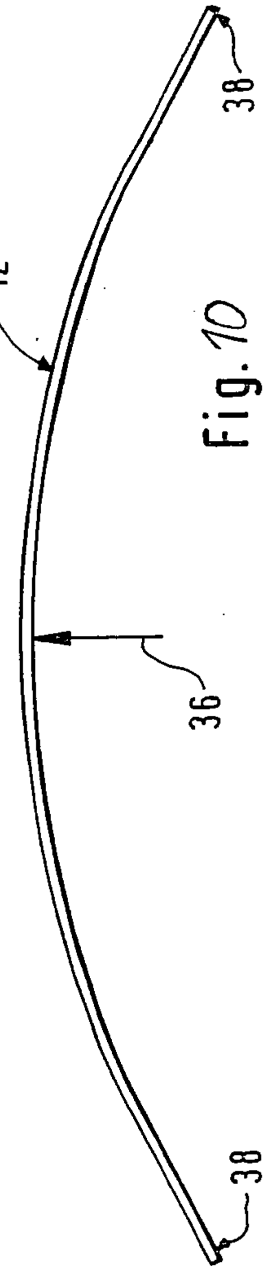


Fig. 10

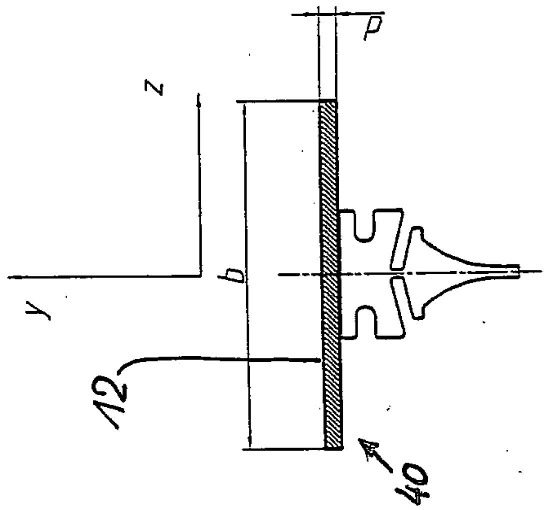


Fig. 4

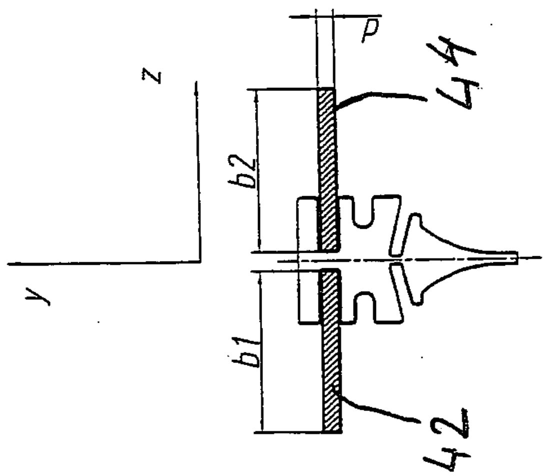


Fig. 5

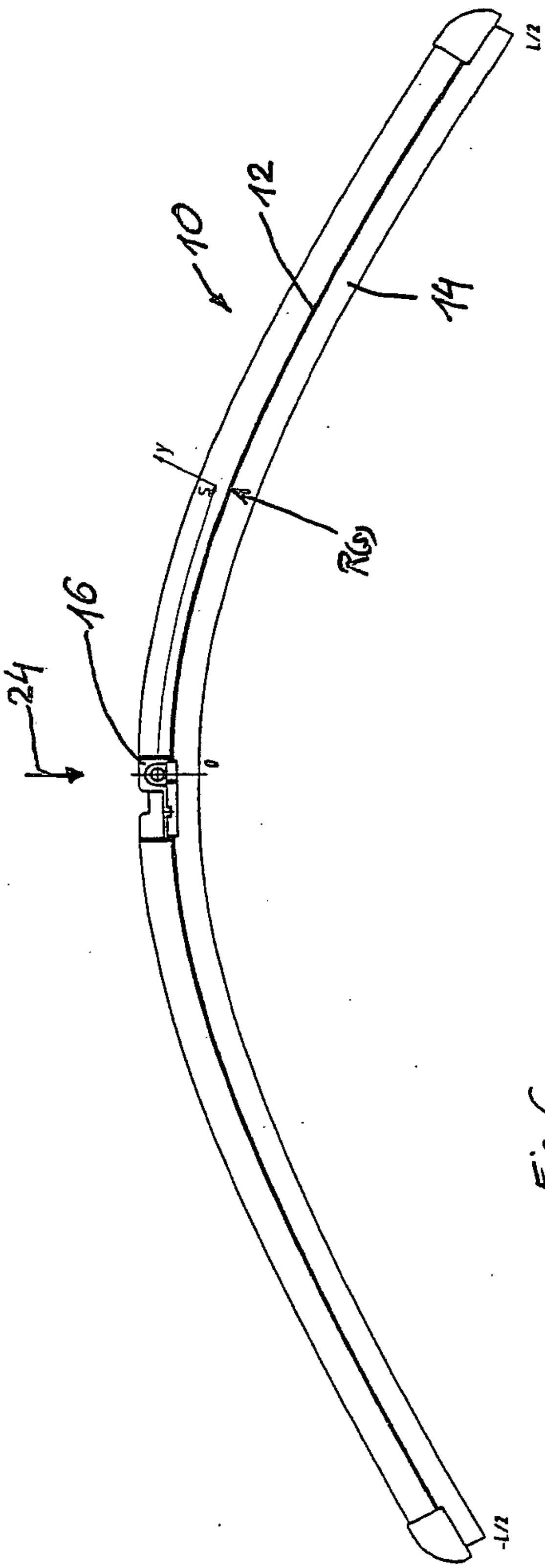


Fig.6

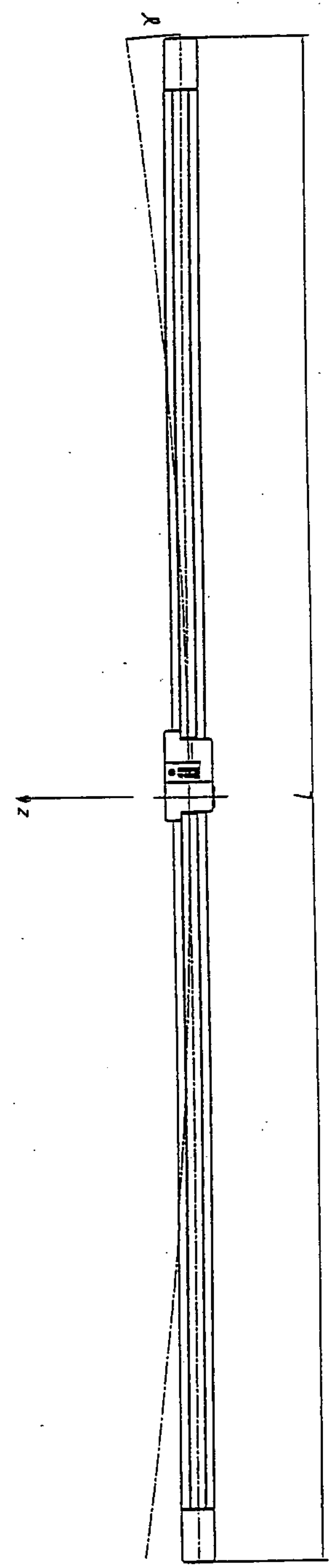


Fig.7

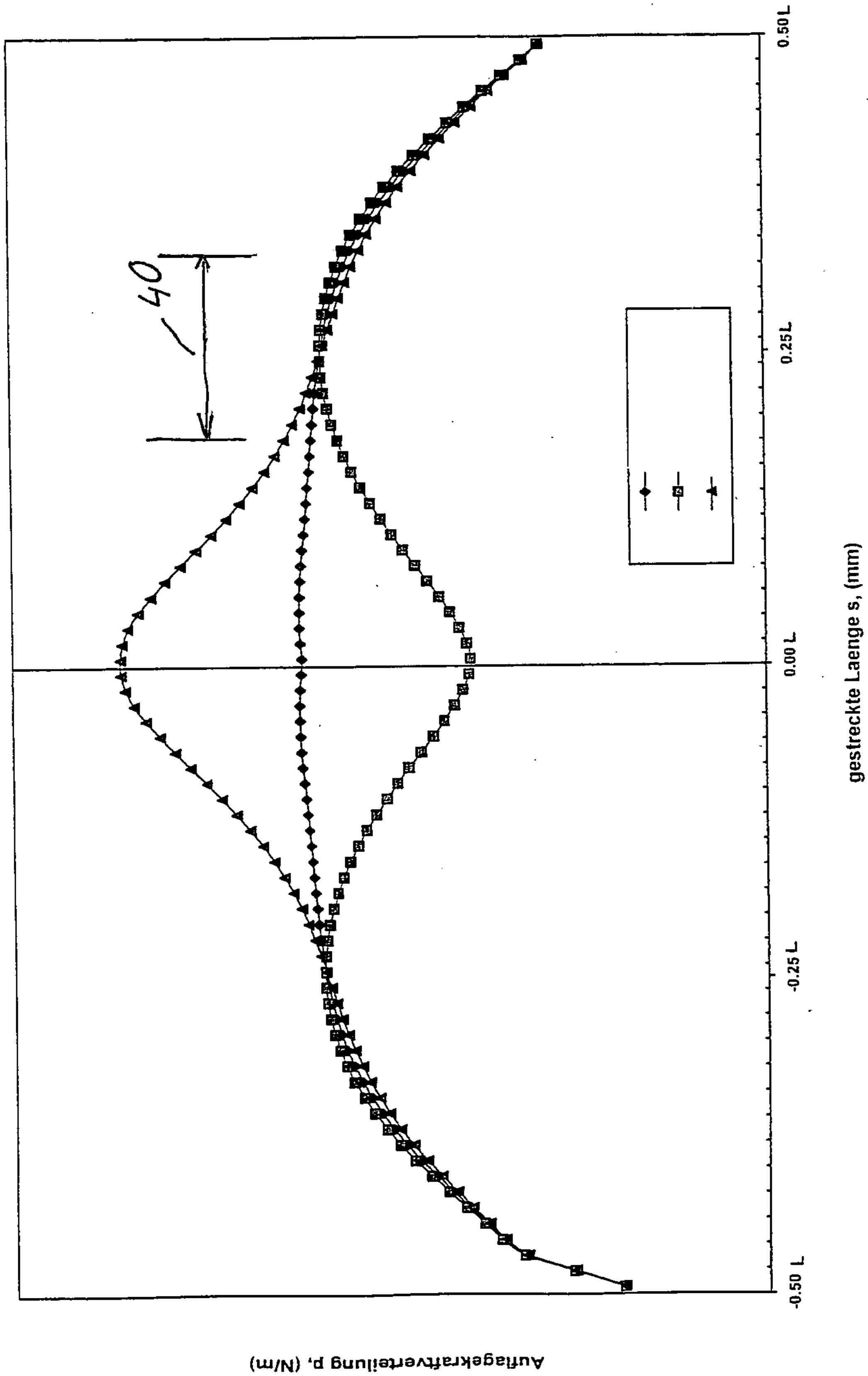
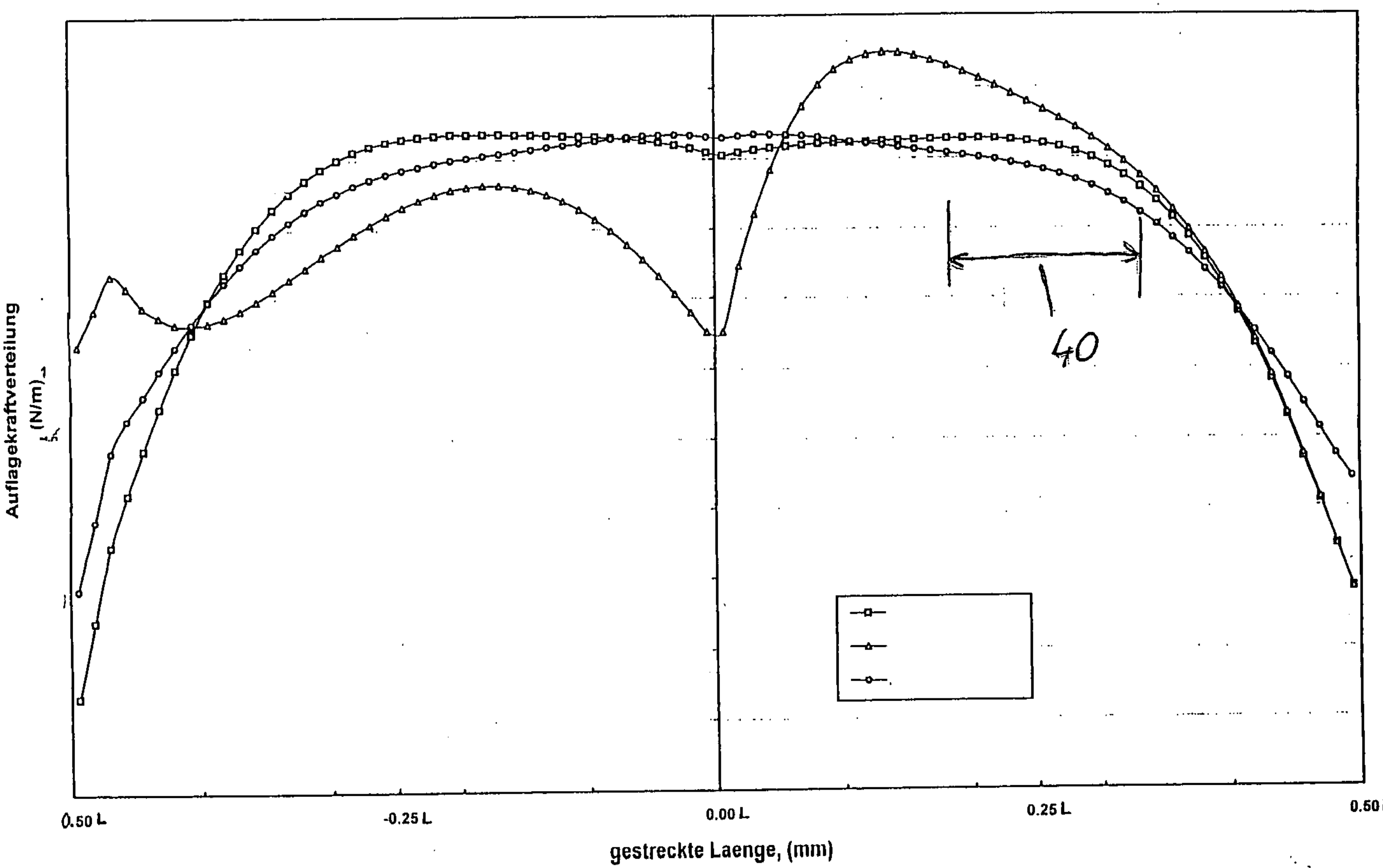

40
0.50L
0.25L
0.00 L
-0.25 L
-0.50 L
gestreckte Laenge s, (mm)
Auflagekraftverteilung p, (N/m)

Fig.8



Auflagekraftverteilung
(N/m)
0.50 L
-0.25 L
0.00 L
0.25 L
0.50 L
gestreckte Laenge, (mm)
40

Fig. 9

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Applicant(s) : RUPP, I., ET AL

Serial No. : 09/786852

Filed : 5-3-01

For : WIPER BLADE FOR WINDSHIELDS, ESPECIALLY OF MOTOR VEHICLES, AND METHOD FOR PRODUCING SUCH A WIPER BLADE

INFORMATION DISCLOSURE STATEMENT

March 9, 2001

Honorable Commissioner of Patents
and Trademarks
Washington, D.C. 20231

S I R S:

_____ In accordance with the Duty of Disclosure, Applicant(s) submit(s) herewith a copy of a Foreign Search Report in a counterpart application and copies of the reference(s) indicated therein.

_____ In the event that the Foreign Search Report is in a foreign language, a translation thereof is herewith submitted.

__X__ Attached hereto is a FORM PTO 1449 listing the references.

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09/786852
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_____ Attached hereto are copies of references cited which may be pertinent to this application. Since the references are in the English language, no statement of relevance is submitted.

_____ Attached hereto is a copy of the Office Action issued in the corresponding German application, together with a translation thereof and copies of the references cited therein. A list of the cited references is also attached.

_____ Attached hereto copies of references cited which may be pertinent to this application. An English translation of the references is also attached.

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Respectfully submitted,

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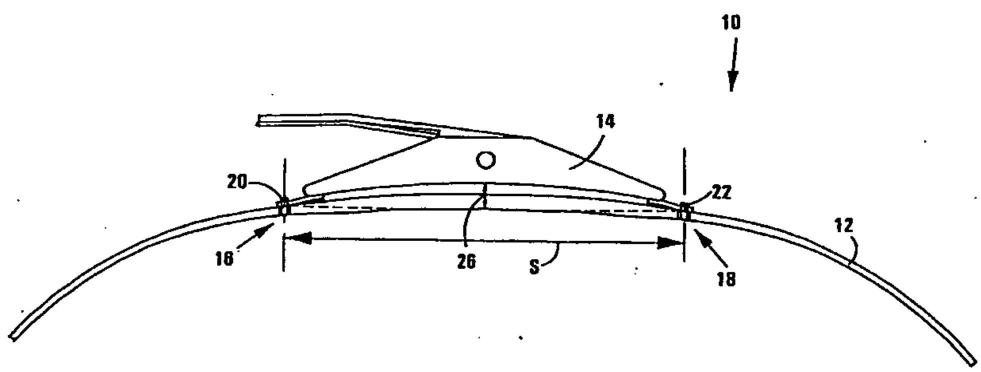
(54) Title: A WINDSCREEN WIPER



(57) Abstract

A windscreen wiper (10) includes an elongate curved backbone (12) which is of a resiliently flexible material and a force applying member (14) which is connected to the backbone at two spaced apart points (20, 22). The spacing distance S (expressed in millimetres) between the points then is between (1) $S_1 = 0.1 * L$ .... and (2) $S_2 = 0.35 * L$ .... where the length is the total length of the backbone expressed in millimetres.

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A WINDSCREEN WIPER

This invention relates to a windscreen wiper, which is also known as a windshield wiper.

The invention relates in particular to a windscreen wiper which has a curved backbone and which may have a varying width and/or thickness. It will be appreciated by those skilled in the art that the backbone may be in the form of a beam that is curved in a plane or may have compound curvature. The beam will then usually have width and thickness dimensions. The beam will also have a radius of curvature at each point along its length.

When such a windscreen wiper is pressed onto a surface such as the windscreen (or windshield) of a vehicle, the force intensity (the force per unit length) will vary at different positions along the length of the beam. A large number of factors affect the manner in which the force intensity distribution varies, such as:

the material from which the beam is made and the Young's modulus thereof;

the length of the beam;

curvature of the beam;

curvature of the surface;

variation in any one or both of the width of the beam and the thickness of the beam;

the magnitude of the force applied to the beam; and the position, or positions, at which the force is applied.

The applicant has found that, with shorter beams, it is adequate to apply the force at a single point. However, with longer beams, ie beams that are longer than about 400mm it is preferable to apply the force to the beam at two spaced apart points. The applicant has further found that the degree of variation of force intensity resulting from changes in curvature of the surface and the magnitude of the force applied to the beam, in use, varies significantly depending on the spacing between the points of application of the force and the ratio between the spacing distance and the total length of the beam.

The applicant has further found that if the spacing between the points exceeds a certain limit, the windscreen wiper will not operate in an efficient manner. There are two main factors which should be taken into account when determining the upper bound of the spacing between the points. Firstly, the vertical clearance between the beam and a force applying member should be taken in to account when, in use, the beam changes from straight to free form and vice versa. Secondly, longitudinal movement of the beam between the force application points should also be considered, when the beam changes from straight to free form and vice versa.

The applicant has conducted substantial analysis in this regard and believes that he has found a relationship between the spacing distance and the total length of the beam and, consequently, between the ratio of spacing distance to total length and length, which provides a windscreen wiper that operates in an improved manner.

According to a first aspect of the invention there is provided a windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material; and

a force applying member which is connected to the backbone at two spaced apart points

with the spacing distance S (expressed in millimetres) between the points being between

$S_1 = 0.1 * L$ .... (1)

and

$S_2 = 0.35 * L$ .... (2)

where the length L is the total length of the backbone expressed in millimetres.

Further according to a second aspect of the invention there is provided a windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material; and

a force applying member which is connected to the backbone at two spaced apart points

with the ratio R of spacing distance S between the points and the total length L (R = S/L) being between

$R_1 = 0.1$ .... (3)

and

$R_2 = 0.35$ .... (4)

where the spacing distance S and the length L are expressed in the same units of measure.

The preferred spacing distance S_p between the spaced apart points is about

$$S_p = 0.363 * L - 0.000146 * L^2 \quad \text{..........} \quad (5)$$

and the preferred ratio R_p is about

$$R_p = 0.363 - 0.000146 * L \quad \text{..........} \quad (6)$$

The force applying member may be connected to the backbone in such a manner as to permit relative longitudinal displacement between the force applying member and the backbone.

The curved backbone may have a varying width and or thickness, along its length. The backbone may further have a free form curvature in a plane or may have a compound curvature (that is curved in two planes).

It will be appreciated that the force applying member normally straddles the geometric centre of the backbone. This is particularly so for a windscreen wiper that is intended for use on a driver's side. However, the force applying member may be positioned off-centre for certain cases, such as on passenger side windscreens. In that way the overall performance of the wiper may be optimised.

The invention is now described, by way of example with reference to the accompanying drawings. In the drawings,

Figure 1 shows schematically a windscreen wiper in accordance with the invention;

Figure 2 or Graph A illustrates the beam width at various positions along the length of the beam;

Figure 3 or Graph B illustrates the thickness of the beam at various positions along the length of the beam;

Figure 4 or Graph C shows the beam centre-line coordinate relative to the position along the length of the beam;

Figure 5 or Graph D illustrates the typical clearance required for the beam as a function of spacing distance S; and

Figure 6 or Graph E illustrates the typical amount of longitudinal movement between the beam and the pin when the beam changes shape from curved to straight and vice-versa.

The windscreen wiper 10 includes a backbone 12 which is in the form of a beam. The beam is made from spring steel having a Young's modulus of 205GPa. The length of the beam is 700mm. The beam tapers both in width and thickness from its centre toward its free ends or tips as shown in Graph A and Graph B respectively. Graph A illustrates the beam width (in millimetres) at various positions along the length of the beam, which is also measured in millimetres. Graph B illustrates the thickness of the beam (in millimetres) at various positions along the length of the beam which is also measured in millimetres.

The beam is curved longitudinally, in a plane, with a predetermined radius of curvature at every point along its length. Graph C shows the beam centre-line coordinate relative to the position along the length of the beam (in millimetres).

A force applying member 14 is connected to the beam 12 at two spaced apart points 16 and 18, with a spacing distance S between the points. At the point 16, the force applying member 14 is connected to the beam 12 by means of a pin 20 which is pivotally located in a complementary hole in the beam 12 which does not permit relative longitudinal movement between the beam 12 and the force applying member 14. At the other point 18, the force applying member 14 is connected to the beam 12 by means of a pin 22 which is received in a longitudinal slot 24 in the beam 12 so that relative longitudinal and pivotal movement between the pin 22 and beam 12 is permitted.

It will be appreciated that there needs to be clearance between the force applying member 14 and a line between the points 16 and 18, indicated at 26, in which the section of the beam 12 between the points 16 and 18 can move when the beam changes shape from curved to straight and vice-versa.

Graph D illustrates the typical clearance 26 required for the beam 12 described above as a function of spacing distance S and Graph E illustrates the typical amount of longitudinal movement between the beam 12 and the pin 22 when the beam 12 changes shape from curved to straight and vice-versa.

The spacing S is 150mm. In this case, the ratio R of spacing distance S between the points 16 and 18 and the total length L (R = S/L) is therefore 0,214.

CLAIMS:

1. A windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material; and

a force applying member which is connected to the backbone at two spaced apart points

with the spacing distance S (expressed in millimetres) between the points being between

$$S_1 = 0.1 * L \; .... \qquad (1)$$

and

$$S_2 = 0.35 * L \; .... \qquad (2)$$

where the length L is the total length of the backbone expressed in millimetres.

2. A windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material; and

a force applying member which is connected to the backbone at two spaced apart points

with the ratio R of spacing distance S between the points and the total length L (R = S/L) being between

$$R_1 = 0.1 \; .... \qquad (3)$$

and

$$R_2 = 0.35 \; .... \qquad (4)$$

where the spacing distance S and the length L are expressed in the same units of measure.

3. The windscreen wiper as claimed in Claim 1, in which the preferred spacing distance S_p between the spaced apart points is about

$$S_p = 0.363 * L - 0.000146 * L^2 \quad \text{..........} \quad (5)$$

4. The windscreen wiper as claimed in Claim 2, in which the preferred ratio R_p is about

$$R_p = 0.363 - 0.000146 * L \quad \text{..........} \quad (6)$$

5. The windscreen wiper as claimed in Claim 1, in which the force applying member is connected to the backbone in such a manner as to permit relative longitudinal displacement between the force applying member and the backbone.

6. The windscreen wiper as claimed in Claim 1, in which the curved backbone has a varying width and thickness, along its length.

7. The windscreen wiper as claimed in Claim 1, in which the curved backbone has a constant thickness along its length.

8. The windscreen wiper as claimed in Claim 1, in which the curved backbone has a constant width along its length.

9. The windscreen wiper as claimed in Claim 1, in which the backbone has a free form curvature in a plane.

10. The windscreen wiper as claimed in Claim 1, in which the backbone has a compound curvature.

11. The windscreen wiper as claimed in Claim 1, in which the force applying member straddles the geometric centre of the backbone.

12. A windscreen wiper substantially as herein desribed with reference to the accompanying drawing.

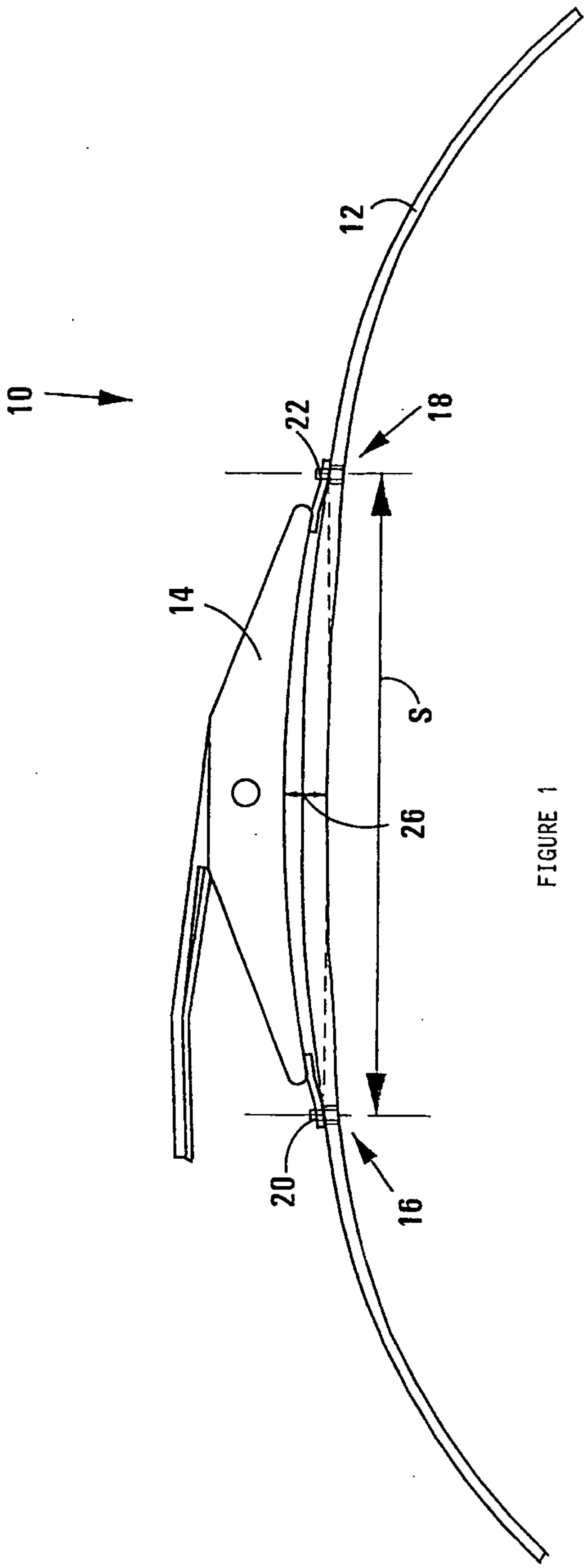
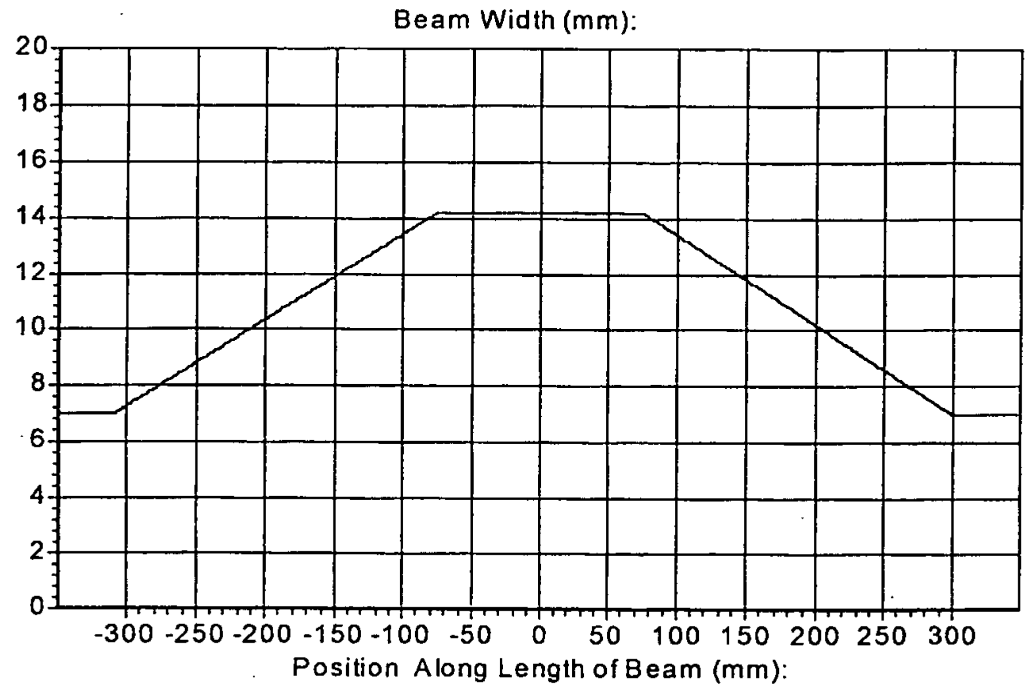
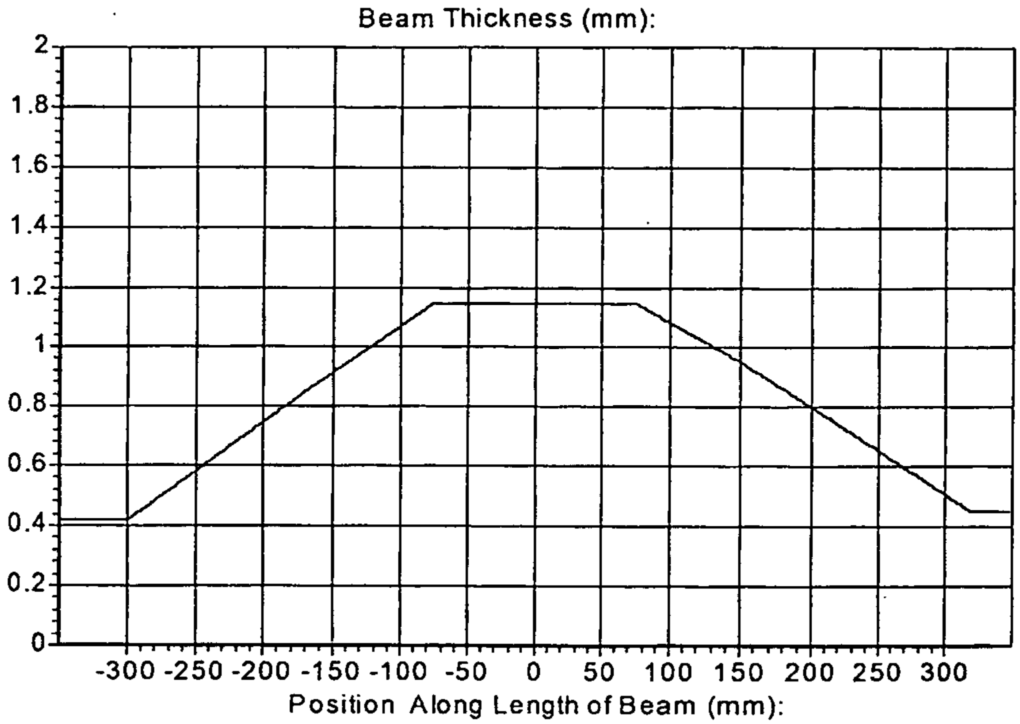


FIGURE 1



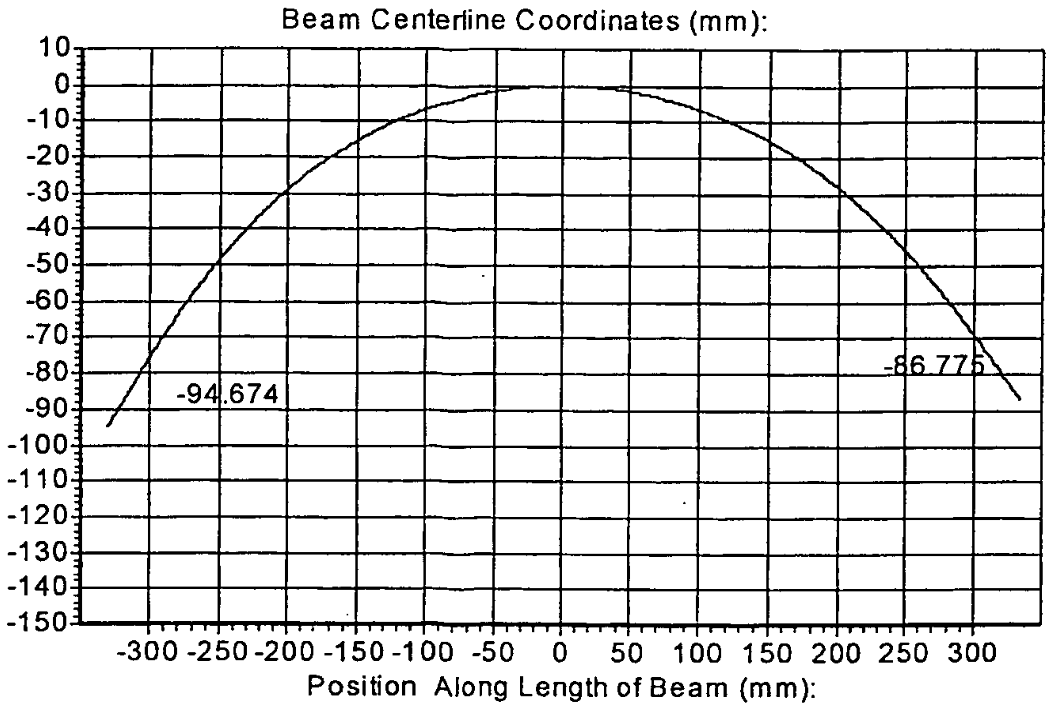
GRAPH A.

FIGURE 2



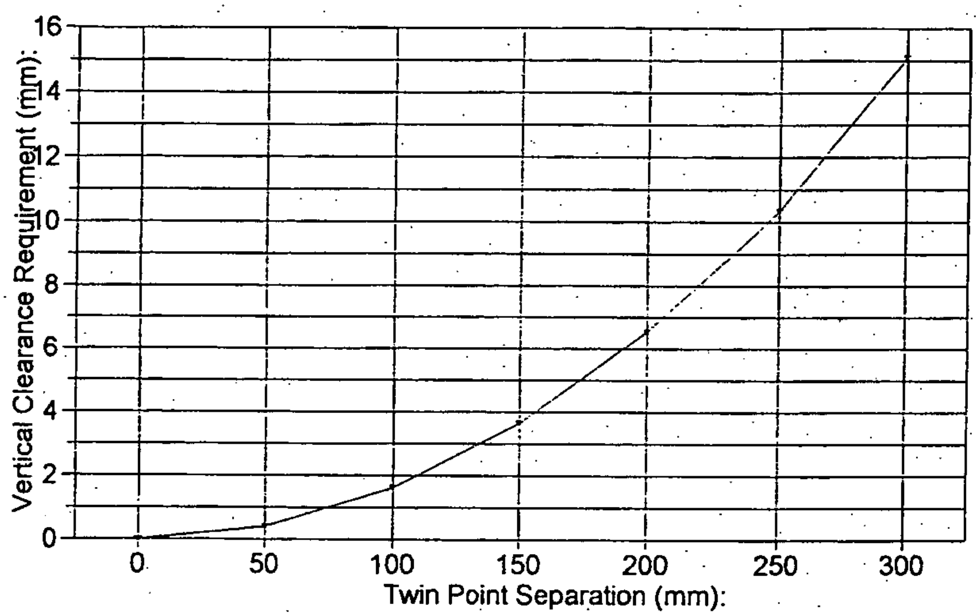
GRAPH B.

FIGURE 3



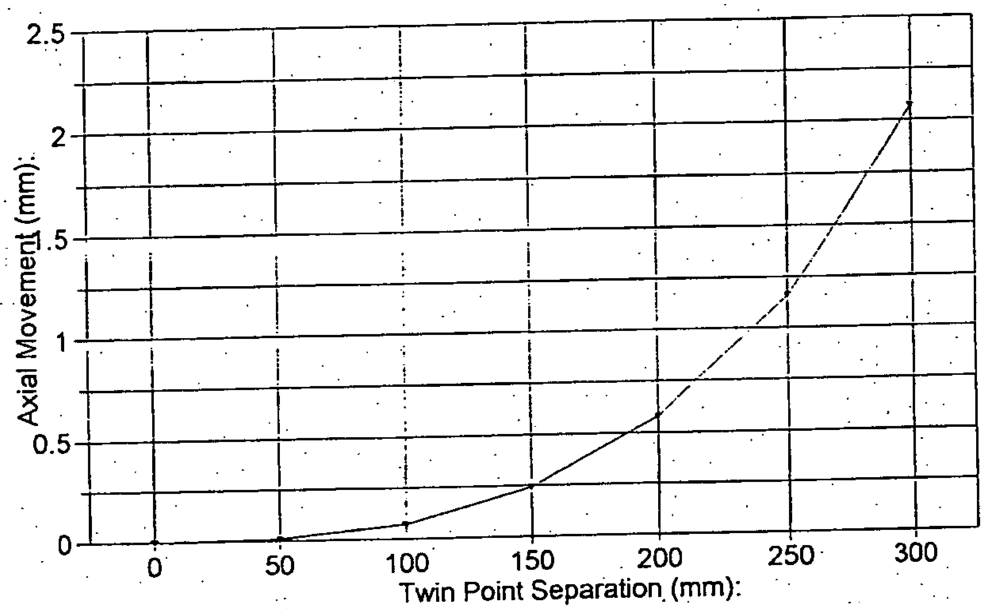
GRAPH C.

FIGURE 4



GRAPH D

FIGURE 5



GRAPH E

FIGURE 6

INTERNATIONAL SEARCH REPORT

Int tional Application No
PCT/IB 99/01574

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B60S1/38 B60S1/40

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 B60S

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)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 785 002 A (QUINLAN W ET AL) 15 January 1974 (1974-01-15)	1-5,7-9, 11,12
Y	abstract; figures 1-7 column 2, line 10 - line 53 column 3, line 3 - line 53 ---	6,10
Y	EP 0 594 451 A (ANGLO AMERICAN IND CORP LTD) 27 April 1994 (1994-04-27)	6
A	abstract; figures 1-3 page 2, line 1 - line 10 ---	1,2,9
Y	GB 2 308 542 A (VALEO SYSTEMES ESSUYAGE) 2 July 1997 (1997-07-02) abstract; claim 1; figures 1-3 page 1, line 6 -page 3, line 3 ---	10
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[X] Further documents are listed in the continuation of box C.

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14 December 1999	21/12/1999

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International Application No
PCT/IB 99/01574

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 816 194 A (ROBERT BOSCH GMBH) 7 January 1998 (1998-01-07) abstract; figures column 2, line 26 -column 3, line 29	1,2,6,9, 11
A	US 3 192 551 A (APPEL) 6 July 1965 (1965-07-06) claims 5,7; figures 1-3,7,8 column 1, line 29 - line 41 column 2, line 23 - line 72 column 3, line 9 -column 4, line 25	1,2,6-9

1

INTERNATIONAL SEARCH REPORT

Information on patent family members

Int tional Application No
PCT/IB 99/01574

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
US 3785002	A	15-01-1974	NONE			
EP 0594451	A	27-04-1994	DE	69303250	D	25-07-1996
			DE	69303250	T	07-11-1996
			ES	2088236	T	01-08-1996
			JP	2812651	B	22-10-1998
			JP	6340249	A	13-12-1994
			US	5485650	A	23-01-1996
			ZA	9307792	A	16-05-1994
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			DE	19651230	A	03-07-1997
EP 0816194	A	07-01-1998	DE	29611722	U	06-11-1997
US 3192551	A	06-07-1965	NONE			

US 20030033683A1

(19) **United States**
(12) **Patent Application Publication** (10) **Pub. No.: US 2003/0033683 A1**
KOTLARSKI (43) **Pub. Date: Feb. 20, 2003**

(54) **WIPER BLADE FOR CLEANING MOTOR VEHICLE WINDOWS**

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HUNTINGTON, NY 11743

(*) Notice: This is a publication of a continued prosecution application (CPA) filed under 37 CFR 1.53(d).

(21) Appl. No.: **09/445,047**

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(30) **Foreign Application Priority Data**

Apr. 1, 1998 (DE) 198 14 609.4

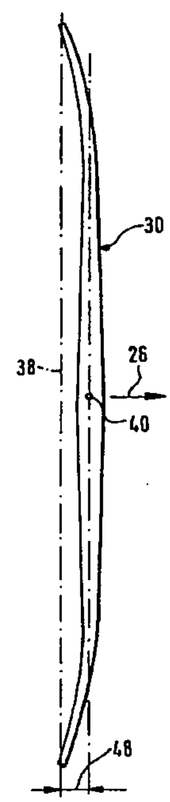
Publication Classification

(51) **Int. Cl.**^{7} **B60S 1/38**; B60S 1/40

(52) **U.S. Cl.** **15/250.43**; 15/250.32

(57) **ABSTRACT**

A wiper blade is proposed, which is used for cleaning windows of motor vehicles. The wiper blade has a band-like, elongated, spring-elastic carrying element **(30)** whose one band surface oriented away from the window **(24)** has a device **(32)** for the connection of an oscillatingly driven wiper arm **(34)** disposed on it and whose other band surface oriented toward the window has an elongated, rubber-elastic wiper strip **(17)** disposed on it that can be placed against the window **(24)** and is disposed so that its longitudinal axis is parallel to the carrying element, and the wiper arm moves the wiper blade lateral to its longitudinal span during the wiping operation, wherein the carrying element moves in a plane essentially parallel to the window surface. A reliable and low-noise tilting over of the wiper lip belonging to the wiper strip from its one drag position into the other is achieved when in each of the two oscillating directions **(12, 26)** viewed perpendicular to the window surface, a straight line **(38)** extending through the longitudinal center of the two ends of the wiper blade is disposed behind the center **(40)** of the connecting point between the wiper arm **(34)** and the wiper blade **(10)** in the respective wiping direction.



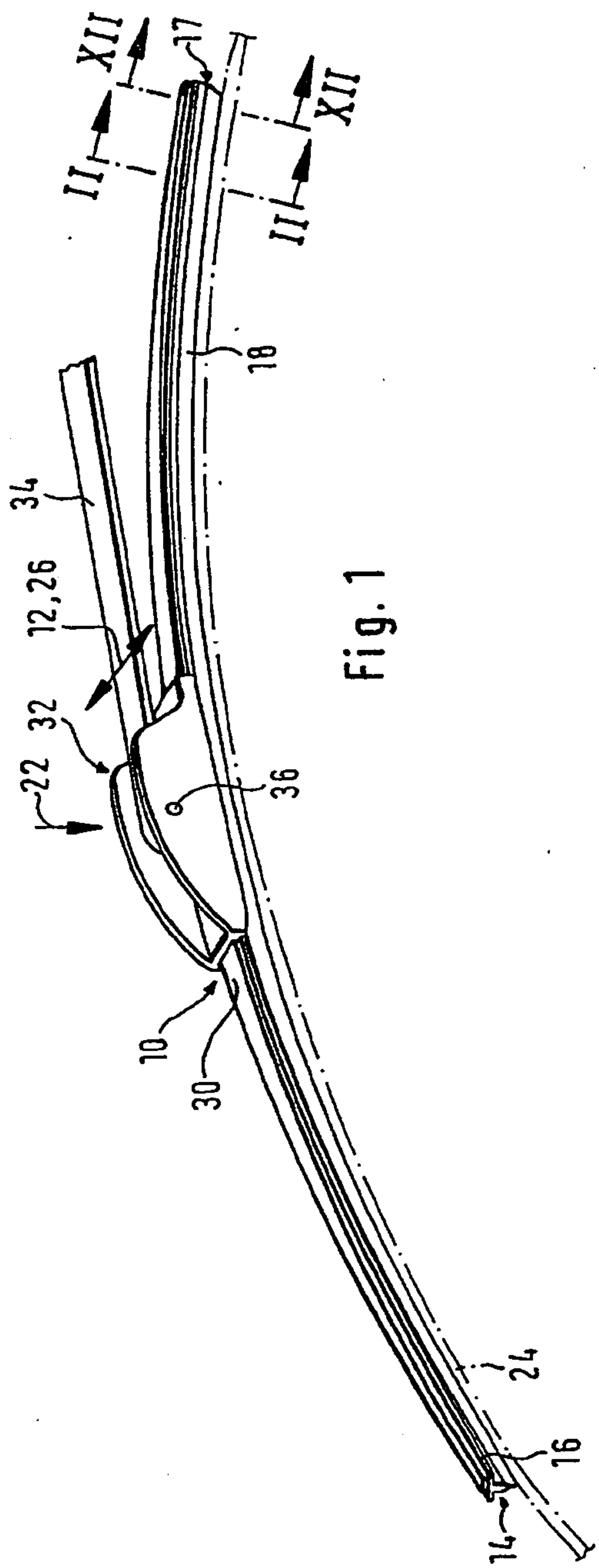


Fig. 1

Fig. 3

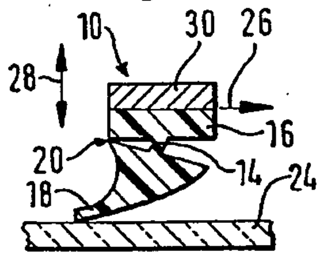


Fig. 2

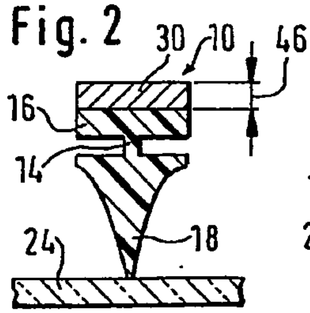
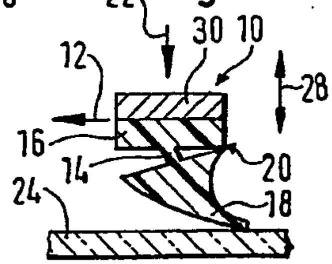


Fig. 4



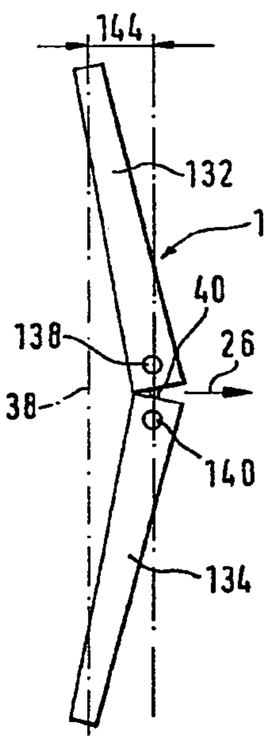


Fig. 9

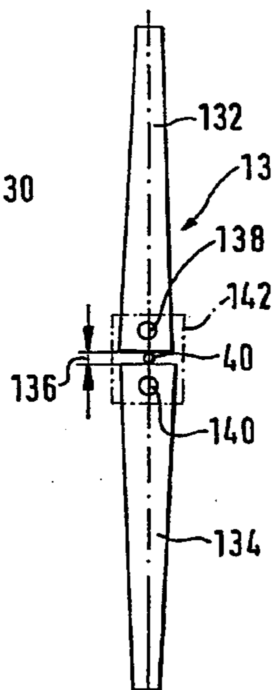


Fig. 8

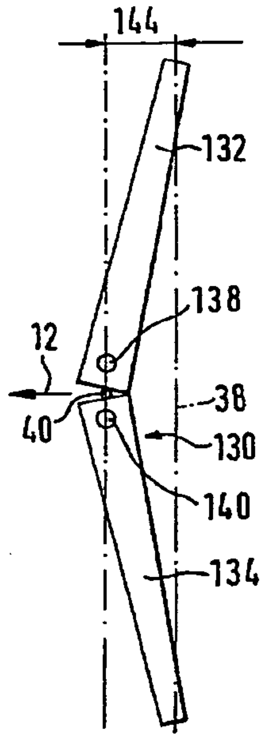


Fig. 10

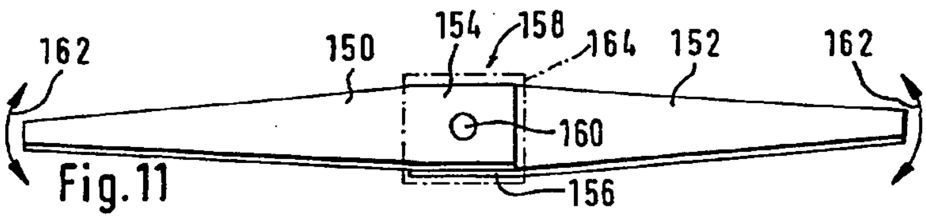


Fig. 11

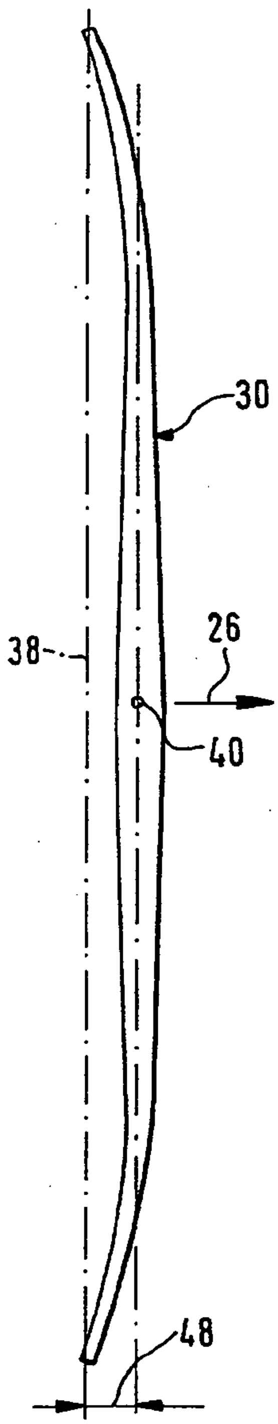


Fig. 6

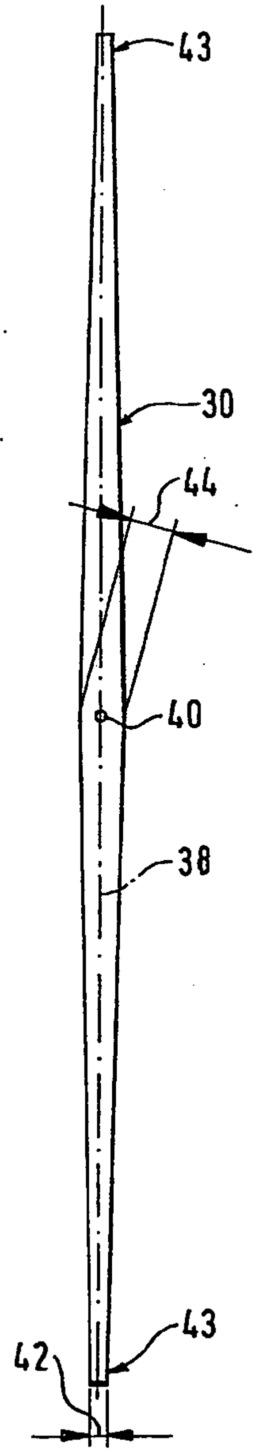


Fig. 5

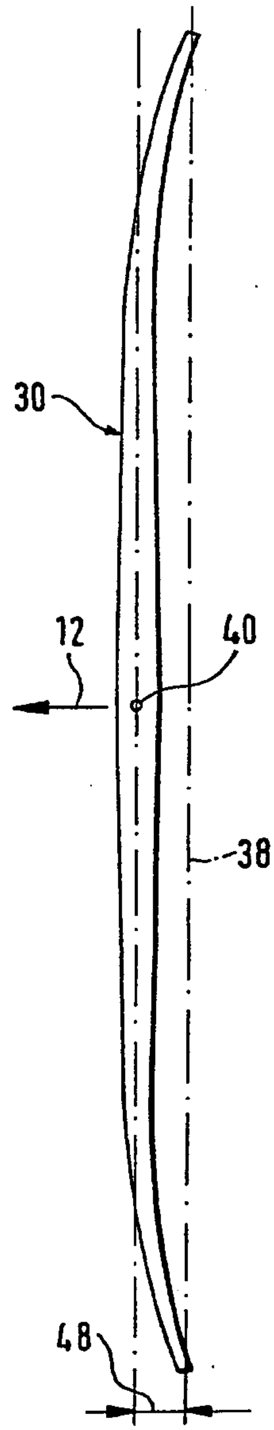


Fig. 7

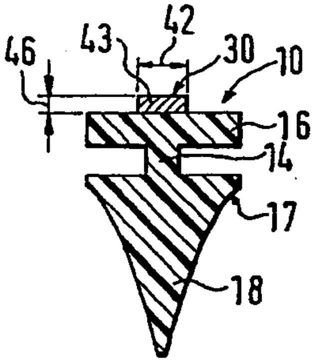


Fig. 12

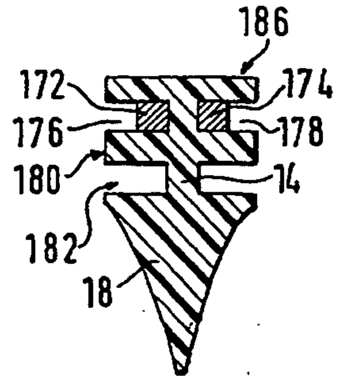


Fig. 13

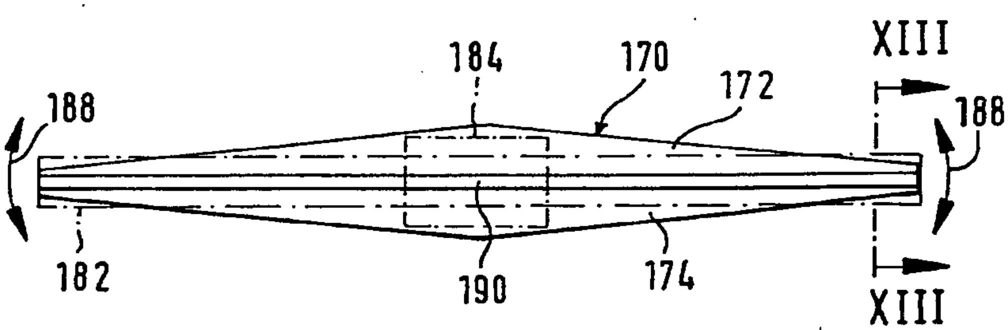


Fig. 14

WIPER BLADE FOR CLEANING MOTOR VEHICLE WINDOWS

PRIOR ART

[0001] In wiper blades of the type described in the preamble to claim 1, the carrying element is intended to assure a uniform distribution of the wiper blade pressure against the window, which pressure comes from the wiper arm, over the entire wiping field swept across by the wiper blade. Through a corresponding curvature of the unstressed wiper blade—i.e. when the wiper blade is not resting against the window—the ends of the wiper strip, which are placed completely against the window during the operation of the wiper blade, are loaded toward the window by the carrying element which is then stressed, even when the curvature radii of spherically curved vehicle windows change with each wiper blade position. The curvature of the wiper blade in relation to the window surface must therefore be slightly sharper than the sharpest curvature measured in the wiping field on the window to be wiped. The carrying element consequently replaces the expensive support bracket construction with two spring rails disposed in the wiper strip, as is practiced in conventional wiper blades (Published, non-examined German patent 1505357).

[0002] The invention is based on a wiper blade according to the preamble to claim 1. In a known wiper blade of this type, which is called a window wiper or wiper blade (EP 0594451), the carrying element is constituted by a spring rail whose surface oriented toward the window has a wiper blade glued to it, which essentially corresponds to the wiper strip according to the invention. The carrying element of this wiper blade is distinguished by a high degree of lateral rigidity, which is intended to prevent rattling noise due to an erratic action. However, with wiper blades of this kind, noise problems arise in the reversal positions.

[0003] For the comprehension of this problem, particular reference is made to FIGS. 2 to 4, which are intended to clarify the behavior of the wiper blade during its back and forth wiping or working motion. When the wiper blade **10** has finished its movement in one direction shown in **FIG. 4** with the arrow **12**—i.e. when it has reached its reversal position—its wiper lip **18**, which is connected to a wiper strip body **16** by way of a tilting piece **14**, is disposed in a drag position in relation to the wiper strip body **16**, which drag position is essential for a good wiping result and for a low-noise wiping operation. The wiper lip **18** is supported at **20** with a longitudinal edge against the wiper strip body **16** so that the contact pressure (arrow **22**) acts on the wiper lip **18** and on the window **24** to be wiped. If the return or reverse motion is then begun (arrow **26** in **FIG. 3**) then the wiper lip **18** must, for the recent mentioned above, be transferred from its one drag position (**FIG. 4**) into its other drag position (**FIG. 3**). In this connection, the wiper lip **18** remains temporarily stationary in its achieved position in relation to window **24** so that the wiper blade first reaches the position which is shown in **FIG. 2** before the wiper lip **18** tilts into its other drag position shown in **FIG. 3**. Only then does the actual wiping motion of the wiper blade **10** and the wiper lip **18** begin in relation to the window **24**. The transfer of the wiper lip **18** from its one drag position (**FIG. 4**) into the other drag position (**FIG. 3**) is consequently connected with an up and down motion (double arrows **28** in **FIGS. 3 and 4**) of the wiper blade **10** whose highest position is shown in **FIG. 2** and is reached in a middle position between the two drag positions. This up and down motion occurs abruptly and simultaneously over the entire length of the wiper strip **14, 16, 18**. This snapping over is connected with a considerable, unpleasant knocking noise.

ADVANTAGES OF THE INVENTION

[0004] In the wiper blade according to the invention, with the characterizing features of claim 1, before the transfer of the wiper lip from its one drag position into its other drag position and before the beginning of the actual wiping work over the entire length of the wiper lip, a so-called no-load motion is required, by means of which the center of the connecting point is brought into the respective wiping direction before the straight part. During this no-load motion—in which the ends of the wiper blade preferably remain stationary—the change of the wiper lip drag position according to FIGS. **2** to **4** starts from the center region of the wiper blade, and progresses continuously until the drag position now required has been achieved over the entire length of the wiper lip and the actual working motion of the wiper blade begins. Because the tilting over process of the wiper lip is initiated starting from its center region and continuously progresses from there in a time-delayed fashion until its two ends, the instantaneous snapping over of the wiper lip from the one drag position into the other drag position is prevented so that the unpleasant knocking noise is therefore also eliminated. In this connection, it is helpful but not absolutely necessary that one or both ends are not moved into the new wiping direction until the entire wiper lip has been transferred into the new drag position. It is essential that with regard to the wiping direction, at least one end lags until the transfer of the wiper lip into the new drag position has begun in at least one point.

[0005] This effect is achieved in a particularly reliable manner if the distance from the straight parts to the center of the connecting point is greater than 1 mm.

[0006] Manufacturing advantages ensue from the fact that the thickness of the carrying element is the same over its entire longitudinal span.

[0007] According to a first embodiment of a wiper blade according to the invention, the width of the carrying element measured in the wiping direction is smaller at its end regions than in its center region. As a result, it is possible to influence the cross section of the carrying element so that solely the friction between the wiper lip and the window existing during the wiping process on the one hand and the drive force of the wiper arm acting on the carrying element on the other hand, achieves a deflection of the two carrying element end sections counter to the respective wiping direction in the carrying element movement plane, which results in the fact that the straight line extending through the longitudinal center of the two carrying elements travels behind the center of the connecting point between the wiper arm and the wiper blade. In this connection, it has turned out that the carrying element ends embodied in accordance with this feature do not have a disadvantageous effect on the wiping quality.

[0008] In order to prevent inconvenient corners on the carrying element, the tapering of the carrying element width occurs continuously.

[0009] According to a modification of the first embodiment of the wiper blade according to the invention, the carrying element is divided in the longitudinal direction, wherein the two carrying element rails thus formed are disposed in lateral longitudinal grooves of the wiper strip and the device for connecting the wiper blade arm is disposed on sections of the carrying element rails that protrude from the longitudinal grooves. As a result, it is possible to utilize the advantages of the invention even in those instances in which a longitudinally divided carrying element should be used for particular reasons.

[0010] In another embodiment of the wiper blade according to the invention, the carrying element is divided laterally in its center section and the two carrying element parts thus formed can each oscillate in relation to the connecting device for the wiper arm around a respective axis that is aligned perpendicular to the window surface. This measure gives the wiper blade a V-shape when viewed from above that changes depending on the wiping direction so that the straight line extending through the two end sections of the carrying element ends travels behind the center of the connecting point between the wiper arm and the wiper blade, counter to the respective wiping direction.

[0011] A low-profile wiper blade of this type is achieved if each of the carrying element parts has an oscillation axis associated with it.

[0012] In particular practical applications, it can also be useful if the two carrying element parts overlap with an extension and in the overlapping region, have a common oscillation axis associated with both of the carrying element parts.

[0013] For technical manufacturing reasons it is advantageous if the thickness of the carrying element parts is the same over its entire longitudinal span.

[0014] In order to balance a particular, desirable contact force distribution over the wiper blade length, the width of the carrying element parts measured in the wiping direction is smaller at their end regions than in their center regions, wherein the advantages mentioned above ensue when the tapering in the width of the two carrying element parts occurs continuously.

[0015] In order to prevent an impermissible reduction of the wiping field, the oscillating motion of the carrying element parts is limited in their reversal positions by means of stops.

[0016] Other advantageous improvements and updates of the invention are disclosed in the following description of exemplary embodiments shown in the accompanying drawings.

DRAWINGS

[0017] FIG. 1 is a perspective representation of a first embodiment of a wiper blade according to the invention,

[0018] FIGS. 2 to 4 are enlarged depictions of sectional planes through the wiper blade according to FIG. 1 along the line II-II, wherein the wiper blade is respectively disposed in different operating positions,

[0019] FIG. 5 is a top view of a carrying element belonging to the wiper blade according to FIG. 1, which shows its form when the wiper blade is disposed in the neutral position,

[0020] FIG. 6 shows the form of the carrying element according to FIG. 5 when the wiper blade is wiping toward the right,

[0021] FIG. 7 shows the form of the carrying element according to FIG. 5 when the wiper blade is wiping toward the left,

[0022] FIG. 8 is a top view of another embodiment of the carrying element when the wiper blade is disposed in the neutral position,

[0023] FIG. 9 shows the form of the carrying element according to FIG. 8 when the wiper blade is wiping toward the right,

[0024] FIG. 10 shows the form of the carrying element according to FIG. 8 when the wiper blade is wiping toward the left,

[0025] FIG. 11 is a perspective view of another embodiment of the carrying element according to FIG. 8,

[0026] FIG. 12 is an enlarged depiction of the sectional plane of a section through the wiper blade along the line XII-XII in FIG. 1,

[0027] FIG. 13 shows a cross section corresponding to FIG. 12 through a wiper blade according to the invention in which the carrying element is in contrast longitudinally divided, and

[0028] FIG. 14 is a top view of the carrying element according to FIG. 13, in which the connecting devices for the wiper arm and the wiper strip are depicted with dot-and-dash lines.

DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0029] A wiper blade 10, which is shown in a perspective view in FIG. 1 and is for cleaning motor vehicle windows, is provided with a band-like, elongated, spring-elastic carrying element 30, which in the exemplary embodiment is made of a spring band steel. This carrying element 30, however, can also be made of a different material, for example a plastic, which has the necessary properties to fulfill the purpose of the carrying element 30. A wiper strip 17 is fastened with its wiper strip body 16 to the band surface of the carrying element 30 oriented toward the window 24 to be wiped, and a wiper lip 18 that can be placed against the window 24 is secured by way of a narrow tilting piece 14 to the side of this wiper strip body 16 oriented toward the window 24. Over its entire length—which corresponds approximately to the length of the carrying element 30—the elongated wiper strip 17 has a cross section that is essentially the same. The wiper strip 17 is placed on the carrying element 30 in such a way that the respective longitudinal axes of these components extend parallel to each other. A device 32 for connecting a wiper arm 34 that is driven to oscillate is attached to the band surface of the carrying element 30 remote from the window 24. The free end of a wiper arm 34 engages with a pivot bolt 36 of the connecting device 32 in an intrinsically known fashion. The wiper arm 34 is pressed against the window 24 to be wiped by means of a contact force (arrow 22). In the exemplary embodiment, the wiper blade is driven in a reciprocating fashion lateral to its longitudinal span with the aid of the wiper arm. In this reciprocating motion, which is indicated in FIG. 1 by the double arrow **12, 26**, the carrying element **30** is moved in a plane essentially parallel to the window surface. The construction of the elongated wiper blade described above—with the exception of the connecting device **32**—can be inferred in a particularly clear manner from the above-described **FIG. 2**. The top view of the carrying element **30** of the wiper blade **10** depicted in **FIG. 5** shows that a straight line **38** extending through the longitudinal center of the two ends of the wiper blade also intersects the center **40** of the connecting point between the wiper arm and the wiper blade. With regard to **FIG. 1**, this center **40** is disposed on the pivot bolt **36** in its center region. The configuration of the carrying element **30** show in **FIG. 5** is produced when the wiper blade is lifted up from the window and is placed back onto the window **24** without a drive motion. Furthermore, **FIG. 5** shows that the width of the carrying element **30** measured in the wiping direction (double arrow **12, 26**) is smaller at its end sections or end regions **43** than in its center region **44**. This described tapering of the carrying element toward its ends occurs continuously. It can be dimensioned so that the width **42** of the carrying element end regions **43** is narrower than the width of the wiper strip body **16** (**FIG. 12**). The thickness **46** of the carrying element **30** is the same over its entire longitudinal span, at least in a carrying element **30** that is made of spring band steel. The tapering described above is balanced so that the two end sections **43** of the carrying element **30** can be elastically deflected in the wiping direction (double arrow **12, 26**). The deflection, which is provided with the reference numeral **48** in **FIGS. 6 and 7** and is greater than one millimeter, is achieved by the strip **17**, which is placed against the window with the pressure (arrow **22**). The working motion of the wiper blade is transmitted directly to the wiper strip **17**, namely in the rigid center region of the carrying element, while in the comparatively flexible end sections **43** of the carrying element **30**, first a so-called drag tension must be built up, which must be greater than the friction between the wiper lip **18** and the window **24**. Consequently, depending on the wiping direction, arrow **12FIG. 7** or arrow **26FIG. 6**, the straight line **38** extending through the longitudinal center of the two ends **43** of the wiper blade is disposed offset by the measure **48** in the respective wiping directions, behind the center **40** of the connecting point between the wiper arm **34** and the wiper blade **10**.

[0030] Another embodiment of the wiper blade according to the invention is schematically depicted by FIGS. **8** to **10**. They show operating positions of the wiper blade carrying element that are comparable to those in FIGS. **5** to **7**. In this embodiment, however, the carrying element **130** is divided laterally and consequently has two carrying element parts **132, 134**. The ends of the carrying element parts **132, 134** oriented toward each other are disposed at a slight distance **136** from each other. They are both connected at the end sections oriented toward each other by way of a respective joint **138, 140** associated with each of them to the connecting device **142** that is for the wiper arm and is depicted with dot-and-dash lines in **FIG. 8**. The axes of the joints **138** and **140** are aligned perpendicular to the window surface. When the wiper blade is in the neutral position, the center **40** of the connecting point between the wiper arm and wiper blade is disposed in the region of the spacing distance **136**. The size of the spacing distance **136** is dimensioned so that the two free outer ends of the two carrying element parts **132, 134** can execute a deflecting motion in accordance with the deflection **48** (**FIGS. 6 and 7**), which makes it possible that when the wiper blade is in the wiping operation, depending on the wiping direction (arrow **12** or arrow **26**), a straight line **38** extending through the two ends of the wiper blade is disposed behind the center **40** of the connecting point between the wiper arm and wiper blade in the respective wiping direction **12** or **26**. This spacing dimension is indicated in **FIGS. 9 and 10** by the reference numeral **144**. During the wiping operation, this deflection **144** is achieved by means of the conditions mentioned above in conjunction with FIGS. **5** to **7**. A corresponding matching of the spacing **136** produces a limitation of the deflection because the ends of the carrying element parts **132, 134** oriented toward each other are supported against one another.

[0031] **FIG. 11** shows another embodiment of the wiper blade according to the invention, which is similar to the embodiment described above. In contrast to the embodiment according to FIGS. **8** to **10**, the two carrying element parts **150, 152** in this instance are each provided with an extension **154, 156** and these extensions overlap each other at the ends oriented toward one another. A common joint **160** associated with both of the carrying element parts **151, 152** is disposed in this overlapping region **158** and permits a limited pivoting motion (double arrow **162**) for the two carrying element parts **151, 152**. The behavior of the carrying element according to **FIG. 11** essentially corresponds to the behavior of the carrying element according to FIGS. **8** to **10** during the wiping operation because here, too, both of the carrying element parts **150, 152** can be pivoted (double arrows **162**) in relation to the connecting device **164** schematically depicted with dot-and-dash lines by means of the common joint **160**.

[0032] In particular practical applications, it can be advantageous if the carrying element—as shown in **FIGS. 13 and 14**—is divided in the longitudinal direction. As a result, two carrying element rails **172** and **174** are produced, which constitute a single carrying element and are disposed in longitudinal grooves **176, 178** that are situated on the side, are open at the edges toward the longitudinal side, and are disposed essentially parallel to each other in the wiper strip body **180** (**FIG. 13**).

[0033] **FIG. 14** shows a top view, not to scale, of a longitudinally divided carrying element **170** of this kind, wherein in **FIG. 14**, both the position of the wiper strip **182** and the position of the connecting device **184** are indicated with dot-and-dash lines. Except for this longitudinal division and the placement of the two carrying element rails **172, 174** in the longitudinal grooves of the wiper strip, the wiper blade **186** according to **FIGS. 13 and 14** corresponds to the wiper blade according to **FIG. 1**, with the one-piece carrying element according to FIGS. **5** to **7** and **12**. It is clear that the carrying element rails **172, 174** are in fact spaced apart from each other, but as a whole, correspond completely to the carrying element **30** according to **FIGS. 1, 5** to **7**, and **12**. During the wiping operation, depending on the wiping direction, the carrying element ends consequently can also be deflected in one of the two directions indicated by the double arrows **188** so that a straight line extending through the common longitudinal center of the two ends of the wiper blade is disposed behind the center **190** of the connecting point between the wiper arm and the wiper blade in the respective wiping direction. In this embodiment of the wiper blade, the device for connecting the wiper blade to the wiper arm is disposed on the center sections of the carrying element rails 172, 174 protruding from the longitudinal grooves 176, 178.

[0034] By means of the current measures, which have been described as exemplary embodiments in conjunction with FIGS. 5 to 7, 9 to 11, and 12, 13, it is possible that in each of the two oscillation directions 12, 26, viewed perpendicular to the window surface, a straight line 38 extending through the longitudinal center of the two ends 43 of the wiper blade 10 is disposed behind the center 40 of the connecting point between the wiper arm and the wiper blade in the respective wiping direction. In other words, during the wiping operation, the wiper blade can essentially be deformed in the plane disposed parallel to the window surface in such a way that its two ends 43 lag in relation to the center 40 of the pivot connection between the wiper blade connecting device 32 and the wiper arm 34 in the respective wiping direction 12, 26. As a result, starting from the wiper blade center, a gradual, continuous tilting over of the wiper lip 18 from the one drag position into the other is achieved so that unpleasant noises are prevented.

[0035] Viewed in terms of the wiping direction, the lagging of one or both of the ends of the carrying element in relation to its connecting point for the wiper arm is produced in wiper blades, as in the exemplary embodiments described here, by means of a retention force which acts in opposition to the wiping motion due to the pressing force of the wiper strip against the window and the resulting friction against the carrying element produced during the wiping motion. The deflection, however, can also be produced actively by means of elements attached to or in the carrying element, e.g. by means of catch springs.

1. A wiper blade for cleaning windows of motor vehicles, having a band-like, elongated, spring-elastic carrying element (30) whose one band surface oriented away from the window (24) has a device (32) for the connection of an oscillatingly driven wiper arm (34) disposed on it and whose band surface oriented toward the window has an elongated, rubber-elastic wiper strip (17) disposed on it that can be placed against the window and is disposed so that its longitudinal axis is parallel to the carrying element, and the wiper arm moves the wiper blade lateral to its longitudinal span during the wiping operation, wherein the carrying element moves in a plane essentially parallel to the window surface, characterized in that in each of the two oscillating directions (12, 26) viewed perpendicular to the window surface, a straight line (38) extending through the longitudinal center of the two ends of the wiper blade is disposed behind the center (40) of the connecting point between the wiper arm (34) and the wiper blade (10) in the respective wiping direction.

2. The wiper blade according to claim 1, characterized in that the distance (48 or 144) of the straight line (38) from the center (40) of the connecting point is greater than 1 mm.

3. The wiper blade according to one of claims 1 or 2, characterized in that the thickness of the carrying element (30, 130, 170) is the same over its entire longitudinal span.

4. The wiper blade according to one of claims 1 to 3, characterized in that the width of the carrying element (30, 130, 170) measured in the wiping direction is smaller at its end regions (43) than in its center region (44).

5. The wiper blade according to claim 4, characterized in that the tapering of the carrying element width occurs continuously.

6. The wiper blade according to one of claims 1 to 5, characterized in that the carrying element (170) is divided in the longitudinal direction, that the carrying element rails (172, 174) thus produced are disposed in lateral longitudinal grooves (176, 178) of the wiper strip (182) and the device for connecting the wiper arm is disposed on sections of the carrying element rails (172, 174) that protrude from the longitudinal grooves.

7. The wiper blade according to one of claims 1 to 5, characterized in that the carrying element (130) is divided laterally in its center section and the two carrying element parts (132, 134) can each oscillate in relation to the connecting device (142) for the wiper arm around a respective axis aligned perpendicular to the window surface.

8. The wiper blade according to claim 7, characterized in that each of the carrying element parts (132, 134) has an oscillation axis associated with it.

9. The wiper blade according to claim 7, characterized in that the two carrying element parts (150, 152) overlap with an extension (154, 156) and in the overlap region (158), have a common oscillation axis associated with both carrying element parts.

10. The wiper blade according to one of claims 7 to 9, characterized in that the oscillating motion of the carrying element parts (132, 134 or 150, 152) in their reversal positions is limited by means of stops.

11. A wiper blade for cleaning windows of motor vehicles, having a band-like, elongated, spring-elastic carrying element (30) whose one band surface oriented away from the window (24) has a device (32) for the connection of an oscillatingly driven wiper arm (34) disposed on it and whose band surface oriented toward the window has an elongated, rubber-elastic wiper strip (17) disposed on it that can be placed against the window and is disposed so that its longitudinal axis is parallel to the carrying element, and the wiper arm moves the wiper blade lateral to its longitudinal span during the wiping operation, wherein the carrying element moves in a plane essentially parallel to the window surface, characterized in that when the oscillating direction reverses, at least one end of the wiper blade lags with regard to the wiping direction until the transfer of the wiper strip (17) into the new drag position has begun in at least one point.

* * * * *

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UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner: Graham Group: 1744 Attorney Docket # 1524

Applicant(s) : DE BLOCK, P.

Serial No. : 09/786852

Filed : ~~Simultaneous~~ly 5-3-01

For : WIPER BLADE FOR WINDSHIELDS, ESPECIALLY OF MOTOR VEHICLES, AND METHOD FOR PRODUCING SUCH A WIPER BLADE

SIMULTANEOUS AMENDMENT

March 9, 2001

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

S I R S:

Simultaneously with filing of the above identified application please amend the same as follows:

In the Claims:

Cancel all claims without prejudice.

Add the following claims as attached.

REMARKS:

This Amendment is submitted simultaneously with filing of the above identified application.

With the present Amendment applicant has amended the claims so as to eliminate their multiple dependency.

PCT/DE 00 / 02168

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BUNDESREPUBLIK DEUTSCHLAND

DE 00 / 2168

PRIORITY DOCUMENT

SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

REC'D 03 OCT 2000

WIPO PCT

Prioritätsbescheinigung über die Einreichung einer Patentanmeldung

Aktenzeichen:	199 31 858.1
Anmeldetag:	9. Juli 1999
Anmelder/Inhaber:	ROBERT BOSCH GMBH, Stuttgart/DE
Bezeichnung:	Seitliche Auslenkung eines Flachbalkenwischblatts mit konstantem Profil
IPC:	B 60 S 1/38

Die angehefteten Stücke sind eine richtige und genaue Wiedergabe der ursprünglichen Unterlagen dieser Patentanmeldung.

München, den 22. September 2000
Deutsches Patent- und Markenamt
Der Präsident
Im Auftrag

Dzierzon

A 9161
03/00
EDV-L

2. **Die Wiedergabe der Erfindung (Anlage) muß enthalten** (Hinweise siehe Rückseite):
2.1. Stand der Technik (welche Produkte/Vorschläge auch aus der Literatur werden verbessert?)
2.2. Aufgabe der Erfindung; welche Mängel zum Stand der Technik werden behoben?
2.3. Kern und Vorteile der Erfindung, besonders gegenüber dem Bekannten?
2.4. Detaillierte Beschreibung von Aufbau und Funktion des Vorschlages mit möglichen Alternativen.
2.5. Zeichnung (Blockschaltbild, mech. Aufbau, Diagramm)
2.6. Ist die Erfindung am Erzeugnis gut nachweisbar (wenn nein, was spricht für eine Anmeldung)?

Weitere Ausführungen zu EM — Datum 7.6.99

Bezeichnung der Erfindung [redacted] seitliche Auslenkung [redacted]es Flachbalken-Wischblatt (WBA) mit konstantem Pr[redacted]

R. 36343

2.1:
Stand der Technik: US 3,192,551, EP 0 594 451 B1,

2.2:.
Aufgabe: Abgrenzung von der seitlichen Auslenkung des Federbalkens für Flachbalken-Wischblatt mit konstantem Profil.
Auslegung des Federbalkens (Breite und Dicke), anabhängig von Radiusverlauf (viel zu umständig um nachzuprüfen), jedoch abhängig von Länge, Materialeigenschaften und Auflagekraft.
In EP 0 594 451 B1 werden Flachbalken-WBA mit variierendem Profil beschrieben. In Anspruch 1 wird ein Prüfkraft von 1N eingelegt auf ein unbelastetes Wischblatt. Die seitliche Auslenkung besteht aus 2 Komponenten: eine folgend aus einer Biegung und eine folgend aus Torsion. Für die Funktion ist die seitliche Auslenkung von einem belasteten WBA wichtiger.
In Anspruch 13 wird eine Formel beschrieben, in dem die Auslenkung abhängig [redacted]von Profil, Länge und Radius. Diese Formel ist komplex und schwierig [redacted]zuprüfen. Die physische Bedeutung dieser Formel ist schwierig herzuleiten und eigentlich sogar nicht bestehend.

2.3:
Optimierte Auslegung von Federbalken mit Beschränkung der seitlichen Auslenkung. Einfache Formel zur Beschränkung der seitlichen Auslenkung.
In EP 0 594 451 B1 wird immer eine seitliche Auslenkung über einen Abstand ermittelt. Besser ist über eine maximale Winkel zu beschränken.

2.4:
Flachbalken-Wischblatt, bestehend aus einem Wischgummi und ein oder zwei Federschiene aus einem Federstahl oder irgendeine federnde Werkstoff.
Die Federschiene hat über seine Gesammtlänge ein Konstantes Profil.
Die Federschiene hat eine über seine Länge veränderliche Radius R(s).

a. Das Profil ist so ausgewählt, daß

[redacted]

$$F_{wf}*L^2/48*E*I_{zz} \quad < 0.009$$

mit F_{wf} die Auflagekraft ausgelegt auf dem Wischblatt, oder die Auflagekraft für den das Wischblatt ausgelegt worden ist.
L die Länge des Wischblattes
I_{zz} das Trägheitsmoment des Profiles um die z-Achse (senkrecht auf s-Achse und senkrecht auf y-Achse)
E der Elastizitätsmodul des Federbalkens-Werkstoff

Begründung:
Das Moment M(s), folgend aus eine gewisse Kraftverteilung p(s), ist maximal in der Mitte des Federbalkens. Für eine konstante Auflagekraftverteilung $p = F_{wf}/L$ ist das Moment $M_{p=cte}(s) = p*(L/2-s)^2/2 = F_{wf}*(L/2-s)^2/2*L$. Für eine nach Außenenden abnehmende Auflagekraftverteilung ist das Moment M(s) über seine Gesammtlänge überall etwas niedriger als das Moment, folgend aus eine konstante Kraftverteilung,: $M(s) < p*(L/2-s)^2/2$
Wann man ausgeht von eine Reibwert die trocken ungefähr 1 ist, ist im Betrieb das seitliches Moment gleich wie das Biegemoment M(s), folgend aus die Kraftverteilung p(s).

Weitere Ausführungen zu EM — Datum 7.6.99
Bezeichnung der Erfindu[illegible] seitliche Auslenkung eines [illegible]achbalken-
WBA mit konstantem Profil

R. 36343

Der seitliche Auslenkungswinkel $\gamma = \int_0^{L/2} \{M(s)/(E*Izz)\}\, ds$

Wann man in diesen Formel das Moment für eine konstante Auflagekraftverteilung p eintragt, $M_{pacte}(s) = p*(L/2-s)^2/2$, bekommt man eine leichte Überschätzung für den Winkel .

Dies heißt, daß: $\gamma < \int_0^{L/2} \{p*(L/2-s)^2/(2*E*Izz)\}\, ds$

Durch Integration bekommt man daß $< p*L^3/48*E*I_{zz} = F_{wf}*L^2/48*E*I_{zz}$

Für eine güte Wischqualität, insbesonders gegen Rattern, ist es notwendig den Winkel zu beschränken auf 0.5° (=0.009 rad)

b. Noch bessere Ergebnisse bekommt man, wenn der Winkel beschränkt wird auf 0.3° (=0.005 rad): dies heißt:

$$F_{wf}*L^2/48*E*I_{zz} < 0.005$$

c. Ein Spezialfall, der wahrscheinlich am meisten verwendet wird, ist ein rechteckiges Profil. Dies heißt denn: die Federschiene hat über seine Gesammtlänge eine konstante Dicke d und eine konstante Breite b (für zwei Federschiene ist $b = b_1 + b_2$)
Für dieses Profil ist $Izz = d*b^3/12$

mit d = Dicke des Federbalkens
b = Breite des Federbalkens

Die Breite b und Dicke d sind so ausgewählt, daß:

$$F_{wf}*L^2/4*E*d*b^3 < 0.009$$

[illegible]er : $0.009*d*b^3 > F_{wf}*L^2/4*E$

[illegible]er : $d*b^3 > 27.75*F_{wf}*L^2*E$

d. Bessere Ergebnisse bekommt man, wie in b wenn:

$$0.005*d*b^3 > F_{wf}*L^2/4*E$$

Oder : $d*b^3 > 50*F_{wf}*L^2*E$

2.5:
siehe Seite 4 und 5

2.6:
Die Erfindung ist gut nachweisbar

Costco Exhibit 1002, p. 131

Weitere Ausführungen zu EM Datum 7.6.99

Bezeichnung der Erfindung seitliche Auslenkung e[illegible]es Flachbalken-WBA mit konstantem Pr[illegible]

R. 36343

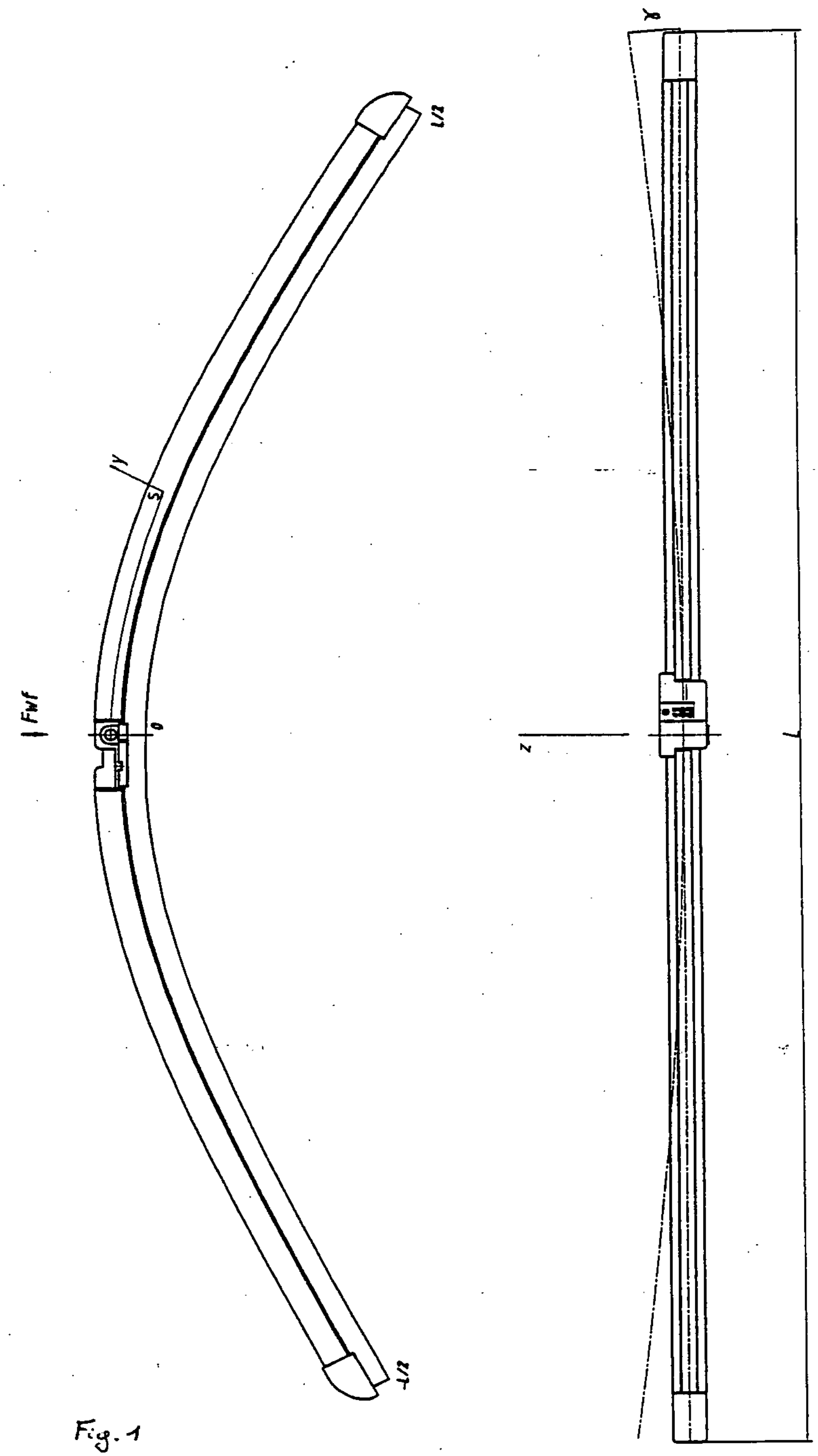

Fig. 1

Weitere Ausführungen zu EM   Datum 7.6.99

Bezeichnung der Erfindung: seitliche Auslenkung eines Flachbalken-WBA mit konstantem Profil

R. 36343

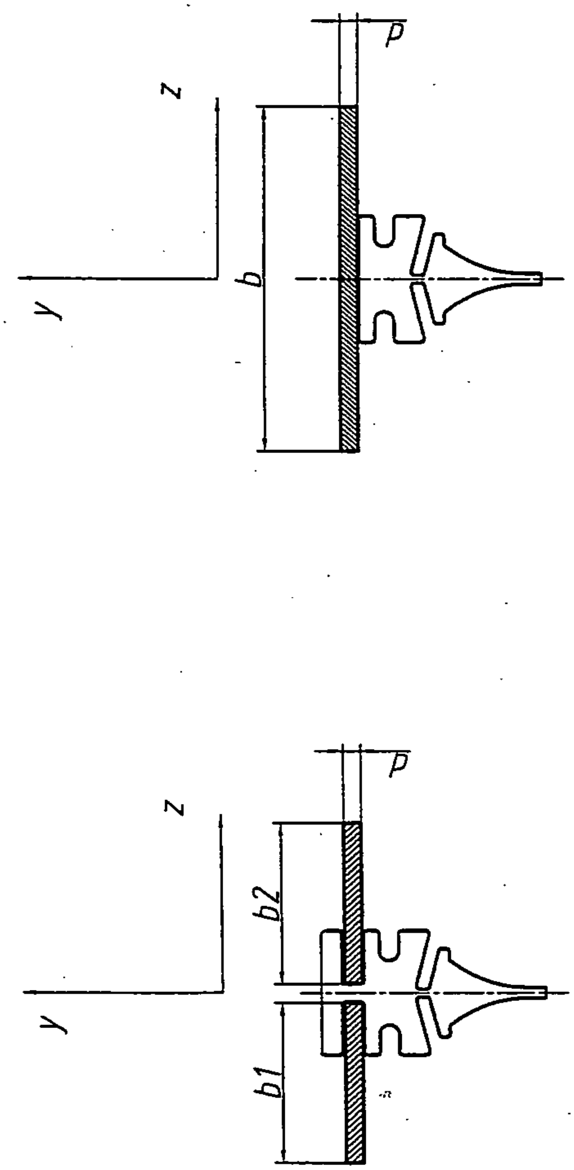

Fig. 2

PCT/DE 00 / 02168

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DE00/2168

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

REC'D 03 OCT 2000
WIPO PCT

Prioritätsbescheinigung über die Einreichung einer Patentanmeldung

Aktenzeichen:	199 31 856.5
Anmeldetag:	9. Juli 1999
Anmelder/Inhaber:	ROBERT BOSCH GMBH, Stuttgart/DE
Bezeichnung:	Flachbauendes Wischblatt mit Federbalken mit konstantem Profil
IPC:	B 60 S 1/38

Die angehefteten Stücke sind eine richtige und genaue Wiedergabe der ursprünglichen Unterlagen dieser Patentanmeldung.

München, den 22. September 2000
Deutsches Patent- und Markenamt
Der Präsident
Im Auftrag

Dzierzon

A 9161
03/00
EDV-L

R. 36338

2. **Die Wiedergabe der Erfindung (Anlage) muß enthalten** (Hinweise siehe Rückseite):
2.1. Stand der Technik (welche Produkte/Vorschläge auch aus der Literatur werden verbessert?)
2.2. Aufgabe der Erfindung; welche Mängel zum Stand der Technik werden behoben?
2.3. Kern und Vorteile der Erfindung, besonders gegenüber dem Bekannten?
2.4. Detaillierte Beschreibung von Aufbau und Funktion des Vorschlages mit möglichen Alternativen.
2.5. Zeichnung (Blockschaltbild, mech. Aufbau, Diagramm)
Ist die Erfindung am Erzeugnis gut nachweisbar (wenn nein, was spricht für eine Anmeldung)?

Weitere Ausführungen zu EM Tienen, 05.05.1999

Bezeichnung der Erfindung **flachbauendes Wischblatt mit Federbalken mit konstantem [redacted]fil**

2.1: R. 36338

Stand der Technik: US 3,192,551, EP 0 528 643 B1, R 33418

2.2:

In US 3 192 551 werden Federbalken mit konstanter Auflagekraftverteilung auf einer vorbestimmten Scheibe beschrieben.
In EP 0 528 643 B1 werden Federbalken mit variabeler Querschnitt beschrieben, wobei die zweite Ableitung von M(x) von Mitte bis Ausende abnimmt.Die zweite Ableitung von M(s) kommt überein mit die Kraftverteilung auf einer ebenen Scheibe. Ziel ist eine ansteigende Auflagekraftverteilung von Mitte bis Ende. Dies führt zu Umlegeprobleme an den Wischblattenden und sogar zu Rattern. Eine solche Auflagekraftverteilung führt im mittlere Bereich, wo ein Flachbalkenwischblatt sensibler ist für Auflagekraftschwankungen, viel schneller zu Abhebefehler bei höhen Geschwindigkeiten. (HSQ-Problemen)
In R 33148 wird ein Federbalken-Wischblatt beschrieben, bei dem in der Mitte die Auflagekraftverteilung (spezifische Kraft) in der größer ist als an den Enden. Das Problem ist, daß die Auflagekraftverteilung sehr stark abhängig ist von der erzeugten Auflagekraft und von der Lage auf der Scheibe. Deswegen ist dieser Anspruch sehr schwierig nachzuprüfen. Weil die Auflagekraftverteilung vor allem in der Mitte sehr empfindlich ist, ist eine Patentverletzung sehr schwierig zu überprüfen.(siehe Fig.1)

2.3:

[redacted]e EM 99/0826
[redacted]vollziehbare Überprüfung von einer Patentverletzung möglich.

2.4:

Flachbalken-Wischblatt, bestehend aus einem Wischgummi und ein oder zwei Federschiene.
Die Federschiene hat eine konstanten Durchschnitt.
Die Federschiene hat ein über seine Länge veränderlicher Radius.
a. Der Radiusverlauf ist so ausgewählt, daß die zweite Ableitung der Krümmung (Krümmung = 1/Radius) nach s(Position entlang der Federschiene) (siehe Fig. 2)

$$K(s) = 1/R(s)$$

$$K(s) = M(s)/EI$$

$$d^2K/ds^2 = d^2M/ds^2/EI = p(s)/EI$$

s = Koordinat entlang der Federschiene
R(s) = Radius
K(s) = Krümmung
M(s) = Moment
E = Elastizitätsmodul
[redacted]Oberflächenträgheitsmoment der Federbalken bezüglich der neutralen Achse
[redacted] = spezifische Kraft pro Längeeinheit = Auflagekraftverteilung

Die zweite Ableitung der Krümmung kommt bis auf einer Konstante überein mit der Auflagekraftverteilung auf einer ebenen Scheibe.

b. Der Radiusverlauf R(s) entlang der Federschiene ist so ausgewählt, daß die zweite Ableitung der Krümmung der Federschiene minus die zweite Ableitung der Krümmung der Scheibe, von der Mitte des WBA bis zu den Enden abnimmt. (siehe Fig. 3).

$$K_{fed}(s) = 1/R_{fed}(s)$$

$$K_{fed}(s) - K_{scheibe}(s) = M(s)/EI$$

$$d^2K_{fed}/ds^2 - d^2K_{scheibe}/ds^2 = d^2M/ds^2/EI = p(s)/EI$$

s = Koordinat entlang der Federschiene
$R_{fed}(s)$ = Radius der Federschiene
$K_{fed}(s)$ = Krummung der Federschiene
M(s) = Moment
E = Elastizitätsmodul
I = Oberflächenträgheitsmoment der Federbalken bezüglich der neutralen Achse
p(s) = spezifische Kraft pro Längeeinheit = Auflagekraftverteilung

Weitere Ausführungen zu EM

Tienen, 05.05.1999

Bezeichnung der Erfindung: flachbauendes Wischblatt mit Feder-
balken mit konstantem Profil

$K_{scheibe}(s)$ = Krummung der Scheibe

R. 36338

Das Unterschied zwischen den zweiten Ableitungen der Krümmungen der Federschiene und der Scheibe kommt bis auf einer Konstante überein mit der Auflagekraftverteilung auf dieser Scheibenkrümmung.

c. Der Radiusverlauf ist so ausgewählt, daß die Auflagekraftverteilung des Wischblattes auf einer ebenen Scheibe soll so sein, daß am Ende eine kleinere spezifische Auflagekraft ist als halbwegs zwischen Mitte und Ende.(siehe Fig.4) So werden die Auflagekraftschwankungen aufgefangen.(siehe Fig.1)

d. Der Radiusverlauf ist so ausgewählt, daß die Auflagekraftverteilung des Wischblattes auf der Scheibe soll so sein, daß am Ende eine kleinere spezifische Auflagekraft ist als halbwegs zwischen Mitte und Ende. So werden die Auflagekraftschwankungen aufgefangen.(siehe Fig.1)

2.5: Zeichnungen: siehe Seite 4 bis 7

2.6:
Die Erfindung ist gut nachweisbar

Costco Exhibit 1002, p. 137

Tienen, 05.05.1999

R. 36338

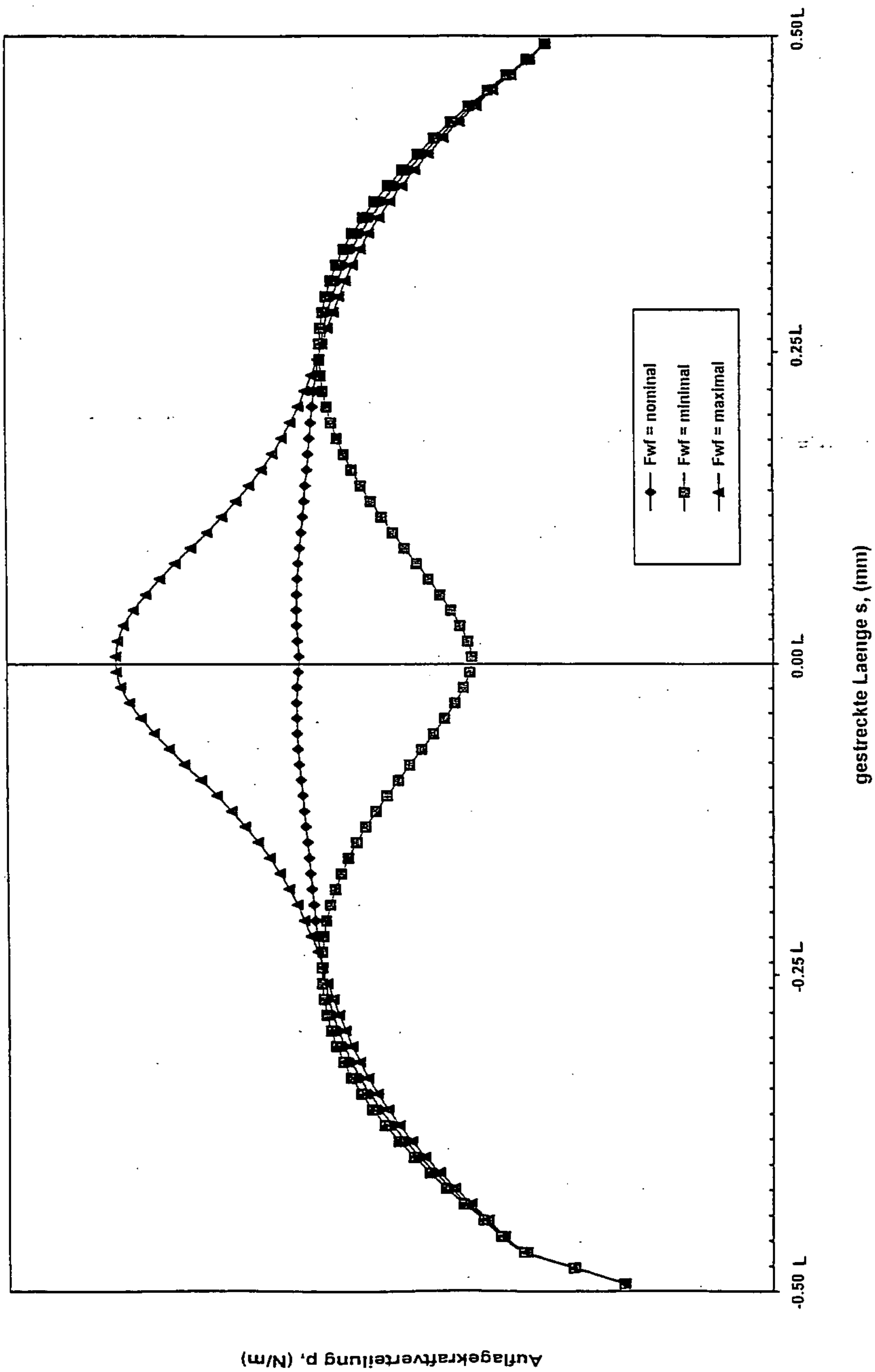

Fig. 1

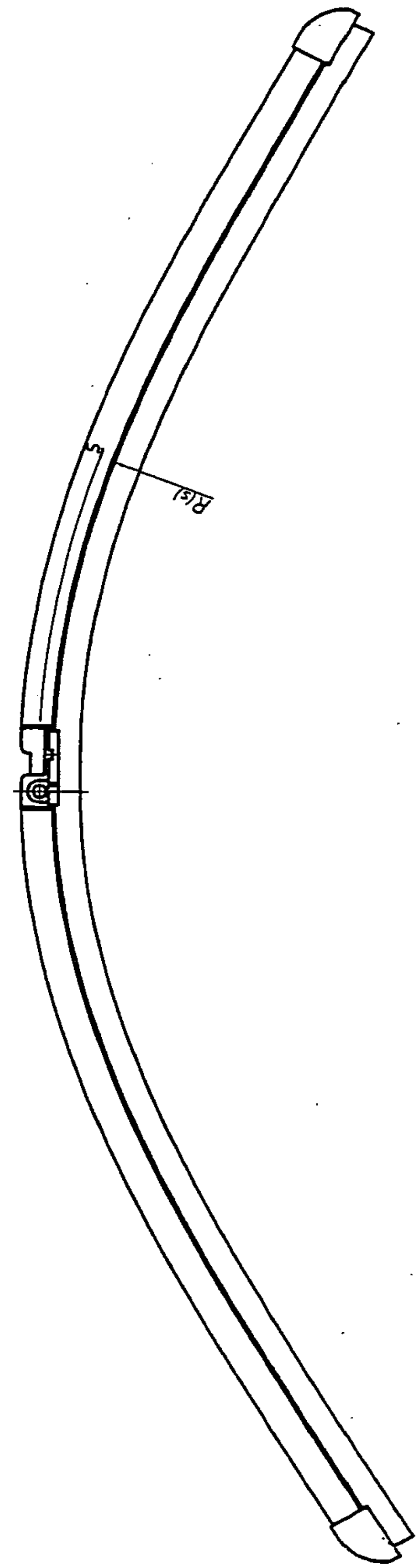

Fig. 2

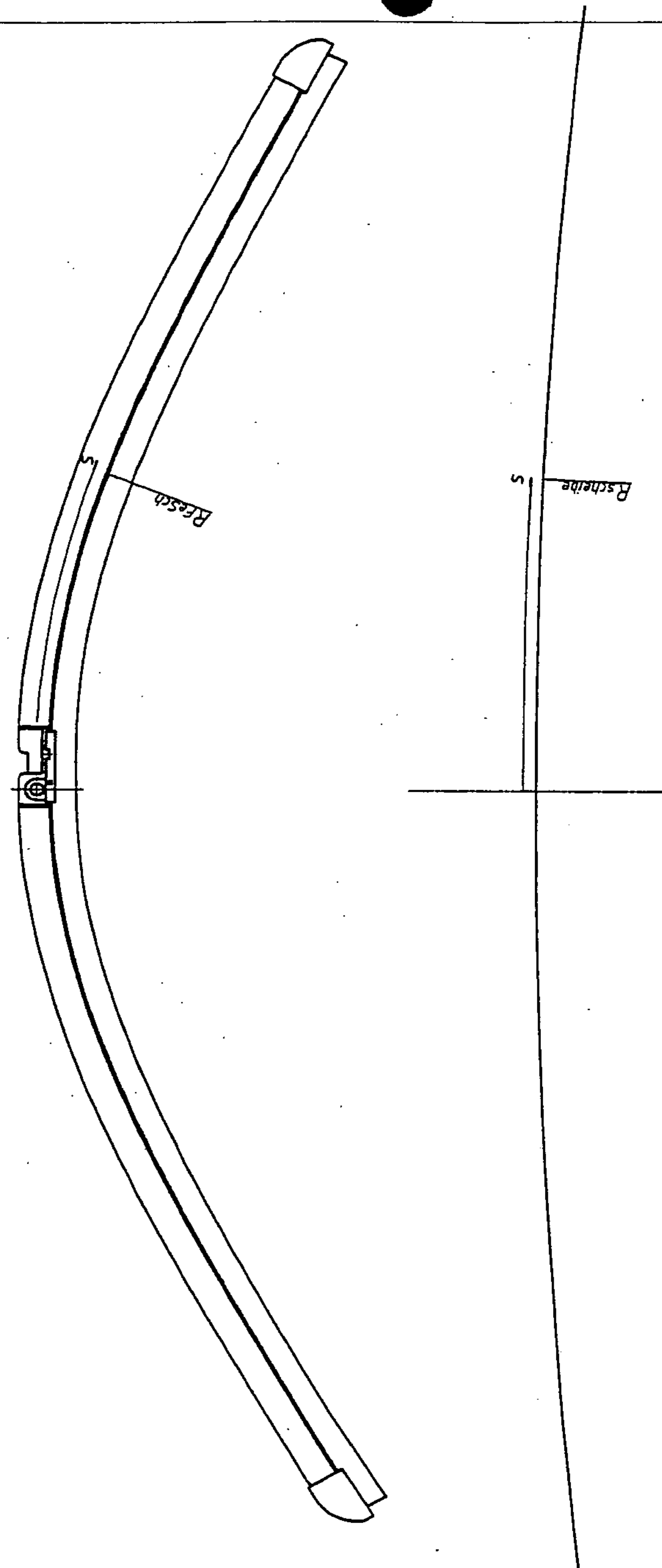

Fig. 3

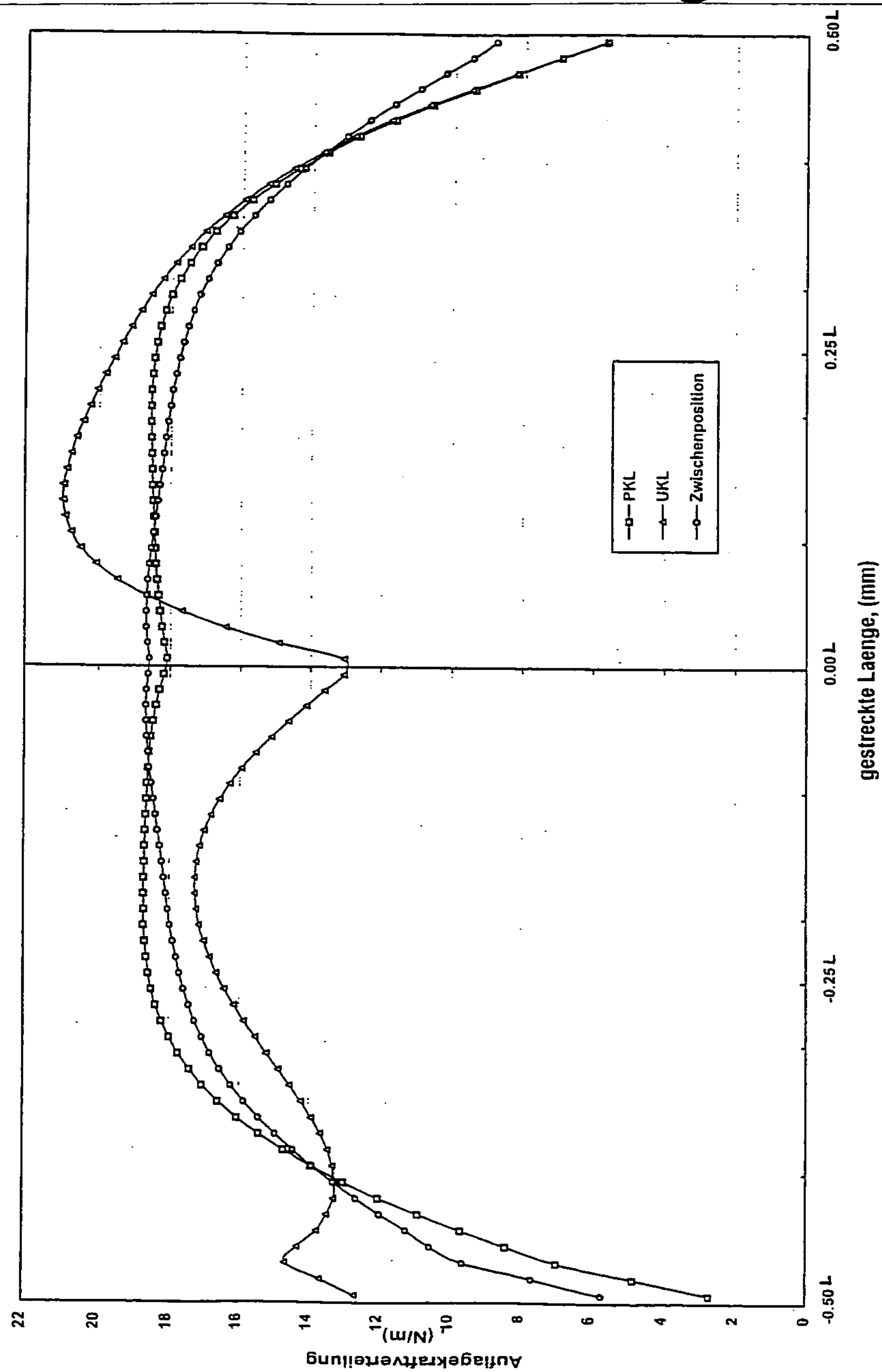
PKL
UKL
Zwischenposition
gestreckte Laenge, (mm)
Auflagekraftverteilung
(N/m)
-0.50 L
-0.25 L
0.00 L
0.25 L
0.50 L
0
2
4
6
8
10
12
14
16
18
20
22

Fig. 4

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REC'D 03 OCT 2000
WIPO PCT

Prioritätsbescheinigung über die Einreichung einer Patentanmeldung

Aktenzeichen: 199 31 857.3

Anmeldetag: 9. Juli 1999

Anmelder/Inhaber: ROBERT BOSCH GMBH, Stuttgart/DE

Bezeichnung: Auslegung eines Flachbalken-Wischblatts mit konstantem Profil

IPC: B 60 S 1/38

Die angehefteten Stücke sind eine richtige und genaue Wiedergabe der ursprünglichen Unterlagen dieser Patentanmeldung.

München, den 22. September 2000
Deutsches Patent- und Markenamt
Der Präsident
Im Auftrag

Dzierzon

A 9161
03/00
EDV-L

R. 36345

2. **Die Wiedergabe der Erfindung (Anlage) muß enthalten** (Hinweise siehe Rückseite):
2.1. Stand der Technik (welche Produkte/Vorschläge auch aus der Literatur werden verbessert?)
2.2. Aufgabe der Erfindung; welche Mängel zum Stand der Technik werden behoben?
2.3. Kern und Vorteile der Erfindung, besonders gegenüber dem Bekannten?
2.4. Detaillierte Beschreibung von Aufbau und Funktion des Vorschlages mit möglichen Alternativen.
2.5. Zeichnung (Blockschaltbild, mech. Aufbau, Diagramm)
2.6. Ist die Erfindung am Erzeugnis gut nachweisbar (wenn nein, was spricht für eine Anmeldung)?

Weitere Ausführungen zu EM | Datum 4.6.99

Bezeichnung der Erfindung Auslegung eines Flachbalken-WBA (Wischblatt)
mit konstantem Profil

R. 36345

2.1:
Stand der Technik: US 3,192,551, EP 0 528 643 B1,

2.2:.
Aufgabe: Abgrenzung von Federschiene-Profil(Breite und Höhe) für Flachbalken-Wischblatt mit konstantem Profil.
Abgrenzung der Breite des Federbalken, mit Berücksichtigung der Belastung des Federbalkens. Zu schmale Federschiene werden zu stark belastet. Zu breite Federbalken stören optisch und nehmen auch viel Wassertropfen auf, die nachher durch den Wind auf die gereinigte Scheibe geblasen werden.

2.3:
Belastungsoptimierte Auslegung von Federbalken.

2.4:
Flachbalken-Wischblatt, bestehend aus einem Wischgummi und ein oder zwei Federschiene aus einem Federstahl.
Die Federschiene hat über seine Gesammtlänge eine konstante Dicke d.
Die Federschiene hat über seine Gesammtlänge eine konstante Breite b (für zwei Federschiene ist $b = b_1 + b_2$)
Die Federschiene hat eine über seine Länge veränderliche Radius.

a. Die Breite b und Dicke d sind so ausgewählt, daß

$$20L^2 < bd^2 < 40L^2$$

mit L die Länge des Wischblattes in m
b die Breite des Federbalkens in mm
d die Dicke des Federbalkens in mm

Begründung:
Das Moment M(s) folgend aus eine gewisse Kraftverteilung p(s) ist maximal in der Mitte des Federbalkens. Für eine konstante Auflagekraftverteilung p ist das maximale Moment $M_{max} = pL^2/8$. Für eine nach Außenenden abnehmende Auflagekraftverteilung ist das maximale Moment etwas niedriger.
Das Widerstandsmoment gegen Biegung $W = bd^2/6$
Die maximale Biegespannungen sind $\sigma = M_{max}/W$

Beispiele:
Für ein 600mm langes Wischblatt mit Federbalken von 1,1 mm dick kann die Breite zwischen 6 und 11 mm liegen.
Für ein 700mm langes Wischblatt mit Federbalken von insgesammt 14 mm breit kann die Dicke zwischen 0.85 und 1.15 mm liegen.

b. Die Breite wird beschränkt auf minimal 8 und maximal 16mm

2.5:
siehe Seite 3

2.6:
Die Erfindung ist gut nachweisbar

Weitere Ausführungen zu EM Datum 4.6.99

Bezeichnung der Erfindung Auslegung eines Flachbalken-WBA mit konstantem Profil

R. 36345

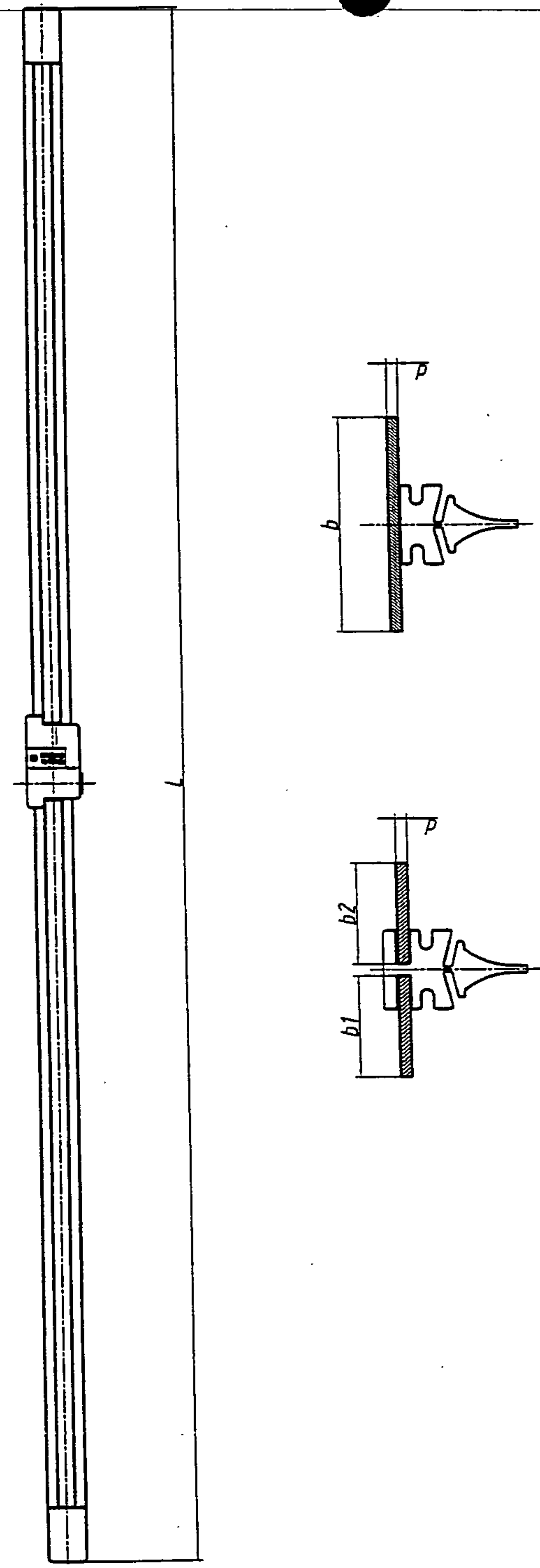

Fig. 1

PCT/DE 00 / 02168

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4

PRIORITY DOCUMENT
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DE 00/2168

REC'D 03 OCT 2000
WIPO PCT

Prioritätsbescheinigung über die Einreichung einer Patentanmeldung

Aktenzeichen: 100 32 048.1

Anmeldetag: 5. Juli 2000

Anmelder/Inhaber: ROBERT BOSCH GMBH, Stuttgart/DE

Bezeichnung: Wischblatt für Scheiben, insbesondere von Kraftfahrzeugen, sowie Verfahren zum Herstellen eines solchen

Priorität:
09.07.1999 DE 199 31 858.1
09.07.1999 DE 199 31 856.5
09.07.1999 DE 199 31 857.3

IPC: B 60 S 1/38

Die angehefteten Stücke sind eine richtige und genaue Wiedergabe der ursprünglichen Unterlagen dieser Patentanmeldung.

München, den 22. September 2000
Deutsches Patent- und Markenamt
Der Präsident
Im Auftrag

A 9161
03/00
EDV-L

05.07.00 Km/Hx

ROBERT BOSCH GMBH, 70442 Stuttgart

Wischblatt für Scheiben, insbesondere von Kraftfahrzeugen, sowie Verfahren zum Herstellen eines solchen

Stand der Technik

Bei Wischblättern der im Oberbegriff des Anspruchs 1 bezeichneten Art soll das Tragelement über das gesamte vom Wischblatt bestrichene Wischfeld eine vorbestimmte Verteilung der vom Wischerarm ausgehenden Wischblatt-Anpresskraft - oft auch als Anpreßdruck bezeichnet - an der Scheibe gewährleisten. Durch eine entsprechende Krümmung des unbelasteten Tragelements - also wenn das Wischblatt nicht an der Scheibe anliegt - werden die Enden der im Betrieb des Wischblatts vollständig an der Scheibe angelegten Wischleiste durch das dann gespannte Tragelement zur Scheibe belastet, auch wenn sich die Krümmungsradien von sphärisch gekrümmten Fahrzeugscheiben bei jeder Wischblattposition ändern. Die Krümmung des Wischblatts muß also etwas stärker sein als die im Wischfeld an der zu wischenden Scheibe gemessene stärkste Krümmung. Das Tragelement ersetzt somit die aufwendige Tragbügelkonstruktion mit zwei in der Wischleiste angeordneten Federschienen, wie sie bei herkömmlichen Wischblättern praktiziert wird (DE-OS 15 05 357).

Die Erfindung geht aus von einem Wischblatt nach der Gattung der unabhängigen Ansprüche. Bei einem bekannten Wischblatt dieser Art (DE-PS 12 47 161) sind zur Erzielung einer möglichst gleichmäßigen Druckbelastung des Wischblatts an einer ebenen Scheibe über seine gesamte Länge mehrere Ausgestaltungen des Tragelements als Problemlösung vorgesehen.

Bei einem anderen bekannten Wischblatt dieser Gattung (EP 0 528 643 B1) nimmt - zur Erzielung einer gleichmäßigen Druckbelastung des Wischblatts an sphärisch gekrümmten Scheiben - die Druckbelastung an den beiden Endabschnitten wesentlich zu, wenn das Wischblatt auf eine ebene Scheibe gepreßt wird.

Die in beiden Fällen angestrebte gleichmäßige Druckverteilung über die gesamte Wischblattlänge führt jedoch zu einem schlagartigen Umspringen der zum Wischblatt gehörenden, die eigentliche Wischarbeit ausführenden Wischlippe über deren gesamte Länge aus ihrer einen in ihre andere Schlepplage, wenn das Wischblatt seine Arbeitsrichtung umkehrt. Diese Schlepplage ist unabdingbar für einen effektiven und geräuscharmen Betrieb der Wischanlage. Das schlagartige Umspringen der Wischlippe - welches zwangsläufig mit einer Auf- und Abbewegung des Wischblatts verbunden ist - erzeugt jedoch unerwünschte Klopfgeräusche. Auch ist die Abstimmung der Tragelementspannung auf die gewünschte, von Fall zu Fall andersartige Druckverteilung bei sphärisch gekrümmten Scheiben problematisch.

In der EP 0 594 451 werden Flachbalkenwischblätter mit variierendem Profil beschrieben, die beim Anlegen einer Prüfkraft eine bestimmte seitliche Auslenkung nicht überschreiten sollen. Dazu wird über einen äußerst komplexen Zusammenhang innerer, den Federbalken bestimmender Parameter eine Größe angegeben, die einen bestimmten Grenzwert nicht überschreiten soll. Aus der angegebenen Gleichung können nur schwierig und unvollständig Aussagen über die tatsächlich einzusetzenden Größen abgeleitet werden. Die weiteren Angaben betreffen ein unbelastetes Wischblatt, so dass Aussagen über die Qualität eines Wischblatts im Betrieb kaum möglich sind.

Außerdem erweist sich die Umsetzung der Lehren des bekannten Standes der Technik als schwierig, da die zur Verfügung stehenden Parameter nicht direkt auf neu herzustellende Wischblätter anwendbar sind.

Vorteile der Erfindung

Das erfindungsgemäße Wischblatt mit den Merkmalen des Hauptanspruchs hat den Vorteil einer durchweg guten Wischqualität, weil unter anderem ein Rattern des Wischblatts über der Scheibe - der sogenannte slip-stick-Effekt - vermieden ist. Dies resultiert aus der Erkenntnis, dass insbesondere der seitliche Auslenkungswinkel und weniger das absolute Nacheilen, also die absolute Auslenkung der Spitzen unter Belastung für den slip-stick-Effekt zu beachten ist. Es ist demnach von Vorteil, wenn das Wischblatt so ausgelegt wird, dass die seitliche Auslenkung der im Betrieb nacheilenden Enden des Wischblatts einen seitlichen Auslenkungswinkel einer bestimmten Größe nicht überschreiten. Aus der gefundenen Größe für diese Winkel können dann für das Wischblatt wichtige Parameter abgeleitet werden, die zueinander in einer einfachen Beziehung stehen und in dieser Beziehung eine obere Grenze von 0,009 nicht überschreiten sollen. Mit Hilfe dieser Beziehung und der angegebenen Obergrenze lassen sich sehr einfach Querschnittsprofile für das Tragelement bestimmen, die dann zu einem guten Wischergebnis führen. Insbesondere Wischblätter mit über ihre Länge konstantem Querschnitt sind auf diese Weise besonders einfach herzustellen.

Durch die in den weiteren Ansprüchen angegebenen Maßnahmen sind vorteilhafte Weiterbildungen und Ausgestaltungen des erfindungsgemäßen Wischblatts möglich.

Die Wischqualität steigt weiter, wenn das Verhältnis aus dem Produkt aus der Auflagekraft und dem Quadrat der Länge zu dem Produkt aus dem 48-fachen des Elastizitätsmoduls des Tragelements und dem I_{zz}-Trägheitsmoment eine obere Grenze von 0,005 nicht übersteigt.

Besonders gut anwendbare Querschnittsprofile sind von rechteckiger Gestalt und weisen über die Länge des Wischblatts eine im wesentlichen konstante Breite und eine im wesentlichen konstante Dicke auf. Das Tragelement kann dabei auch aus Einzelbalken bestehen, die seitlich nebeneinander oder übereinander angeordnet sind und deren Gesamtbreite bzw. deren Gesamtdicke sich jeweils zu einer Gesamtbreite und/oder zu einer Gesamtdicke addieren. Bei einem solchen rechteckigen Querschnittsprofil kann das Trägheitsmoment I_{zz} als $d*b^3/12$ eingesetzt werden, wobei für d und b jeweils die Gesamtdicke bzw. die Gesamtbreite einzusetzen ist. Auf diese Weise erhält man eine sehr einfach handhabbare Beziehung, über die das Tragelement für die Wischblätter optimiert werden kann, wenn die angegebenen Obergrenzen von 0,009 und insbesondere von 0,005 nicht überschritten werden.

Insbesondere wenn komplexere Querschnittsprofile für das Tragelement gewählt werden, die beispielsweise über die Länge des Wischblatts variieren oder eine leiterartige Struktur oder dergleichen aufweisen, kann eine gute Wischqualität dennoch erreicht werden, wenn berücksichtigt wird, dass der seitliche Auslenkungswinkel γ während des Betriebs des Wischblatts eine Größe von 0,5° insbesondere von 0,3° nicht überschreiten. Diese Angaben gelten für einen mittleren

Reibwert μ von 1 und sind bei größeren oder kleineren Reibwerten entsprechend zu vergrößern bzw. zu verkleinern.

Der seitliche Auslenkungswinkel γ ist der Winkel unter dem die Tangente an das Tragelementende die in Richtung der Längserstreckung des Tragelements verlaufende Achse schneidet. In einer ersten Näherung kann darunter auch der von der Achse in Längserstreckungsrichtung des Tragelements und einer Geraden durch den Angriffspunkt des Wischerarms am Tragelement und durch ein Tragelelementende eingeschlossene Winkel verstanden werden.

Sehr gute Wischergebnisse lassen sich erzielen, wenn die Breite b und die Dicke d zur Gesamtlänge des Tragelements in einem bestimmten Verhältnis stehen. Insbesondere soll das Produkt aus der Breite und dem Quadrat der Dicke das 40-fache des Quadrats der Länge nicht über und das 20-fache des Quadrats der Länge nicht unterschreiten. Die Breiten und/oder die Dicken von zusammengesetzten Tragelementen addieren sich jeweils zu einer Gesamtbreite bzw. Gesamtdicke, die dann berücksichtigt wird.

Das erfindungsgemäße Wischblatt mit den Merkmalen des Anspruchs 10 hat den Vorteil, dass lediglich ein Parameter zur Einstellung der nach außen abfallenden Auflagekraftverteilung variiert werden muß. Die Krümmung bzw. der Krümmungsverlauf entlang des Tragelements kann in frei programmierbaren Biegemaschinen voreingestellt werden. Dadurch können auch kurze Versuchsreihen zur Optimierung der Auflagekraftverteilung und damit des Krümmungsverlaufs schnell und ohne großen Aufwand durchgeführt werden. Insbesondere ist es von Vorteil, wenn die den Krümmungsverlauf beherrschende Koordinate entlang des Trägheitselements verläuft. Damit sind aufwendige Rückrechnungen auf ein kartesisches Koordinatensystem, bei dem jede Änderung an einer Position x eine Verschiebung der nachfolgenden „x-Werte“ bedingt, vermieden.

Der mathematische Zusammenhang zwischen der zweiten Ableitung der Krümmung nach der angepaßten Koordinate und dem Auflagekraftverlauf ebenfalls nach der angepaßten Koordinate wird besonders einfach, wenn der Elastizitätsmodul des Tragelementwerkstoffs sowie das Flächenträgheitsmoment des Tragelements über dessen Länge konstant sind. Bei vorgegebener Auflagekraftverteilung kann dann durch zweifaches Integrieren oder auch nummerisch die Krümmung direkt ausgerechnet werden.

Eine optimale Anpassung eines solchen Wischblattes auch an Scheiben mit komplizierterem Krümmungsverlauf ist möglich, wenn die Krümmung der Scheibe von der Krümmung des Tragelements bzw. die zweite Ableitung der Krümmung der Scheibe von der zweiten Ableitung der Krümmung des Tragelements abgezogen wird. In diesem Fall kann eine Auflagekraftverteilung vorgegeben werden, wie sie für ein Wischblatt, das auf eine ebene Scheibe aufgedrückt wird, erwünscht ist. Die Differenz der zweiten Ableitungen der jeweiligen Krümmungen ist dann wieder proportional dieser Auflagekraftverteilung.

Ein erfindungsgemäßes Wischblatt mit den Merkmalen des Anspruchs 15 zeichnet sich dadurch aus, dass ohne spezielle Anpassung für durchschnittliche Scheibentypen ein hervorragendes Wischergebnis erzielt wird. Durch die aufgeführte, sehr einfache Maßnahme wird erreicht, dass die Auflagekraftverteilung in den allermeisten Fällen den Anforderungen genügt. Die genannten Stützpunkte sind hinreichend genau, um daraufhin einen einzuhaltenden Krümmungsverlauf zu bestimmen.

Optimiert wird ein Wischblatt nach Anspruch 15 durch die Maßnahmen des Anspruchs 16. Auch bei komplexeren Scheibungskrümmungsverläufen kann durch die Vorgabe der Auflagekraftverteilung an bestimmten Stützpunkten die Wischqualität gesteigert werden. Trotzdem ist es möglich, das Wischblatt ohne aufwendige Berechnungen zu konstruieren. Der Krümmungsverlauf kann im wesentlichen vorbestimmt und durch einfache Versuche optimiert werden. Solange die Vorgabe, dass die Auflagekraftverteilung, die vorherrscht, wenn das Wischblatt auf die zu wischende Scheibe gedrückt ist, in einem Bereich ungefähr hälftig zwischen Mitte und Ende des Wischblatts höher ist als am Ende des Wischblatts eingehalten werden, ist eine hervorragende Wischqualität gewährleistet.

In einem erfindungsgemäßen Verfahren zur Herstellung eines solchen Wischblatts werden die einzelnen Parameter entsprechend der erfindungsgemäßen Lehre ausgewählt und wird das Tragelement so vorgebogen, dass sein Krümmungsverlauf mindestens eine der vorgenannten Bedingungen erfüllt. Dabei ist es besonders günstig, das Tragelement zuerst zu biegen und dann mit der Wischleiste und dem Verbindungselement zusammenzufügen. Es ist aber auch möglich, das Verbindungselement mit dem Tragelement zu verbinden und dann erst die Wischleiste hinzuzufügen.

Zeichnung

In der Zeichnung zeigen: Figur 1 eine perspektivische Darstellung eines an der Scheibe angelegten, mit einem zur Scheibe belasteten Wischerarm verbundenen Wischblatts, Figur 2 eine Prinzipdarstellung einer Seitenansicht eines unbelastet auf die Scheibe aufgesetzten Wischblatts, gegenüber Figur 1 verkleinert dargestellt, Figur 3 die Schnittfläche eines Schnitts durch das Wischblatt gemäß Figur 1, entlang der Linie III-III in vergrößerter Darstellung, die Figuren 4 und

5 eine Variante zu Figur 3, die Figuren 6 und 7 ein Wischblatt in einer anderen Ausführungsform mit einem eingezeichneten Koordinatensystem, die Figuren 8 und 9 jeweils berechnete und gemessene Werte für die Auflagekraftverteilung über der Länge des Wischblatts aufgetragen und Figur 10 eine unmaßstäbliche Prinzipdarstellung eines zum Wischblatt gehörenden Tragelements in Seitenansicht.

Beschreibung des Ausführungsbeispiels

Ein in Figur 1 dargestelltes Wischblatt 10 weist ein langgestrecktes, federelastisches, auch als Flachbalken zu bezeichnendes Tragelement 12 für eine Wischleiste 14 auf, das in Figur 10 separat dargestellt ist. Wie aus den Figuren 1, 3 und 4 ersichtlich ist, sind das Tragelement 12 und die Wischleiste 14 längsachsenparallel miteinander verbunden. An der von der zu wischenden Scheibe 15 - in Figur 1 strichpunktiert gezeichnet - abgewandten Oberseite des Tragelements 12 ist als Verbindungsmittel eine Anschlußvorrichtung 16 angeordnet, mit deren Hilfe das Wischblatt 10 mit einem an der Karosserie eines Kraftfahrzeugs geführten, angetriebenen Wischerarm 18 lösbar verbunden werden kann. An der der Scheibe 15 zugewandten Unterseite des Tragelements 12 ist die langgestreckte, gummielastische Wischleiste 14 angeordnet.

An dem freien Ende 20 des Wischarms 18 ist ein als Gegenanschlußmittel dienender Haken angeformt, welcher einen zur Anschlußvorrichtung 16 des Wischblatts 10 gehörenden Gelenkbolzen 22 umgreift. Die Sicherung zwischen dem Wischerarm 18 und dem Wischblatt 10 wird durch nicht näher dargestellte, an sich bekannte, als Adapter ausgebildete Sicherungsmittel übernommen.

Der Wischerarm 18 und damit auch dessen Hakenende 20 sind in Richtung des Pfeiles 24 zur zu wischenden Scheibe 15 belastet, deren zu wischende Oberfläche in den Figuren 1 und 2 durch eine strichpunktierte Linie 26 angedeutet ist. Die Auflagekraft F_{wf} (Pfeil 24) legt das Wischblatt 10 über dessen gesamte Länge an der Oberfläche 26 der zu wischenden Scheibe 15 an.

Da die in Figur 2 dargestellte strichpunktierte Linie 26 die stärkste Krümmung der Scheibenoberfläche im Bereich des Wischfeldes darstellen soll ist klar ersichtlich, daß die Krümmung des mit seinen beiden Enden an der Scheibe anliegenden, noch unbelasteten Wischblatts 10 stärker ist als die maximale Krümmung der sphärisch gekrümmten Scheibe 15. Unter der Auflagekraft F_{wf} (Pfeil 24) legt sich das Wischblatt 10 mit seiner zur Wischleiste 14 gehörenden Wischlippe 28 über seine gesamte Länge an der Scheibenoberfläche 26 an. Dabei baut sich im bandartigen federelastischen Tragelement 12 eine Spannung auf, welche für eine ordnungsgemäße Anlage der Wischleiste 14 bzw. der Wischlippe 28 über deren gesamte Länge an der Kraftfahrzeugscheibe 15 sorgt. Während des Wischbetriebs bewegt der Wischerarm 18 das Wischblatt 10 quer zu dessen Längserstreckung über die Scheibe 15. Diese Wisch- oder Arbeitsbewegung ist in Figur 1 mit dem Doppelpfeil 29 bezeichnet.

Im folgenden soll nun auf die besondere Ausgestaltung des erfindungsgemäßen Wischblatts näher eingegangen werden. Wie die unmaßstäblich dargestellte Figur 3 zeigt, ist die Wischleiste 14 an der unteren, der Scheibe 15 zugewandten Bandfläche des Tragelements 12 angeordnet. Mit Abstand von dem Tragelement 12 ist die Wischleiste 14 von ihren beiden Längsseiten her so eingeschnürt, daß in ihrem Längsmittelbereich ein Kippsteg 30 verbleibt, der sich über die gesamte Länge der Wischleiste 14 erstreckt. Der Kippsteg 30 geht in die Wischlippe 28 über, die einen im wesentlichen keilförmigen Querschnitt aufweist. Durch die Auflagekraft (Pfeil 24) wird das Wischblatt beziehungsweise die Wischlippe 28 gegen die zu wischende Oberfläche 26 der Scheibe 15 gedrückt, wobei sie unter dem Einfluß der Wischbewegung - von der in der Figur 3 speziell die eine der beiden gegenläufigen Wischbewegungen (Doppelpfeil 29) betrachtet wird und die durch den Richtungspfeil 32 angedeutet ist - in eine sogenannte Schlepplage kippt, in der sich die Wischlippe an dem am Tragelement 12 gehaltenen Teil der Wischleiste 14 über ihre gesamte Länge abstützt. Dieser Abstützung welche in der Figur 3 mit dem Pfeil 34 gekennzeichnet ist erfolgt stets - in Abhängigkeit von der jeweiligen Wischrichtung (Doppelpfeil 29 bzw. Pfeil 32) an der in der jeweiligen Wischrichtung hintenliegenden Oberkante der Wischlippe 28, sodaß diese stets in einer sogenannten Schlepplage über die Scheibe geführt wird. Diese Schlepplage ist für einen effektiven und geräuscharmen Betrieb der Wischvorrichtung notwendig. Die Umkehrung der Schlepplage erfolgte in der sogenannten Umkehrposition des Wischblatts 10, wenn dieses seine Wischbewegung (Doppelpfeil 29) umkehrt. Dabei führt das Wischblatt eine Auf- und Abbewegung aus, welche durch das Umkippen der Wischlippe 28 bedingt ist. Die Aufbewegung erfolgt entgegen Richtung des Pfeiles 24 und somit auch entgegen der Anlegekraft. In der entgegen dem Pfeil 32 gerichteten anderen Wischbewegung ergibt sich somit ein Spiegelbild der Figur 3.

In der gegenüber dem Wischblatt in Figur 1 vergrößert dargestellten Figur 4 ist ein Querschnittsprofil 40 gezeigt, mit einer rechteckigen Schnittfläche mit einer Breite b und einer Dicke d. Außerdem ist ein Koordinatensystem über das Tragelement 12 gezeichnet. In Figur 6 ist als 3. Koordinate eine der Krümmung des Tragelements 12 folgende s-Koordinate eingezeichnet, zu der die y- und z-Koordinaten senkrecht stehen.

Wird nun das Wischblatt 10 mit einer Kraft F_{wf} (Pfeil 24) insbesondere vom Wischarm 18 auf eine Scheibe 26 gepreßt, ergibt sich eine gewisse Kraftverteilung p(s), die zu einem Moment M(s) führt, das maximal in der Mitte des Tragelements 12 ist. Für eine, für den Wischbetrieb günstige konstante Auflagekraftverteilung

$$p = \frac{F_{wf}}{L}$$

ist das Moment

$$M(s) = p * \frac{(\frac{L}{2} - s)^2}{2}$$

und somit

$$M(s) = F_{wf} * \frac{(\frac{L}{2} - s)^2}{2L}$$

Für eine nach außen abnehmende Auflagekraftverteilung, die sich insbesondere zum Umlegen der Wischlippen eignet, ist das Moment M(s) über seine Gesamtlänge etwas kleiner als das für eine konstante Kraftverteilung berechnete Moment:

$$M(s) < p * \frac{(\frac{L}{2} - s)^2}{2}$$

Geht man nun davon aus, dass ein Reibwert μ für eine trokkene Scheibe ungefährt 1 ist, ist im Betrieb das seitliche Moment gleich dem Biegemoment M(s), was insbesondere aus der vorgegebenen Kraftverteilung p(s) folgt.

Aus dem seitlichen Biegemoment folgt ein seitlicher Auslenkungswinkel γ, der sich durch Integration der Einzelauslenkungen vom Angriffspunkt des Wischerarms am Wischblatt bis zum Wischblattende hin berechnen läßt. Im Falle einer mittig angeordneten Anschlußvorrichtung 16 berechnet sich der Auslenkungswinkel nach

$$\gamma = \int_0^{L/2} \frac{M(s)}{E * I_{zz}} ds$$

Unter Berücksichtigung der Beziehung des Momentes für eine konstante Auflagekraftverteilung erhält man eine einfache Abschätzung für den Winkel γ:

$$\gamma < \int_0^{L/2} \frac{p(s)(\frac{L}{2} - s)}{2 * E * I_{zz}} ds$$

Durch Integration erhält man

$$\gamma < \frac{p * L^3}{48 * E * I_{zz}} = \frac{F_{wf} * L^2}{48 * E * I_{zz}}$$

Der Erfindung liegt unter anderem die Erkenntnis zugrunde, dass eine gute Wischqualität insbesondere durch Vermeiden von Rattern dann erzielt wird, wenn der Winkel γ die Größe 0,5° (=0,009rad) insbesondere die Größe 0,3° (=0,005rad) nicht überschreitet. Damit läßt sich eine einfache Beziehung zwischen der Auflagekraft und den geometrischen Größen des Wischblatts herleiten, gemäß dem

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0{,}009$$

insbesondere < 0,005 ist.

Für dem am häufigsten auftretenden Fall eines rechteckigen Profils 40, wie in Figur 3 dargestellt, bestimmt sich das Trägheitsmoment zu:

$$I_{zz} = \frac{d * b^3}{12}$$

wobei d = Dicke des Tragelements
b = Breite des Tragelements ist.

Die Breite b und die Dicke d sind folglich so auszuwählen, dass

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0{,}009$$

insbesondere <0,005 sein soll.

Ist das Tragelement 12 in zwei einzelne Federbalken 42 und 44 aufgeteilt, wie das in Figur 4 dargestellt ist, so kann bei den obigen Überlegungen in erster Näherung die Breite b als Summe der Einzelbreiten b1 und b2 angenommen werden: $b=b_1+b_2$. Damit lassen sich auch für derartige Systeme einfache Beziehungen zwischen der Breite und der Dicke eines Tragelements herleiten.

Für den Fall, dass kein rechteckiges Querschnittsprofil gewählt werden soll, ist es notwendig, das Trägheitsmoment I_{zz} zu bestimmen und in die oben genannten Beziehungen entsprechend einzusetzen. Ebenso sind Querschnittsveränderungen über die Länge des Wischblatts oder ein nicht zentraler Angriffspunkt des Wischerarms am Wischblatt in den obigen Überlegungen entsprechend zu berücksichtigen.

Um ein möglichst geräuscharmes Umlegen der Wischlippe 28 aus ihrer einen Schlepplage in ihre andere Schlepplage zu erreichen, wird das zur Verteilung der Anlegekraft (Pfeil 24) dienende Tragelement 12 so ausgelegt, daß der Anlegedruck der Wischleiste 24 beziehungsweise der Wischlippe 28 an der Scheibenoberfläche 26 in deren Mittelabschnitt 36 (Figur 11) größer ist als an wenigsten einen der beiden Endabschnitten 38.

Die Verteilung der Anlagekraft über das Tragelement erfolgt in Abhängigkeit verschiedener Parameter des Tragelements wie beispielweise das Querschnittsprofil, der Querschnittsverlauf über die Länge des Tragelements oder auch der Radiusverlauf R(s) entlang des Tragelements. Eine Optimierung des Tragelements in Richtung auf eine vorgegebene Auflagekraftverteilung p (s) ist deshalb sehr aufwendig. Der Erfindung liegt nun die Erkenntnis zugrunde, dass bei einem Tragelement mit einem über die Länge des Tragelements im wesentlichen konstanten, insbesondere rechteckigen Querschnitt, die Auflagekraftverteilung p(s) über eine Vorgabe der Krümmung K entlang einer Koordinate s festgelegt werden kann, wobei die Koordinate s sich entlang des Tragelements erstreckt. Die Krümmung K(s) ist gleich dem inversen Radius in Abhängigkeit von s:

$$K(s) = \frac{1}{R(s)}$$

Bei dem Tragelement besteht eine Beziehung zwischen dem Biegemoment M, dem Radius R des Tragelements, dessen Elastizitätsmodul E sowie dem an dem jeweiligen Ort vorherrschenden Flächenträgheitsmoment I. Die Beziehung wird besonders einfach, wenn sie auf die mit den Tragelementen mitlaufenden Koordinate s bezogen wird:

$$K(s) = \frac{M(s)}{E * I}$$

Durch zweimaliges Differenzieren nach dem Ort s erhält man die Beziehung:

$$\frac{d^2K(s)}{ds^2} = \frac{d^2M(s) / ds^2}{E * I}$$

Da die zweite Ableitung des Biegemoments M nach der mitlaufenden Koordinate s gleich der Auflagekraftverteilung p entlang der Koordinate s entspricht, die entsteht, wenn man das Tragelement auf eine ebene Scheibe aufpreßt, folgt daraus, dass die zweite Ableitung der Krümmung K nach der mitlaufenden Koordinate s bis auf eine Konstante mit dieser Auflagekraftverteilung p auf einer ebenen Scheibe übereinstimmt. Die Konstante ist abhängig vom Elastizitätsmodul E sowie vom Flächenträgheitsmoment I, das seinerseits sehr einfach wird, wenn es sich um einen rechteckigen Querschnitt handelt. Bei vorgegebener, nach außen abfallender Auflagekraftverteilung p kann darüber rechnerisch oder in einfachen Versuchen das Krümmungsprofil K(s) ermittelt werden. Die äußere Gestalt und damit die für die Herstellung notwendigen Parameter des Tragelements sind damit vom Fachmann einfach zu ermitteln.

Um die Form der Scheibe zu berücksichtigen, für die das Wischblatt verwendet werden soll, ist die obige Beziehung dahingehend zu korrigieren, dass von der für eine ebene Scheibe vorgegebene, nach außen abfallenden Auflagekraftverteilung p entlang der Koordinate s, die noch durch den Elastizitätsmodul E und das Flächenträgheitsmoment I dividiert wird, die zweite Ableitung der Krümmung $K_{Scheibe}$ der Scheibe nach der Koordinate s dazu addiert werden muß:

$$\frac{d^2K(s)}{ds^2} = \frac{p(s)}{E * I} + \frac{d^2K_{Scheibe}(s)}{ds^2}$$

Auch hierüber ist es für den Fachmann einfach, ein Tragelement für eine bestimmte Scheibe zu konfigurieren:

- Festlegen der Länge L und des Querschnittprofils, insbesondere die Breite b und die Dicke d über Erfahrungswerte,
- Festlegen einer Auflagekraft F_{wf} bzw. einer Auflagekraftverteilung p für eine ebene Scheibe, die eine gute Wischqualität gewährleistet, ebenfalls über Erfahrungswerte,
- Ausmessen des Krümmungsverlaufes $K_{Scheibe}$ der Scheibe,
- Zweifaches Ableiten dieses Krümmungsverlaufes $K_{Scheibe}$ der Scheiben nach einer mit der Krümmung mitlaufenden Koordinate s,
- Berechnung der zweiten Ableitung des Krümmungsverlaufes K(s) des Tragelements nach obiger Beziehung,
- Zweifaches Integrieren ergibt den gesuchten Krümmungsverlauf K(s) des Tragelements.

Es hat sich gezeigt, dass gute Wischergebnisse dann erzielt werden können, wenn die Krümmung K entlang der mitlaufenden Koordinate s derart ist, dass die Auflagekraftverteilung, die vorherrscht, wenn das Wischblatt auf eine ebene Scheibe gedrückt ist, in einem Bereich ungefähr hälftig zwischen Mitte und Ende des Wischblatts höher ist als am Ende des Wischblatts. In den Figuren 8 und 9 ist dieser Bereich 40 für eine Seite angedeutet. Der Erfindung liegt die Erkenntnis zugrunde, dass der Verlauf der Auflagekraftverteilung p im Bereich 40 eine kleinere Bedeutung zukommt, als der Relation zwischen der Auflagekraftverteilung p im Bereich 40 zur Auflagekraftverteilung p an den Enden des Wischblatts. In den Figuren 8 und 9 ist jeweils die gesamte Länge L eines Wischblatts aufgetragen, wobei das Anschlußelement 16 in der

Mitte des Wischblatts angeordnet ist, so dass den Wischblattenden die Größe 0,50 L zukommt.

Sehr gute Wischergebnisse werden erzielt, wenn die Krümmung K entlang einer der Längserstreckung des Tragelements 12 folgenden Koordinate s solche Werte aufweist, dass die Auflagekraftverteilung p, die vorherrscht, wenn das Wischblatt auf die zu wischende Scheibe gedrückt ist, im Bereich ungefähr hälftig zwischen Mitte und Ende des Wischblatts höher ist als am Ende des Wischblatts. Durch die Berücksichtigung des Scheibenverlaufs, für den das Wischblatt vorgesehen ist, wird die allgemeine Eigung für beliebige Scheiben zwar eingeschränkt, die ausgewählte Scheibe jedoch optimal gewischt.

Figur 10 zeigt einen möglichen Krümmungsverlauf K des Tragelements 12, der eine Auflagekraftverteilung p der Wischlippe 28 an der Scheibe 15 ergeben kann, die zum Wischblattende hin abfällt. Bei diesem federelastischen Tragelement 12, das unbelastet eine stärkere Hohlkrümmung gegenüber der Scheibe aufweist als diese im Bereich des vom Wischblatt überstrichenen Wischfeldes gekrümmt ist, ist der Krümmungsverlauf K so ausgeführt, daß dieser im Mittelabschnitt 36 des Tragelements 12 stärker ist als an dessen Endabschnitten 38.

Durch die Verringerung der Auflagekraft der Wischlippe 28 an der Scheibenoberfläche 26 im Bereich eines Wischblattendes oder an beiden Wischblattenden wird ein schlagartiges Umspringen oder Umschnappen der Wischlippe 28 aus ihrer einen Schlepplage in ihre andere Schlepplage vermieden. Vielmehr erfolgt beim erfindungsgemäßen Wischblatt ein vergleichsweise sanftes Umlegen der Wischlippe vom Wischblattende aus fortschreitend zur Wischlippenmitte beziehungsweise bis zum anderen Wischlippenende. Die Figur 3 zeigt in Verbindung mit Figur 1, daß auch bei sphärisch gekrümmten Scheiben die geringer belasteten Endabschnitte der Wischlippe 28 noch wirksam an der Scheibenoberfläche anliegen.

Allen Ausführungsbeispielen ist gemeinsam, daß der Anlegedruck (Pfeil 24) der Wischleiste 14 an der Scheibe 15 in deren Mittelabschnitt 36 größer ist als an wenigstens einem ihrer beiden Endabschnitte 38. Dies gilt auch dann, wenn - abweichend vom gegenständlich gezeigten Wischblatt 10 mit einem einteiligen, als Federschiene dargestelltem Tragelement 12 - das Tragelement mehrteilig aufgebaut ist. Unter Umständen kann es jedoch nötig sein, auch andere Auflagekraftverteilungen vorzugeben. Mit den aufgezeigten Beziehungen können aber auch dann Wischblätter konzipiert werden, die hervorragende Wischergebnisse erzielen.

Bei dem erfindungsgemäßen Verfahren zur Herstellung eines Wischblatts wird wie bereits oben angegeben zuerst die Kontur und der Krümmungsverlauf K bestimmt und dann das Tragelement 12 mit der Wischleiste 14 und dem Verbindungselement 16 zusammengefügt. Ist das Tragelement aus zwei parallelen Flachbalken aufgebaut, können diese bevorzugt miteinander, d.h. direkt nebeneinander vorgebogen werden, was einen sehr symmetrischen und damit verwindungsstabilen Aufbau des Wischblatts gewährleistet. Die beiden Tragelementhälften sind dann im laufenden Verfahren gemeinsam weiter zu verarbeiten, um eine versehentliche Separation zu vermeiden. Nach dem das Tragelements gebogen ist, wird entweder zuerst die Wischleiste angebracht, beispielsweise durch Ankleben oder Anvulkanisieren, oder auch insbesondere bei zwei Tragelementhälften durch Einlegen der Tragelementhälften in Längsnuten der Wischleiste und dann das Verbindungselement aufgebracht. Insbesondere, wenn das Verbindungselement aufgeschweißt wird, ist die Wischleiste erst nachträglich anzubringen, um thermische Schäden am Wischgummi zu vermeiden.

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Ansprüche

1. Wischblatt für Scheiben, insbesondere für Kraftfahrzeuge, mit mindestens einem Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18), wobei das Tragelement (12) ein langgestreckter Flachbalken ist, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind, dadurch gekennzeichnet, dass das Tragelement (12) ein Querschnittsprofil aufweist, bei dem

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0{,}009$$

sind, wenn F_{wf} die vom Wischerarm (18) auf das Wischblatt ausgeübte Auflagekraft oder die Auflagekraft ist, für die das Wischblatt ursprünglich ausgelegt wurde und L die Länge des Tragelements (12), E der Elastizitätsmodul des Tragelements (12), I_{zz} das Trägheitsmoment des Querschnittsprofils um die z-Achse senkrecht auf eine mit dem Tragelement (12) mitlaufende s-Achse sowie senkrecht auf eine y-Achse ist.

2. Wischblatt nach Anspruch 1, dadurch gekennzeichnet, dass

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0{,}005$$

ist.

3. Wischblatt nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass das Tragelement (12) ein im wesentlichen rechteckiges Querschnittsprofil (40) aufweist, mit einer im wesentlichen konstanten Breite b und einer im wesentlichen konstanten Dicke d.

4. Wischblatt nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass das Tragelement (12) aus mindestens zwei Einzelbalken (42, 44) besteht und dass sich die Breiten (b1, b2) der Einzelbalken (42, 44) zu einer Gesamtbreite b addieren.

5. Wischblatt nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Breite b und die Dicke d des Tragelements (12) so ausgewählt sind, dass

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0{,}009$$

ist.

6. Wischblatt nach einem der Ansprüche 1 bis 4, dadurch gekennzeichnet, dass die Breite b und die Dicke d des Flachbalkens so ausgewählt sind, dass

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0{,}005$$

ist.

7. Wischblatt für Scheiben, insbesondere für Kraftfahrzeug, mit mindestens einem Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18), wobei das Tragelement (12) ein langgestreckter Flachbalken ist, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind, insbesondere nach ei-

nem der vorhergehenden Ansprüchen, dadurch gekennzeichnet, dass das Tragelement (12) ein Querschnittsprofil (40) aufweist, das einen seitlichen Auslenkungswinkel mindestens eines der Tragelementenden bezogen auf die Längserstreckung des Tragelements von $\gamma < 0{,}5°$ insbesondere $< 0{,}3°$ auf der Scheibe (26) erzeugt, wenn das Wischblatt auf der Scheibe (26) quer zu seiner Längserstreckung bewegt wird und der Reibungskoeffizient zwischen Scheibe (26) und Wischleiste (14) ungefähr 1 ist.

8. Wischblatt für Scheiben, insbesondere für Kraftfahrzeuge, mit mindestens einem Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18), wobei das Tragelement (12) ein langgestreckter Flachbalken ist, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind, insbesondere nach einem der vorhergehenden Ansprüche dadurch gekennzeichnet, dass das Tragelement eine Länge L, eine Breite b und eine Dicke d aufweist, derart, dass

$$20L^2 < bd^2 < 40L^2$$

wenn L in Meter und b und d in Millimeter angegeben werden.

9. Wischblatt nach Anspruch 8, dadurch gekennzeichnet, dass das Tragelement aus mindestens zwei Federbalken besteht, deren Breiten sich addieren.

10. Wischblatt für Scheiben (15) insbesondere für Kraftfahrzeuge, mit mindestens einem langgestreckten Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18), der in einer Betriebsstellung das Wischblatt (10) auf die Scheibe (15) drückt, wobei das Tragelement (12) ein langgestreckter Flachbal-

ken ist, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind und der in einer vom Wischerarm (18) unbelasteten Stellung eine Krümmung aufweist, insbesondere nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Krümmung entlang einer der Längserstreckung des Tragelements (12) folgenden Koordinate (s) solche Werte aufweist, dass die zweite Ableitung der Krümmung nach dieser Koordinate (s) im wesentlichen proportional zu einer Auflagekraftverteilung p (s) ist, die entsteht, wenn das Wischblatt (10) auf eine ebene Scheibe (15) gedrückt ist und dass die Auflagekraftverteilung zu mindestens zu einem Ende hin abnimmt.

11. Wischblatt nach Anspruch 10, dadurch gekennzeichnet, dass

$$\frac{d^2K(s)}{ds^2} = \frac{d^2M(s)}{ds^2} * E * I = \frac{p(s)}{E * I}$$

s	=	Koordinate entlang dem Tragelement
K(s)	=	Krümmung des Tragelements
M(s)	=	Biegemoment
E	=	Elastizitätsmodul
I	=	Flächenträgheitsmoment des Tragelements

bezüglich der neutralen Achse

p(s) = spezifische Kraft pro Längeneinheit = Auflagekraftverteilung.

12. Wischblatt für Scheiben (15) insbesondere für Kraftfahrzeuge, mit mindestens einem langgestreckten Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18), der in einer Betriebsstellung das Wischblatt (10) auf die Scheibe (15) drückt, wobei das Tragelement (12) ein langgestreckter Flachbalken ist, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind und der in einer vom Wischer-

arm (18) unbelasteten Stellung eine Krümmung aufweist, insbesondere nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Krümmung entlang einer der Längserstreckung des Tragelements (12) folgenden Koordinate (s) solche Werte aufweist, dass die zweite Ableitung der Krümmung nach dieser Koordinate (s) minus der zweiten Ableitung der Krümmung der Scheibe (15) von einem mittleren Bereich (40) zu den Enden hin abnimmt.

13. Wischblatt nach Anspruch 12, dadurch gekennzeichnet, dass der mittlere Bereich (40) der Ort des Verbindungsmittels (16) ist.

14. Wischblatt nach einem der Ansprüche 12 oder 13, dadurch gekennzeichnet, dass

$$\frac{d^2K(s)}{ds^2} = \frac{p(s)}{E*I} + \frac{d^2K_{Scheibe}(s)}{ds^2}$$

s = Koordinate entlang dem Tragelement
K(s) = Krümmung des Tragelements
M(s) = Biegemoment
E = Elastizitätsmodul
I = Flächenträgheitsmoment des Tragelements bez. der neutralen Achse
p(s) = spezifische Kraft pro Längeneinheit = Auflagekraftverteilung

15. Wischblatt für Scheiben (15) insbesondere für Kraftfahrzeuge, mit mindestens einem langgestreckten Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18), der in einer Betriebsstellung das Wischblatt (10) auf die Scheibe (15) drückt, wobei das Tragelement (12) ein langgestreckter Flachbalken ist, an dem die Wischleiste (14) und das Verbindungs-

mittel (16) befestigt sind und der in einer vom Wischerarm (18) unbelasteten Stellung eine Krümmung aufweist, insbesondere nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Krümmung entlang einer der Längserstreckung des Tragelements (12) folgenden Koordinate (s) solche Werte aufweist, dass die Auflagekraftverteilung p(s), die vorherrscht, wenn das Wischblatt (10) auf eine ebene Scheibe (15) gedrückt ist, in einem Bereich (40) ungefähr hälftig zwischen Mitte und Ende des Wischblatts (10) höher ist als am Ende des Wischblatts (10).

16. Wischblatt für Scheiben (15) insbesondere für Kraftfahrzeuge, mit mindestens einem langgestreckten Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18), der in einer Betriebsstellung das Wischblatt (10) auf die Scheibe (15) drückt, wobei das Tragelement (12) ein langgestreckter Flachbalken ist, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind und der in einer vom Wischerarm (18) unbelasteten Stellung eine Krümmung aufweist, insbesondere nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, dass die Krümmung entlang einer der Längserstreckung des Tragelements (12) folgenden Koordinate (s) solche Werte aufweist, dass die Auflagekraftverteilung p(s), die vorherrscht, wenn das Wischblatt (10) auf die zu wischende Scheibe (15) gedrückt ist, in einem Bereich (40) ungefähr hälftig zwischen Mitte und Ende des Wischblatts (10) höher ist als am Ende des Wischblatts (10).

17. Verfahren zum Herstellen eines Wischblatts nach einem der vorhergehenden Ansprüchen, gekennzeichnet durch folgende Schritte:
Ermitteln der für die zu wischenden Scheibe notwendigen

Länge L und angepaßten Auflagekraft F_{wf}, Ermitteln der Breite b und der Dicke d, Ermitteln des Krümmungsverlaufs K(s), Biegen des Tragelements, Verbinden von Tragelement, Wischleiste und Verbindungsmittel.

18. Verfahren nach Anspruch 17, gekennzeichnet durch folgende Schritte:
   - Festlegen der Länge L und des Querschnittprofils, insbesondere die Breite b und die Dicke d über Erfahrungswerte,
   - Festlegen einer Auflagekraft F_{wf} bzw. einer Auflagekraftverteilung p für eine ebene Scheibe, die eine gute Wischqualität gewährleistet, ebenfalls über Erfahrungswerte,
   - Ausmessen des Krümmungsverlaufes $K_{Scheibe}$ der Scheibe,
   - Zweifaches Ableiten dieses Krümmungsverlaufes $K_{Scheibe}$ der Scheiben nach einer mit der Krümmung mitlaufenden Koordinate s,
   - Berechnung der zweiten Ableitung des Krümmungsverlaufes K(s) des Tragelements nach obiger Beziehung,
   - Zweifaches Integrieren ergibt den gesuchten Krümmungsverlauf K(s) des Tragelements.

05.07.00 Km/Hx

ROBERT BOSCH GMBH, 70442 Stuttgart

Wischblatt für Scheiben, insbesondere von Kraftfahrzeugen sowie Verfahren zum Herstellen solcher Wischblätter

Zusammenfassung

Die Erfindung betrifft ein Wischblatt für Scheiben, insbesondere von Kraftfahrzeugen, mit mindestens einem Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18). Das Tragelement (12) ist ein langgestreckter Flachbalken, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind. Es wird vorgeschlagen, dass der Flachbalken ein Querschnittsprofil (40) aufweist, bei dem F_{wf} * L^2 / 48 * E * I_{zz} < 0,009 sind, wenn F_{wf} die auf das Wischblatt ausgeübte Auflagekraft oder die Auflagekraft ist, für die das Wischblatt ursprünglich ausgelegt wurde, L die Länge des Wischblatts, E der Elastizitätsmodul des Flachbalkenwerkstoffes und I_{zz} das Trägheitsmoment des Querschnittsprofils um die z-Achse (senkrecht auf eine mit dem Flachbalken mitlaufende s-Achse sowie senkrecht auf eine y-Achse) ist.

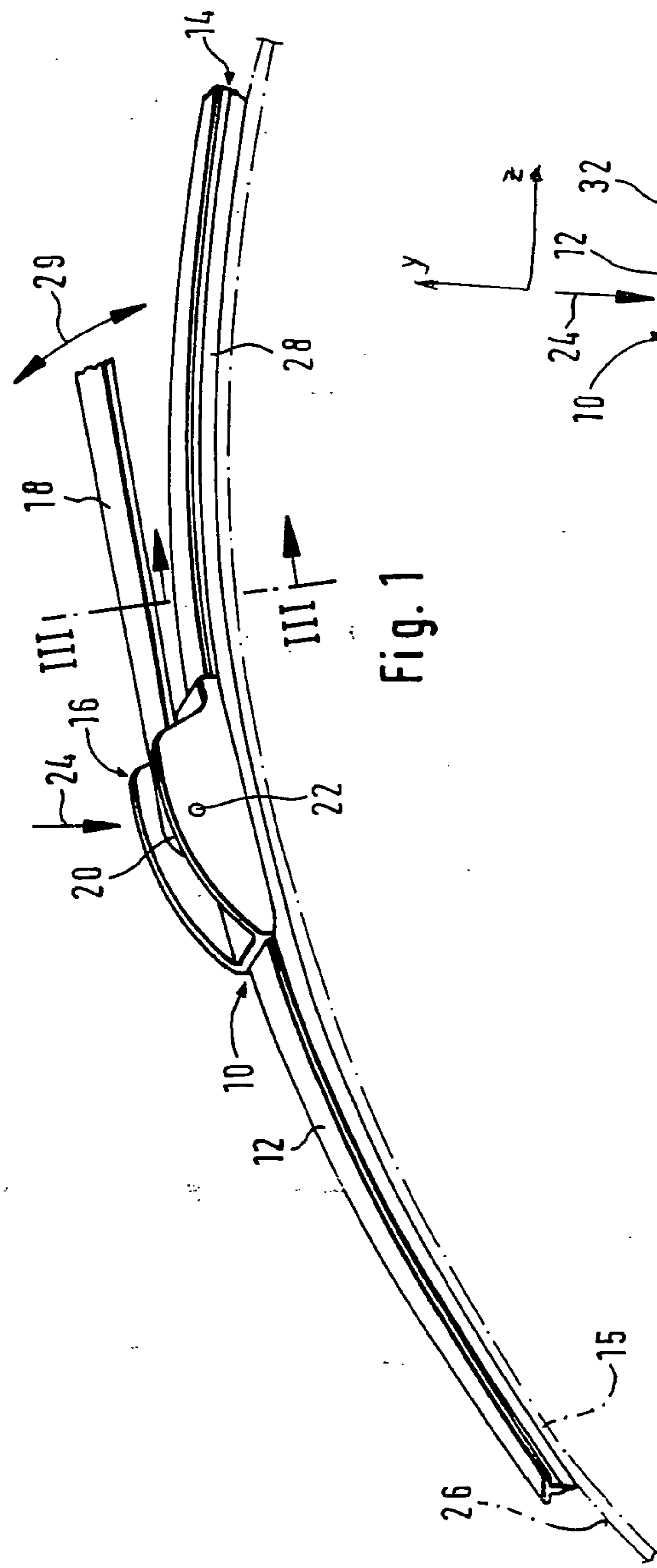
14
29
28
18
III
III
16
24
22
20
10
12
15
26

Fig. 1

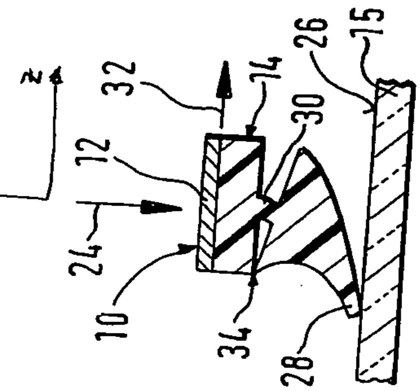
z
y
32
14
12
30
26
15
24
10
34
28

Fig. 3

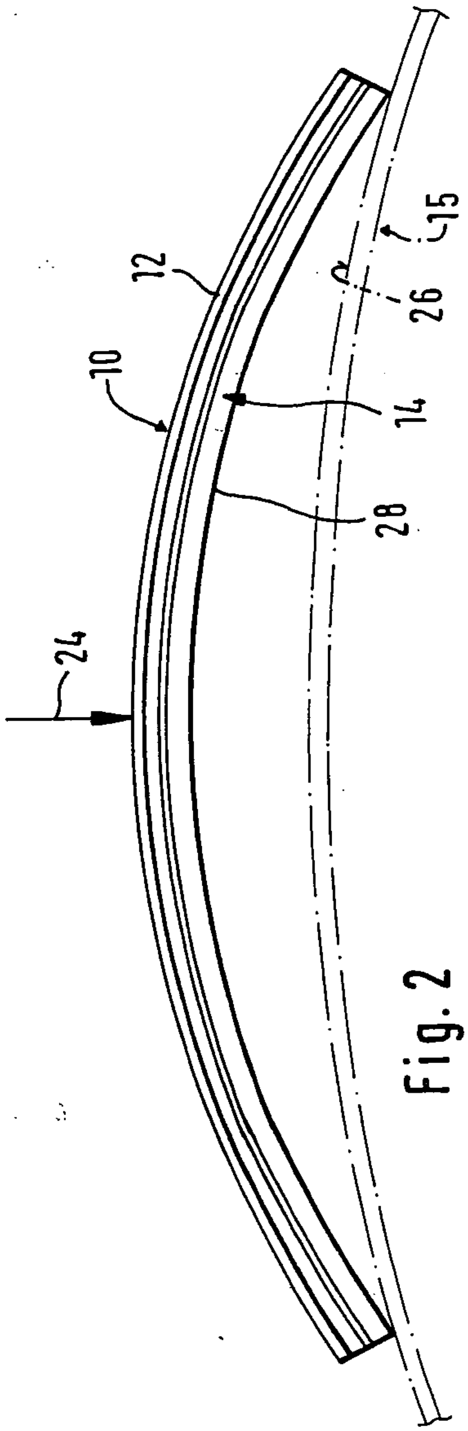

Fig. 2

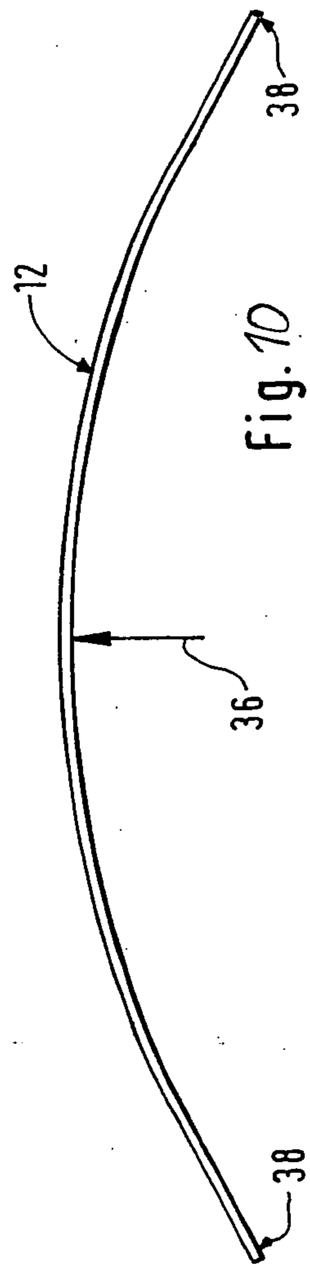

Fig. 10

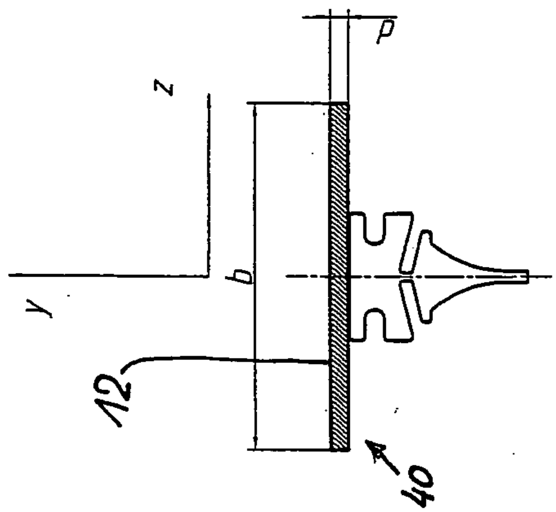

Fig. 4

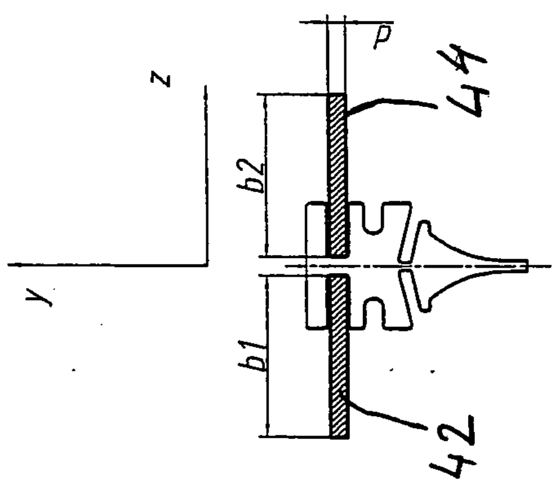

Fig. 5

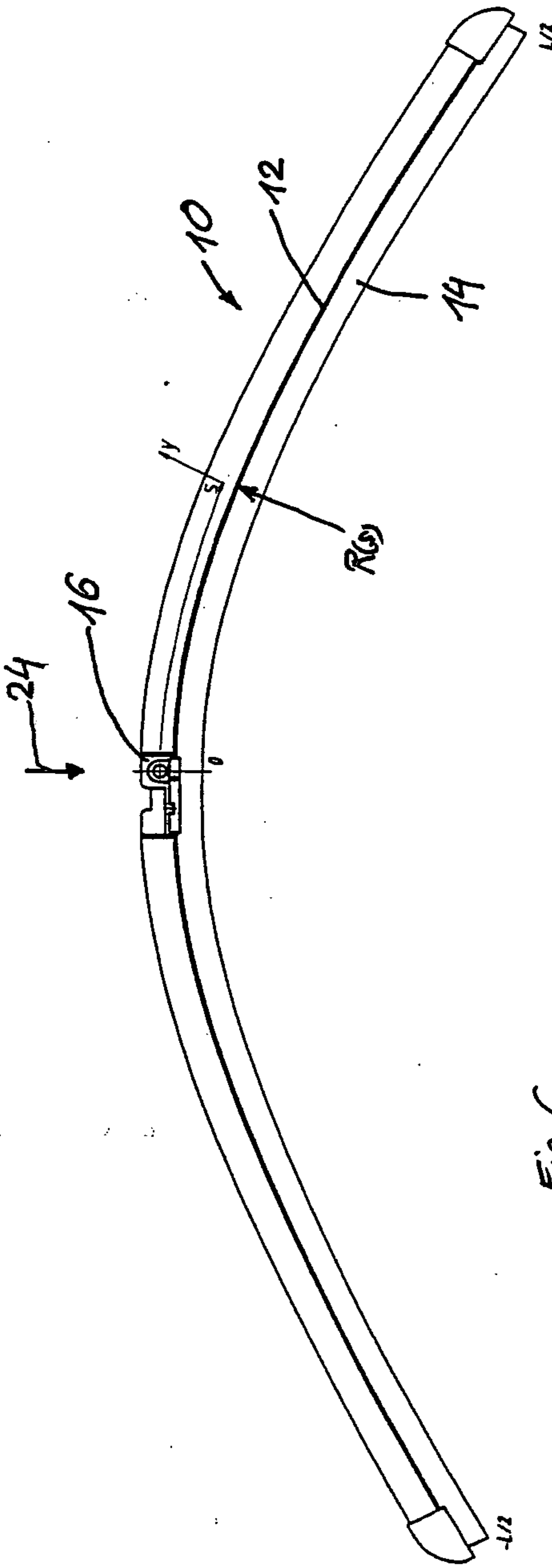

Fig. 6

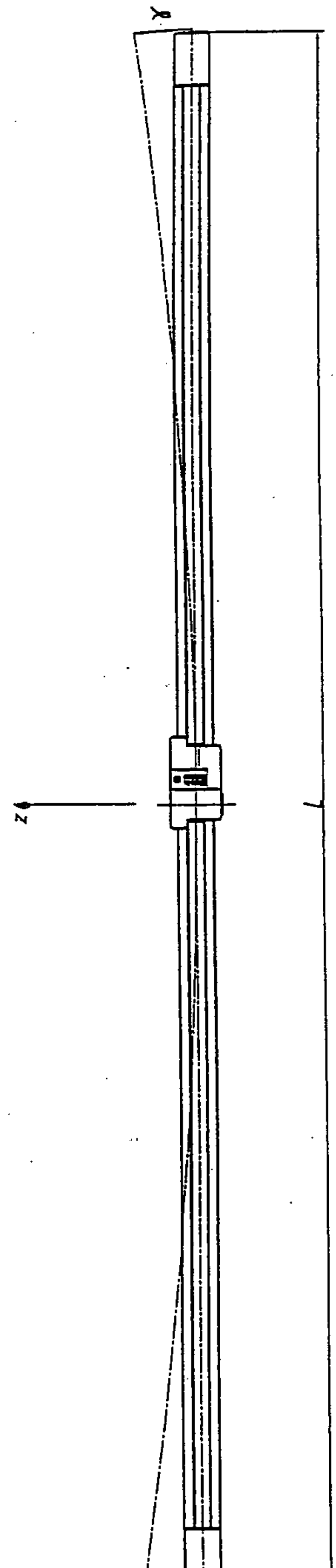

Fig. 7

Costco Exhibit 1002, p. 176

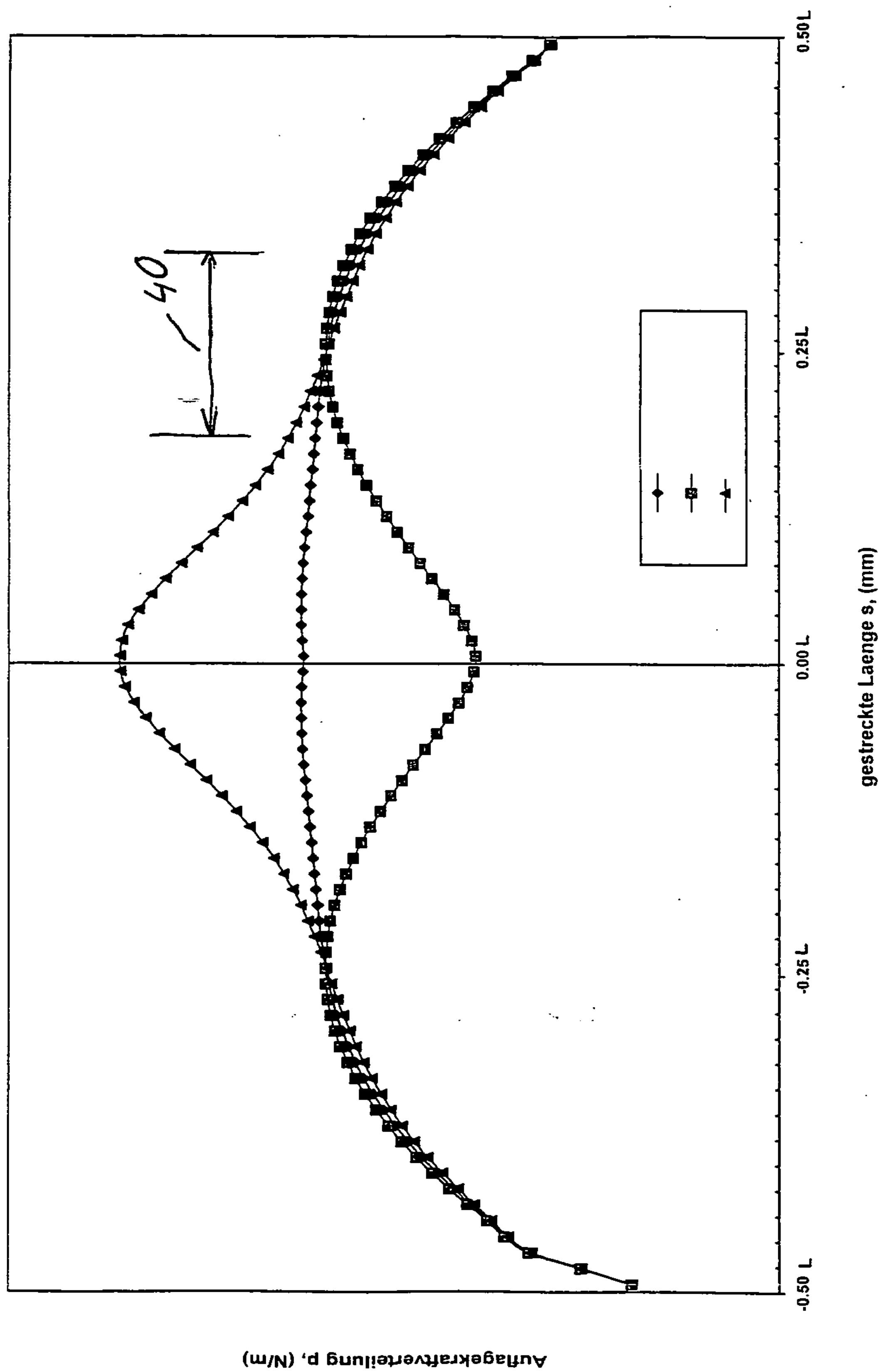
40
0.50 L
0.25 L
0.00 L
-0.25 L
-0.50 L
gestreckte Laenge s, (mm)
Auflagekraftverteilung p, (N/m)

Fig.8

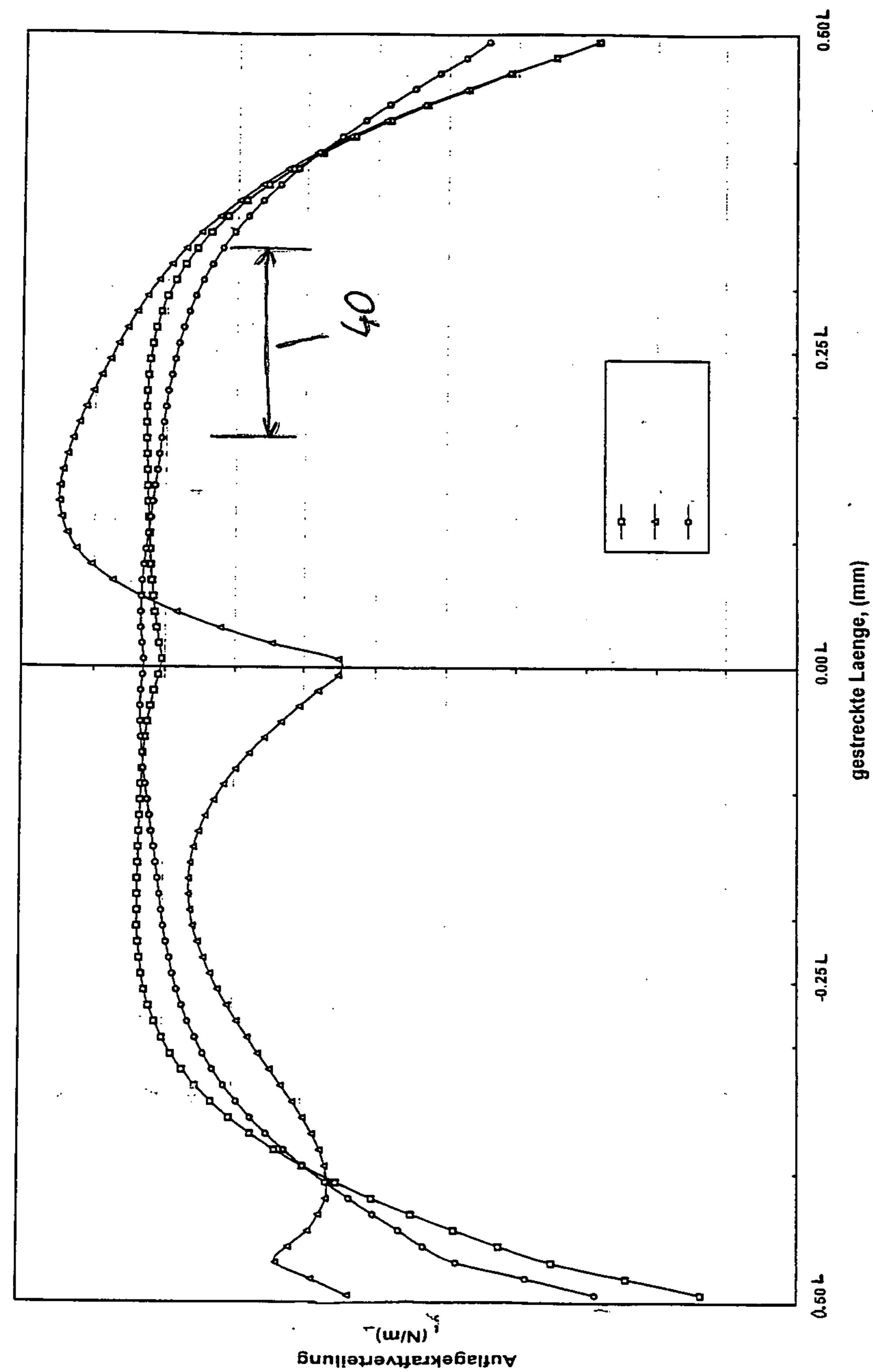
0.50 L
0.25 L
0.00 L
-0.25 L
0.50 L
gestreckte Laenge, (mm)
Auflagekraftverteilung
(N/m)
40

Fig.9

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(54) **Windscreen wiper.**

(57) A windscreen wiper (10) includes an elongate curved backbone (12) which is of a resiliently flexible material and which has a connecting formation (16) at a position intermediate its length for connection to a displacing and force applying member. The backbone (12) has a free-form curved profile in a plane, thereby to define a transverse axis perpendicular to the plane. The backbone (12) further has a suitably varying transverse cross-sectional profile along its length such that if it is clamped at its connecting formation (16) and a test force of 1N applied at a tip in a direction that is parallel to the transverse axis, the tip is displaced less than 1,0mm.

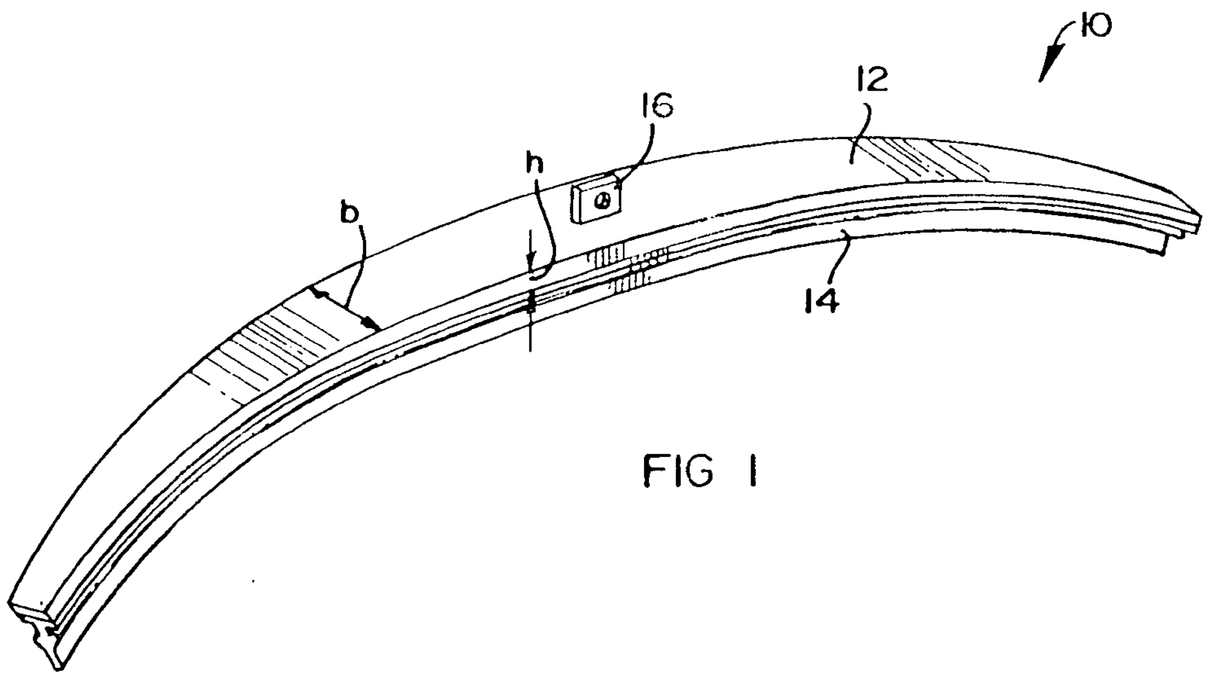

FIG 1

THIS INVENTION relates to a windscreen wiper and more particularly to an elongate curved backbone for a windscreen wiper which is of a suitably resiliently flexible material.

According to a first aspect of the invention there is provided a windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material and which has a connecting formation at a position intermediate its length for connection to a displacing and force applying member;

the backbone having a free-form curved profile in a plane, thereby to define a transverse axis perpendicular to the plane; and

the backbone having a suitably varying transverse cross-sectional profile along its length such that if it is clamped at its connecting formation and a test force of 1N applied at a tip in a direction that is parallel to the transverse axis, the tip is displaced less than 1,0mm.

Preferably, it is displaced less than 0,7 mm. Most preferably, it is displaced less than 0,25 mm.

The tip to which the test force is applied may be displaced a distance

$$Z_E < \left(\frac{0,7}{\ell}\right)^{0,625} \quad (1)$$

Preferably, said displacement may be

$$Z_E < \left(\frac{0,0763}{\ell}\right)^{0,625}$$

where ℓ is the cantilever length of the backbone from the connecting formation to the tip to which the test force is applied and where Z_E is the displacement in mm if ℓ is in metres.

The windscreen wiper may include a wiper blade attached to the backbone. The backbone may be of metal. Further, the backbone may be in the form of a single homogenous strip or in the form of a laminate.

The connecting formation may be centrally located. The backbone may be asymmetrically arranged about the connecting formation. The distance from the connecting formation to each tip may be at least 200mm.

According to a second aspect of the invention, there is provided

a windscreen wiper which includes

an elongate backbone which is curved in a plane, is of a resiliently flexible material and which has a connecting formation at a position intermediate its length for connection to a displacing and force applying member;

the backbone defining an x-y plane, a z-axis extending perpendicularly from the x-y plane;

the backbone having a suitably varying cross-sectional profile along its length and a suitable free-form curvature, such that a double integral Z_T is less than 1,0mm, where

$$Z_T = \int_0^{\ell} \sin\left[\int_0^{x} \frac{I_{zz}(x)}{R(x)\ I_{yy}(x)}\, dx\right] dx$$

and $I_{zz}(x)$ is the moment of inertia about the z-axis at a position x along the backbone, R(x) is the radius of curvature of the backbone at position x, and $I_{yy}(x)$ is the moment of inertia about the y-axis at position x.

Preferably Z_T < 0,5mm.

The windscreen wiper may include a wiper blade attached to the backbone.

Persons skilled in the art will appreciate that the backbone will have a concave side and a convex side, the wiper blade being attached to the concave side and the displacing and force applying member on the convex side.

The backbone may be of metal such as spring steel and may be in the form of a single homogenous strip or may be in the form of a laminate.

The connecting formation may be centrally located or the backbone may be asymmetrically arranged about the connecting formation.

The distance from the connecting formation to each tip may be at least 200mm.

Those skilled in the art will appreciate that $I_{zz}(x)$ and $I_{yy}(x)$ are determined by the transverse dimensions of the backbone at any position along its length. In most cases, the backbone will have a regular cross-sectional profile which may, for example, be rectangular or ellipsoidal. In most instances, the backbone will have a width and a thickness. It will be understood that the width dimension (b) will be that dimension which extends perpendicularly to the plane of curvature and the thickness (h) will be the dimension which lies in the plane of curvature.

It can be shown, with a backbone which has a rectangular cross-section at all positions along its length, that

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$$I_{yy}(x) = \frac{b^3(x) * h(x)}{12}, \text{ and} \quad (3)$$

$$I_{zz}(x) = \frac{b(x) * h^3(x)}{12} \quad (4)$$

Thus, with a rectangular cross-section,

$$Z_{TR} = \int_0^{\ell} \sin \left[\int_0^{x} \frac{h^2(x)}{R(x)\, b^2(x)}\, dx \right] dx \qquad \text{----(5)}$$

The invention is now described, by way of an example, with reference to the accompanying drawings, in which:

Figure 1 is a schematic perspective view from above of a windscreen wiper in accordance with the invention;

Figure 2 is a side elevation of the windscreen wiper in an unloaded, free-form condition;

Figure 3 is a schematic sectioned view of the wiper along lines III-III in Figure 2;

Figure 4 shows schematically the axial convention utilised in this specification; and

Figure 5 shows graphically the variation in the radius of curvature of the backbone of the wiper in its free-form condition.

A symmetrical windscreen wiper in accordance with the invention is referred to generally by reference numeral 10. It includes a spring backbone 12 and a rubber wiper blade 14. The backbone 12 has a centrally located connector 16 for releasably connecting the wiper 10 to a spring loaded wiper arm (not shown). The connector 16 could be of any suitable type. The backbone 12 has suitable attachment formations (also not shown) whereby the blade 14 is securely attached to the backbone 12, or the blade 14 is glued to the backbone 12.

The spring backbone 12 is preferably made from spring steel and tapers both in width and thickness from its centre towards its free ends or tips. The backbone is pre-curved longitudinally with a predetermined radius of curvature (R) at every point in its length. The backbone 12 defines a plane, which is defined by the sheet of paper in Figure 2. As indicated in Figure 4, a median line 18 of the backbone 12 lies in the x-y plane with the x axis extending tangentially at the centre of the backbone 12. The z-axis defines a transverse axis perpendicular to the plane in which the free-form curved profile of the backbone 12 lies.

The backbone 12 has a rectangular cross-sectional profile at all points along its length. Thus the backbone 12 has a width b and a thickness h as indicated in Figure 1. It will be appreciated that the width b is the dimension parallel to the z-axis and the thickness h is the dimension perpendicular to the tangent at each point.

The free-form radius of curvature R of the backbone 12 is indicated in Figure 2 and the variation thereof is shown in Figure 5.

In the example shown, the backbone has a total length L = 450 mm
a modulus of elasticity = 207 x 10^9 N/m^2
thickness at the centre of the backbone = 1,29 mm
thickness at the tips = 0.22 mm
width at the centre = 11 mm, and
width at the tips = 6 mm.

The backbone tapers uniformly in both thickness and width in a straight line manner from its centre to its tips.

If the wiper is securely clamped at its connector 16 and a lateral force applied at either tip, parallel to the Z-axis, of 1 N, the lateral displacement of the tip in the Z direction is 0,28 mm allowing for experimental errors.

The value of Z_E (as determined in the equation 1 above) is 2,03 mm

Similarly, if the value of Z_{TR} (from equation 5 above) is computed it will be found to be 0,28 mm.

Claims

1. A windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material and which has a connecting formation at a position intermediate its length for connection to a displacing and force applying member;

the backbone having a free-form curved profile in a plane, thereby to define a transverse axis perpendicular to the plane; and

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the backbone having a suitably varying transverse cross-sectional profile along its length such that if it is clamped at its connecting formation and a test force of 1N applied at a tip in a direction that is parallel to the transverse axis, the tip is displaced less than 1,0mm.

2. The windscreen wiper as claimed in Claim 1, in which said displacement is less than 0,7mm.

3. The windscreen wiper as claimed in Claim 2, in which said displacement is less than 0,25mm.

4. The windscreen wiper as claimed in Claim 1 in which said displacement

$$Z_E < \left(\frac{0{,}7}{\ell}\right)^{0{,}625}$$

5. The windscreen wiper as claimed in Claim 4 in which said displacement

$$Z_E < \left(\frac{0{,}0763}{\ell}\right)^{0{,}625}$$

where ℓ is the cantilever length of the backbone from the connecting formation to the tip to which the test force is applied and where Z_E is the displacement in mm if ℓ is in metres.

6. The windscreen wiper as claimed in Claim 1, which includes a wiper blade attached to the backbone.

7. The windscreen wiper as claimed in Claim 1, in which the backbone is of metal.

8. The windscreen wiper as claimed in Claim 1, in which the backbone is in the form of a single homogenous strip.

9. The windscreen wiper as claimed in Claim 1, in which the backbone is in the form of a laminate.

10. The windscreen wiper as claimed in Claim 1, in which the connecting formation is centrally located.

11. The windscreen wiper as claimed in Claim 1, in which the backbone is asymmetrically arranged about the connecting formation.

12. The windscreen wiper as claimed in Claim 1, in which the distance from the connecting formation to each tip is at least 200mm.

13. A windscreen wiper which includes an elongate backbone which is curved in a plane, is of a resiliently flexible material and which has a connecting formation at a position intermediate its length for connection to a displacing and force applying member;

the backbone defining an x-y plane, a z-axis extending perpendicularly from the x-y plane;

the backbone having a suitably varying cross-sectional profile along its length and a suitable free-form curvature, such that a double integral Z_T is less than 1,0mm, where

$$Z_T = \int_0^{\ell} \sin\left[\int_0^{x} \frac{I_{zz}(x)}{R(x)\, I_{yy}(x)}\, dx\right] dx$$

and $I_{zz}(x)$ is the moment of inertia about the z-axis at a position x along the backbone, R(x) is the radius of curvature of the backbone at position x, and $I_{yy}(x)$ is the moment of inertia about the y-axis at position x.

14. The windscreen wiper as claimed in Claim 13,in which Z_T is less than 0,5mm.

15. The windscreen wiper as claimed in Claim 13, which includes a wiper blade attached to the backbone.

16. The windscreen wiper as claimed in Claim 13, in which the backbone is of metal.

17. The windscreen wiper as claimed in Claim 13, in which the backbone is in the form of a single homogenous strip.

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18. The windscreen wiper as claimed in Claim 13, in which the backbone is in the form of a laminate.

19. The windscreen wiper as claimed in Claim 13, in which the connecting formation is centrally located.

20. The windscreen wiper as claimed in Claim 13, in which the backbone is asymmetrically arranged about the connecting formation.

21. The windscreen wiper as claimed in Claim 13, in which the distance from the connecting formation to each tip is at least 200mm.

22. The windscreen wiper as claimed in Claim 13, in which the backbone has a regular cross-sectional profile.

23. The windscreen wiper as claimed in Claim 22, which has a rectangular cross-section with the backbone having a width dimension b(x), a thickness dimension h(x) and a radius of curvature R(x) at each point x along its length and in which

$$Z_{TR} = \int_o^{\ell} \sin \left[\int_o^{x} \frac{h^{2(x)}}{R(x)\ b^{2(x)}} dx \right] dx$$

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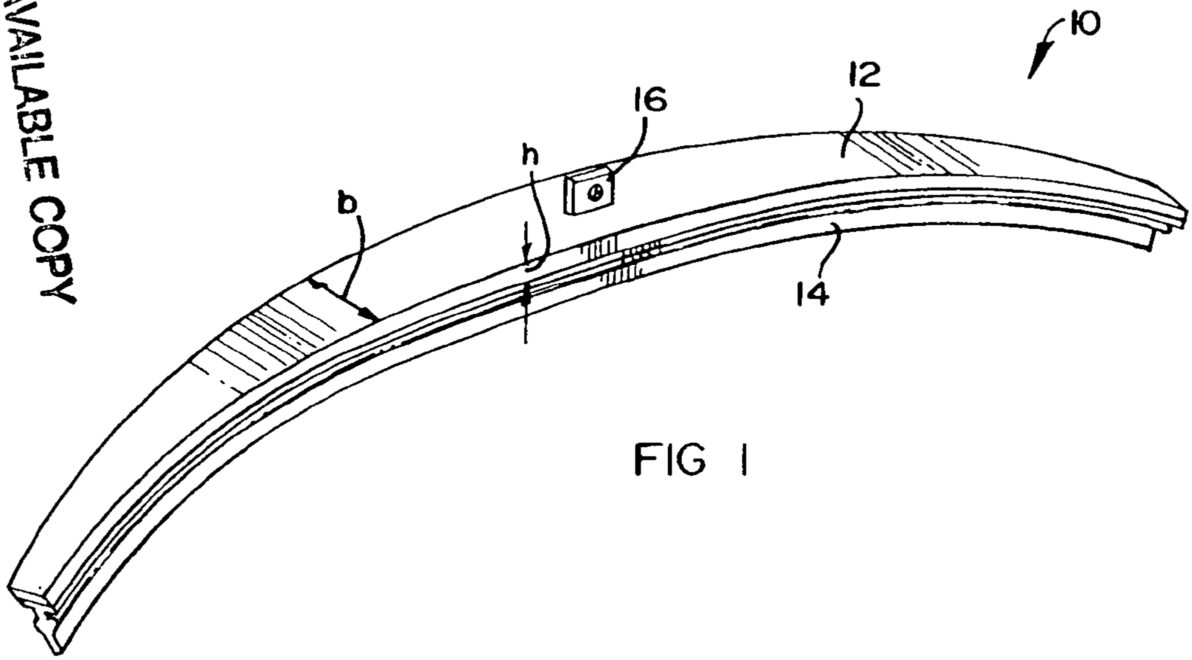

FIG 1

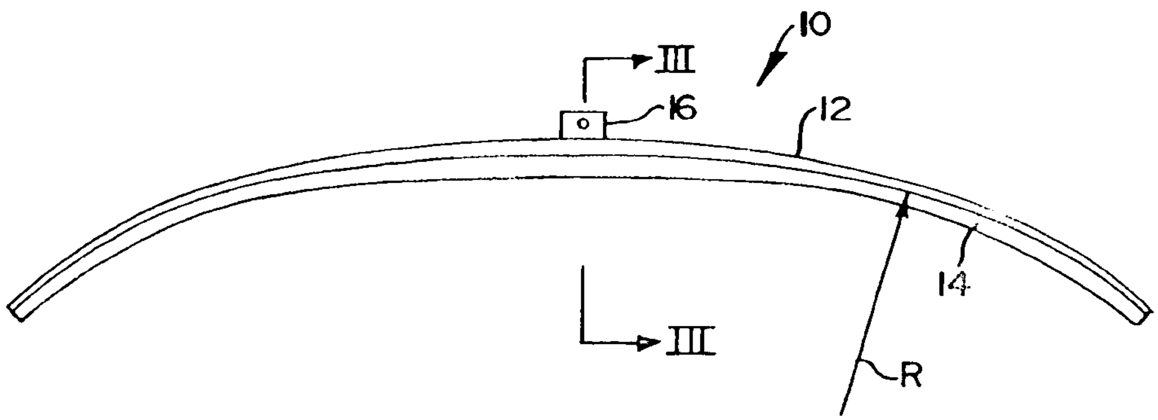

FIG 2

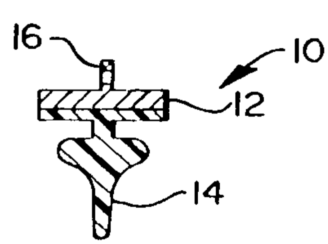

FIG 3

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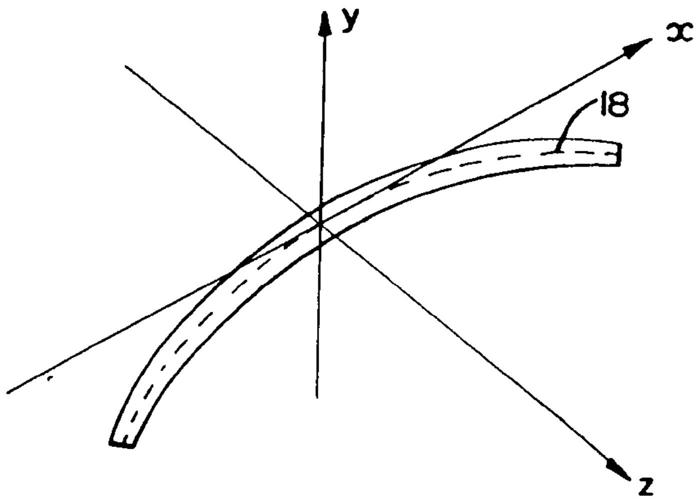

FIG 4

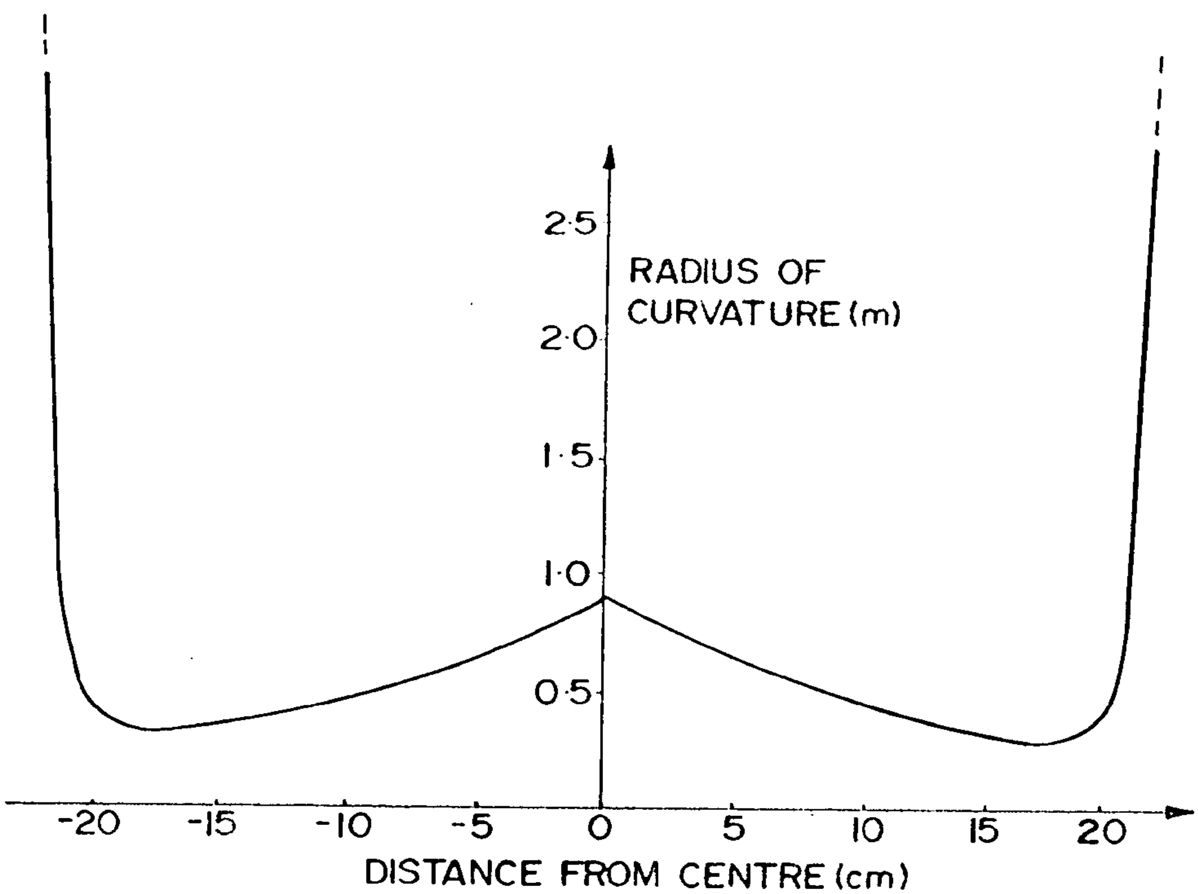

FIG 5

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 30 8427

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.5)
A	GB-A-1 012 902 (APPEL) * the whole document * ---	1,13	B60S1/38
P,A	EP-A-0 528 643 (ANGLO AMERICAN INDUSTRIAL) * the whole document * -----	1,13	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B60S

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	19 JANUARY 1994	BLURTON : .D.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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(54) **Windscreen wiper.**

(57) A curved elongate backbone (10) for a windscreen wiper has a loading profile that increases substantially from a central connector (14) towards one or both ends of the backbone. The second differential of the bending moment also increases substantially from the connector towards the ends. The loading may increase right to the ends of the backbone or the backbone may have end portions with constant loading. In order to obtain the desired loading profile the width, thickness, and free-form radius of curvature are suitably selected. In preferred embodiments, the backbone (10) has a rectangular cross-sectional profile and the thickness and width decrease uniformly from the connector (14) to the ends. However, the thickness may also be constant for end portions.

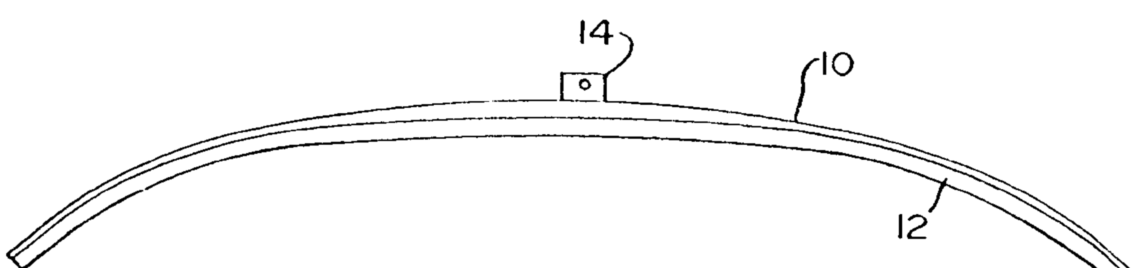

FIG 2

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THIS INVENTION relates to a windscreen wiper and more particularly to an elongate curved backbone for a windscreen wiper which is of a suitably resiliently flexible material.

According to the invention there is provided a windscreen wiper which includes

an elongate curved backbone which is of a resiliently flexible material and which has a connecting formation at a position intermediate its length for connection to a displacing and force applying member,

the backbone having a suitably varying transverse cross-sectional profile along its length and a suitable free-form curvature for the backbone to achieve, when it is pressed downwardly at the connecting formation onto a flat surface by a force sufficient to straighten the backbone, a force per unit length exerted perpendicularly to the surface which increases substantially from the position of the connecting formation towards at least one end of the backbone.

The backbone may be curved in a plane- the plane of curvature.

Further according to the invention there is provided a windscreen wiper which includes

an elongate backbone which is curved in a plane, which is of a resiliently flexible material and which has a connecting formation at a position intermediate its length for connection to a displacing and force applying member, the backbone having a suitably varying cross-sectional profile along its length and a suitable free-form curvature, such that the second differential of the function M(x) increases substantially from the said position towards at least one end of the backbone, where

$$M(x) = \frac{E * I(x)}{R(x)}$$

with E = modulus of elasticity

I(x) = cross-section moment of inertia of the backbone about a neutral axis transverse to the plane of curvature, at a distance x from the said position; and

R(x) = free-form radius of curvature of the backbone in the plane of curvature at x.

The wiper may include a wiper blade attached to the backbone and the sufficient force referred to above may be that force which causes the blade to contact the surface in a straight operative manner.

Persons skilled in the art will appreciate that the backbone will have a concave side and a convex side, the wiper blade being attached to the concave side and the displacing and force applying member on the convex side.

The backbone may conveniently be of a metal such as spring steel and may be in the form of a single strip or may be in the form of a laminate.

The connecting formation may be centrally located or the wiper may be asymmetric. The force per unit length may increase towards only one end of the backbone, but preferably it increases towards both ends of the backbone. Further, the force per unit length may increase towards both ends in a similar or dissimilar manner. Similarly, the second differential of M(x) may increase substantially from the connecting formation towards only one end or towards both ends. If it increases towards both ends this may be in a substantially similar or dissimilar manner.

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The force per unit length and the second differential of M(x) may increase progressively towards the ends of the backbone until a short distance from each end and the backbone may then have two small portions at each end where the force per unit length and the second differential are a constant value. Further, the backbone may be such that in these small portions the force per unit length and the second differential are constant right to the tips of the backbone, or, at tip regions the backbone may be such that the force per unit length and the second differential decrease from the constant value to zero at the extremities of the backbone.

The force per unit length may increase, at least in the central region of the backbone, in an exponential manner. Conveniently,

$$f(x) = A|x|^n + C$$

where

f(x) = force per unit length at a distance x from the connecting formation,

A and C are determinable constants, and

n is greater than unity.

Conveniently, n may be at least 3, is generally at least 6 and is preferably about 10.

Those skilled in the art will appreciate that I (x) is determined by the transverse dimensions of the backbone at any position along its length. In most cases, the backbone will have a regular cross-sectional profile which may, for example be rectangular or ellipsoidal. Thus, in most instances, the backbone will have a width and a thickness. It will be understood that the width dimension will be that dimension which extends perpendicularly to the plane of curvature and the thickness will be the dimension which lies in the plane of curvature.

The thickness of the backbone may decrease from the connecting formation towards both ends until a predetermined distance from the ends, with the thickness being constant along these end portions. These end portions may have a length of at least 20 mm.

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It can be shown, that with a backbone which has a rectilinear cross-section at all positions along its length, that

$$M(x) = \frac{E * b_x * h_x^3}{12 * R_x}$$

where

b_x equals the width at distance x,

h_x equals thickness at distance x.

Thus, with a backbone having a rectangular cross-section, the width and thickness may vary in a predetermined manner and the radius of curvature may then be varied so that M(x), and its second differential vary in the desired manner.

If the backbone has an elliptical cross-section then it can be shown that

$$M(x) = \frac{\pi * E * b_x * h_x^3}{64 * R_x}$$

If the backbone has any other cross-sectional profile the equation for M(x) may be determined utilising conventional mathematical techniques.

Those skilled in the art will appreciate that there is a relationship between the second differential of M(x) and the force per unit length. Thus, the second differential of M(x) may vary in the same manner as that described above for the force per unit length.

It will be appreciated further that the width, thickness and radius of curvature also determine other characteristics of the backbone. Thus, the radius of curvature of the backbone will determine the extent of curvature of a windscreen that can be cleaned by the wiper. Thus, if the windscreen, in any particular region, has a greater curvature than that portion of the wiper that is to pass thereover, then the wiper will not clean that region of the windscreen in an effective manner.

Similarly, the width and thickness will determine the rigidity of the wiper and if the backbone is too thin at its tips it will be vulnerable to mechanical damage.

Those skilled in the art will also appreciate that M(x) is the bending moment of the backbone.

Further, if a curved beam is uniformly loaded, ie. the force per unit length is a constant along the length of the beam when it is pressed down onto a flat surface, then the bending moment is

$$M_c(x) = \frac{F * (4x^2 - 4Lx + L^2)}{8 * L}$$

where

F = the total force applied to the beam to straighten it against a flat surface, and

L = the length of the beam.

Thus, with a rectilinear backbone if

$$\frac{b_x * h^3_x}{R_x} > \frac{12 * F * (4x^2 - 4Lx + L^2)}{8 * L * E}$$

at all positions along at least a part of the backbone (which is a substantial part), then the backbone will be such that the force per unit length increases along the length of this part of the backbone away from the connecting formation.

Similarly, with an elliptical cross-section, the backbone will have an increasing force per unit length if

$$\frac{b_x * h^3_x}{R_x} > \frac{8 * F * (4x^2 - 4Lx + L^2)}{\pi * E * L}$$

For practical reasons, the backbone should have end portions with a constant radius of curvature, and the tips themselves are preferably straight.

The invention is now described by way of example only with reference to the drawings in which:

Figure 1 is a perspective view from above of the windscreen wiper of the invention with the drawing being shortened for clarity of illustration;

Figure 2 is a side elevation of the Figure 1 windscreen wiper shown in an unloaded free form condition;

Figure 3 is an end elevation of the wiper;

Figure 4 is a force distribution diagram illustrating the lengthwise distribution of the force per unit length on the windscreen wiper of Figures 1 to 3 when it is pressed against a flat surface in an operational manner;

Figure 5 illustrates the curvature requirement to which a wiper blade should conform to operate satisfactorily on a typically curved motor vehicle windscreen;

Figure 6 shows graphically the variation in the radius of curvature of the wiper of Figures 1 and 2 in its free form condition;

Figure 7 shows graphically the variation in the radius of curvature of a further embodiment of a wiper which has a symmetrical backbone with tip portions of constant thickness; and

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Figure 8 shows graphically the variation in the radius of curvature of a still further embodiment of a wiper which has an asymmetric backbone with tip portions of constant thickness.

The windscreen wiper of the invention is shown in Figures 1 to 3 to include a spring backbone 10 and a wiper blade 12. The backbone 10 has a centrally located connector 14 for releasably connecting the wiper to a spring loaded wiper arm (not shown). The connector 14 could be of any suitable type. The backbone 10 has suitable attachment formations (also not shown) to ensure that the blade 12 is securely attached to the backbone 10.

The spring backbone of the wiper is preferably made from spring steel and tapers both in width and thickness from its centre towards its free ends or tips. The backbone is pre-curved longitudinally with a predetermined radius of curvature at every point in its length. The backbone 10 defines a plane, which is defined by the sheet of paper in Figure 2. The cross section of the backbone is preferably rectangular but may be of any other suitable shape. Most importantly to the invention the thickness and width of the backbone 10 and its radius of curvature are matched at every point along the length of the backbone so that the backbone will provide a force per unit length distribution in a longitudinal direction which increases towards both tips of the windscreen wiper when the windscreen wiper is, in use, pressed downward intermediate its ends onto a flat surface, as shown in Figure 1, by a force F which is equal in magnitude to the down force required to straighten the backbone. By straighten is meant that the force F must be adequate to render the wiper blade 12 fully functional.

A suitable force per unit length distribution is shown in Figure 4, where the various parameters have the following meaning:

F =	downforce applied to wiper by wiper arm.
$f(x)$ =	force per unit length distribution between $-X_{LMAX}$ and X_{LMAX} in N/m.
B =	Maximum loading acceptable at tips, in N/m.
X_{LMAX} =	point where maximum loading starts.
D_{XLMAX} =	distance from tip for which the maximum loading B applies
L =	length of wiper blade.

In this example, the following values are assumed:-

F =	6,975 N
L =	0,45 m
D_{XLMAX} =	0,02 m, therefor X_{LMAX} = 0,205 m
B =	34,1 N/M

It will be appreciated that the distribution between $-X_{LMAX}$ and $+X_{LMAX}$ is of the form

$$f(x) = A\,|x|^n + C \quad (1)$$

where

$n = 10$.

The co-efficient A in equation (1) is determined from the formula

$$A = \frac{(n+1)\,[F - 2Cx_{LMAX} - 2B\,D_{XLMAX}]}{2\,X_{LMAX}^{\,n+1}} \qquad (2)$$

Equation (2) represents a situation where the force distribution balances the total force F. As indicated in the broad description above, the distribution at the ends of the backbone is a constant (B). Further, as indicated above, the loading may decrease right at the tips, although this is not shown in Figure 4.

To achieve the increasing loading (as discussed above) the thickness of the spring backbone at any position in its length must subscribe to the following equation:

$$h(x) > \left[\frac{3R_x F\,(4x^2 - 4Lx + L^2)}{2LEb_x}\right]^{1/3}$$

The above equation relates to a wiper backbone which has a substantially rectangular cross sectional shape. In further experimentation with the wiper backbone of the invention it may, however, as mentioned above, be found that cross sectional shapes other than rectangular may provide the backbone with better

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structural characteristics than does the rectangular backbone. In this event, the equation will need to be adapted to suit the particular shape required. For example, in a backbone having an elliptical cross section the equation will need to be adjusted as follows:

$$h(x) > \left[\frac{8R_x\ F\ (4x^2 - 4Lx + L^2)}{\pi\ LEb_x}\right]^{1/3}$$

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The wiper blade 12 is made from a suitable rubber or elastomeric material and in the currently preferred embodiment of the invention is shaped in cross section as illustrated in Figure 3. The cross sectional shape of the blade 12 may, however, if required, be made variable at various positions in its length.

EXAMPLE 1

A wiper backbone, which is of spring steel and has a rectangular cross-sectional profile and which has the required loading increase towards its tips, torsional rigidity and wrap around capability has the following dimensional values:

modulus of elasticity	207×10^9 N/m^2
length	450 mm
thickness at the centre of the backbone	1,29 mm
thickness at the tips	0,22 mm
width at the centre	11 mm
width at the tips	6 mm

The backbone tapers uniformly in both thickness and width in a straight line manner from its centre to its tips.

As has been mentioned above it is essential to this invention that the reactive loading on the wiper backbone when pressed onto a flat surface, as illustrated in Figure 4, must increase towards the tips of the backbone as shown in the drawing.

The curvature required to give this loading profile is determined in the following way.

Using equation (1) above, the parameter C in Figure 4 is calculated iteratively until f(x) = B at the point

$$X = X_{LMAX}$$

In this example,

C = 11,64 N/m.

With C known, A can now be determined from equation (2). The value of A is approximately 171 300 000 N/m^{11}.

From basic Strengths of Material theory, the bending moment equation where $L/2 > |x| > X_{Lmax}$ is

$$M(x) = \tfrac{1}{2} B\,[X^2 - L|x| + L^2/4] \quad (3)$$

By derivation from Standard Strengths of Material theory, the bending moment equation where $X < X_{LMAX}$ is

$$m(X) = A\left\{\frac{1}{n+1} - \frac{1}{n+2}\right\}x^{n+2} + \frac{C}{2}x^2 - \left\{\frac{AY^{n+1}}{n+1} + CY\right\}x + \left\{\frac{CY^2}{2} + \frac{AY^{n+2}}{n+2}\right\} + \frac{B}{2}\left\{Y\,(2x - Y) - Lx + \frac{L^2}{4}\right\} \quad (4)$$

where $Y = X_{LMAX}$

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At any point x along the length of the backbone, the radius of curvature R is given by

$$R(x) = \frac{EI(x)}{M(x)} \quad (5)$$

where I(x) = cross section moment of inertia at position x,
E = modulus of elasticity (Young's modulus)
M(x) = is given by either equation (3) or (4), depending on the value of x.

Using equation (5) the radius of curvature as shown in Figure 6 is determined.

At all points x (except for the last 45 mm at the tips) the example backbone satisfies the curvature requirements represented by Figure 5, ie. R(x) according to equation (5) is smaller than the required radius of curvature.

EXAMPLE 2

The example described above is of a wiper having a rectangular backbone which tapers uniformly in both thickness and width in a straight line manner from its centre to its tips. As indicated above, the backbone could have tip portions of constant thickness. The dimensions and other values for such a backbone in accordance with the invention are:-

F	= 6,3 N
L	= 44 cms
D_{XLMAX}	=3cms, therefore
X_{LMAX}	=19 cms
B	=20 N/m
n	= 10
modulus of elasticity	= 207×10^9 N/m²
length	= 440 mm
thickness at the centre of the backbone	= 1,15 mm
thickness at the tip portions	= 0,43 mm
distance from the tips for which thickness remains constant	= 45 mm
width at centre	= 11 mm
width at the tips	= 6 mm.

Thus, the backbone tapers uniformly in width from its centre to its tips and uniformly in thickness from its centre to 175 mm from the centre, then the thickness remains constant for the next 45 mm right to the tips.

These parameters produce the following results:-

C = 12,85 N/m

A = 102 000 000 N/m^{11} (approximately).

Using these values in equations (3), (4) and (5) above, the following radius of curvature are obtained:-

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X (cm)	Radius of Curvature (m)
0	0,766
2	0,704
4	0,643
6	0,586
8	0,535
10	0,490
12	0,454
14	0,430
16	0,433
18	0,568
20	2
22	826

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The radius of curvature of such a wiper is shown graphically in Figure 7.

EXAMPLE 3

Further, as indicated above a rectangular backbone could be assymmetric, having a connector that is not centrally located, and the loading is different towards both ends. The dimensions of, and other values for, such a backbone in accordance with the invention are:-

F = 6,3 N

L = 45 cms.

The connection point is shifted 13 mm longitudinally from the geometric centre, to one side of the backbone. The shorter side of the backbone is therefore 212 mm long and the longer side is 238 mm long.

Dealing firstly with the shorter side. The total force applied to the shorter side of the beam is 3.2 N, therefore for a notional symmetric backbone

F = 2 * 3,2 N = 6,4 N

The length of the shorter side is 212 mm, therefore for a notional symmetric backbone

L = 2 * 212 mm = 424 mm

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D_{XLMAX}	= 3cms, therefore
X_{LMAX}	= 18.2 cms
B	= 22 N/m
n	= 10
modulus of elasticity	= 207 * 10^9 N/m²
thickness at connector	= 1,15 mm
thickness at tips	= 0,43 mm
distance from the tips for which thickness remains the same	= 45 mm
width at connector	= 11 mm
width at the tips	= 6 mm.

Thus the shorter side of the backbone has a width that decreases uniformly to the tip and a thickness that decreases uniformly for a distance of 167 mm from the connector and which then remains constant for the remaining 45 mm right to the tip.

These parameters produce the following results for the short side of the blade:-

C = 13,1 N/m

A = 236 000 000 N/m^{11} (approximately).

Using these above values in equations (3), (4) and (5) above, the following radii of curvature result:-

X (cm)	Radius of Curvature (m)
0	0,778
2	0,709
4	0,641
6	0,579
8	0,522
10	0,472
12	0,433
14	0,408
16	0,416
18	0,777
20	4,657.

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Dealing now with the longer side of the backbone.

The total force applied to the longer side of the backbone is 3,1 N, therefore for a notional symmetric back-

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bone

F = 2 * 3.1 N = 6,2 N

The length of the longer side is 238 mm therefore for a notional symmetric backbone

L	= 2 * 238 mm = 476 mm
D_{XLMAX}	= 0, therefore
X_{LMAX}	= 238 mm
B	= 13,1 N/m
n	= 10
thickness at connector	= 1,15 mm
thickness at tips	= 0,40 mm
distance from the tips for which thickness remains the same	= 45 mm
width at connector	= 11 mm
width at the tips	= 6 mm.

Thus the longer side of the backbone has a width that decreases uniformly to the tip and a thickness that decreases uniformly from the connector for a distance of 193 mm and then remains constant for the next 45 mm right to the tip.

With this example, the longer side has uniform loading and thus, these parameters produce, for the longer side,

C = 13,1 N/m

A = 0 N/m^{11}; and

Using the above values, as before, the following radii of curvature are obtained.

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X (cm)	Radius of Curvature (m)
0	0,779
2	0,727
4	0,675
6	0,627
8	0,584
10	0,546
12	0,515
14	0,493
16	0,488
18	0,515
20	0,757
22	2.993.

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The radius of curvature of such a wiper is shown graphically in Figure 8.

It will be noted that, with the first two examples, between - X_{LMAX} and X_{LMAX}, the force per unit length exerted perpendicularly when the backbone is straightened increases substantially from the middle towards the ends; the second differential of M(x) also increases substantially; and

$$\frac{b_x * h^3_x}{R_x} > \frac{12 * F(4x^2 - 4Lx + L^2)}{8 * L * E.}$$

at all positions. This is also the case with the shorter side of the third example.

The invention is not limited to the precise details as herein described. For example it is not essential that the backbone of the wiper tapers uniformly from the centre down towards the tips and in some applications the load distribution of the blade on the glass of a specific windshield may need to increase only towards one tip of the wiper. Additionally, as indicated above, to achieve a constant angle of wipe of the blade 12 along its lenght it may be necessary to shed the distributed blade load at the tip portions of the wiper.

Claims

1. A windscreen wiper which includes

   an elongate curved backbone which is of a resiliently flexible material and which has a connecting formation at a position intermediate its length for connection to a displacing and force applying member;

   the backbone having a suitably varying transverse cross-sectional profile along its length and a suitable free-form curvature for the backbone to achieve, when it is pressed downwardly at the connecting formation onto a flat surface by a force sufficient to straighten the backbone, a force per unit length exerted perpendicularly to the surface which increases substantially from the position of the connecting formation towards at least one end of the backbone.

2. The wiper as claimed in Claim 1, in which the backbone is curved in a plane.

3. A windscreen wiper which includes

   an elongate backbone which is curved in a plane, which is of a resiliently flexible material and which has a connecting formation at a position intermediate its length for connection to a displacing and force applying member, the backbone having a suitably varying cross-sectional profile along its length and a

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suitable free-form curvature such that the second differential of the function M(x) increases substantially from the said position towards at least one end of the backbone, where

$$M(x) = \frac{E * I(x)}{R(x)}$$

with

E = the modulus of elasticity

I(x) = the cross-section moment of inertia of the backbone about a neutral axis transverse to the plane of curvature, at a distance x from the said position; and

R(x) = the free-form radius of curvature of the backbone in the plane of curvature at x.

4. The wiper claimed in claim 1, 2, or 3, including a wiper blade attached to the backbone.

5. The wiper claimed in any one of the preceding claims, in which the connecting formation is centrally located.

6. The wiper claimed in any one of Claims 1 to 4, in which the connecting formation is not centrally located.

7. The wiper claimed in any preceding claim, in which the perpendicularly exerted force per unit length increases substantially from the position of the connecting formation towards both ends of the backbone.

8. The wiper claimed in Claim 7, in which the force per unit length increases towards both ends in a substantially similar manner.

9. The wiper claimed in Claim 7, in which the force per unit length increases towards both ends in a dissimilar manner.

10. The wiper claimed in Claim 3, in which the second differential of M(x) increases substantially from the position of the connecting formation towards both ends of the backbone.

11. The wiper claimed in Claim 10, in which the second differential of M(x) increases towards both ends in a substantially similar manner.

12. The wiper claimed in Claim 10, in which the second differential of M(x) increases towards both ends in a dissimilar manner.

13. The wiper claimed in Claim 1 or 2, in which the force per unit length increases progressively towards at least one end of the backbone until a predetermined distance from the tip thereof and the force per unit length along this end portion is substantially constant.

14. The wiper claimed in Claim 3, in which the second differential of M(x) increases progressively towards at least one end of the backbone until a predetermined distance from the tip thereof and the second differential of M(x) along this end portion is substantially constant.

15. The wiper claimed in any one of Claims 1, 2, 7, 8, 9, 13 or 14 in which the force per unit length increases, in at least a central region of the backbone in an exponential manner.

16. The wiper claimed in Claim 15, in which

$$f(x) = A|x|^n + C$$

where

f(x) = force per unit length at a distance x from the connecting formation;
A and C are determinable constants; and
n is greater than unity.

17. The wiper claimed in Claim 3, in which the second differential of M(x) increases in an exponential manner.

18. The wiper claimed in Claim 17, in which $M''(x) = A|x|^n + C$

where

M"(x) is the second differential of M(x);
A and C are determinable constants; and
n is greater than unity.

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19. The wiper claimed in Claim 16 or 18, in which n is about 3 or greater than 3, preferably about 6 or greater than 6, and more preferably about 10 or greater than 10.

20. The wiper claimed in any one of the preceding claims in which the backbone has a thickness dimension h which varies from the position of the connecting formation towards at least one end of the backbone until a predetermined distance from the said end and which is constant along said end portion, which preferably has a length of at least 20 mm.

21. A windscreen wiper which includes

an elongate backbone which is curved in a plane, which is of a resiliently flexible material and which has a connecting formation at a position intermediate its length for connection to a displacing and force applying member;

the backbone having a rectilinear transverse cross-sectional profile along a substantial part of its length and in which, at all positions along said part

$$\frac{b_x * h^3_x}{R_x} > \frac{12 * F(4x^2 - 4Lx + L^2)}{8 * L * E}$$

where

b_x = width at distance x from the connection formation;
h_x = thickness at x;
R_x = free-form radius of curvature of the backbone in the plane at x;
F = the total force applied to the said part of the backbone to straighten it against a flat surface;
L = the length of said part; and
E = modulus of elasticity.

22. A windscreen wiper which includes

an elongate backbone which is curved in a plane, which is of a resiliently flexible material and which has a connecting formation at a position intermediate its length for connection to a displacing and force applying member;

the backbone having an elliptical transverse cross-sectional profile along a substantial part of its length and in which, at all positions along said part

$$\frac{b_x * h^3_x}{R_x} > \frac{8 * F(4x^2 - 4Lx + L^2)}{\pi * E * L}$$

where

b_x = width at distance x from the connection formation;
h_x = thickness at x;
R_x = free-form radius of curvature of the backbone in the plane at x;
F = the total force applied to the said part of the backbone to straighten it against a flat surface;
L = the length of said part; and
E = modulus of elasticity.

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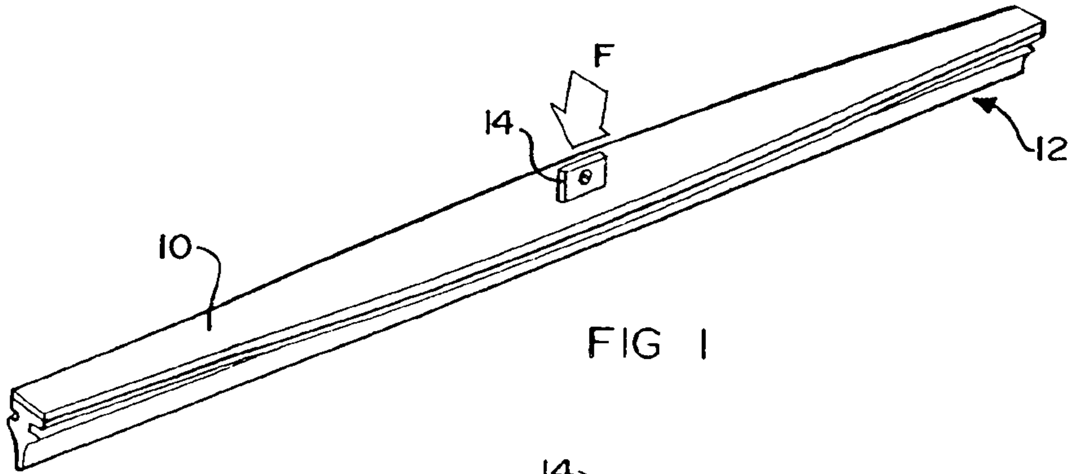

FIG 1

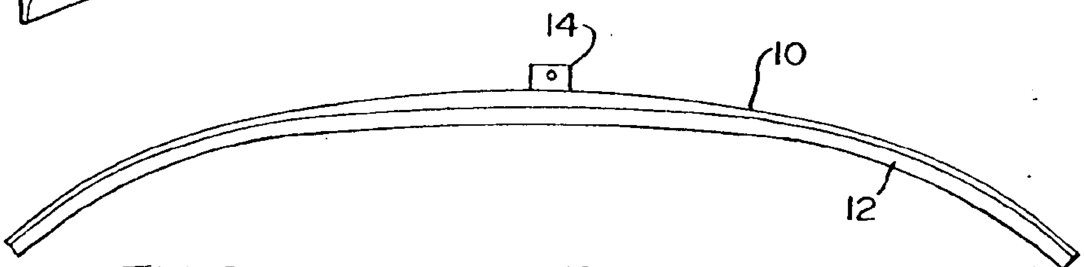

FIG 2

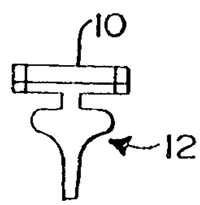

FIG 3

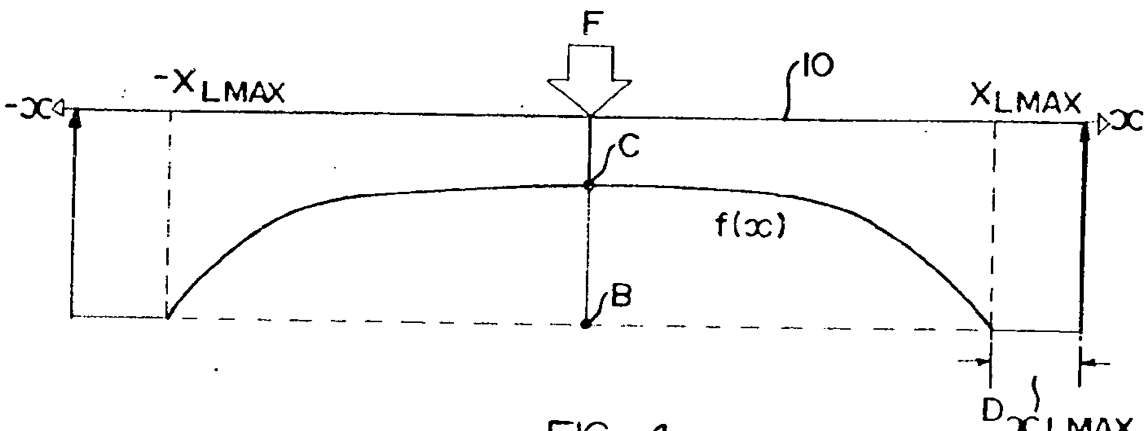

FIG 4

Costco Exhibit 1002, p. 202

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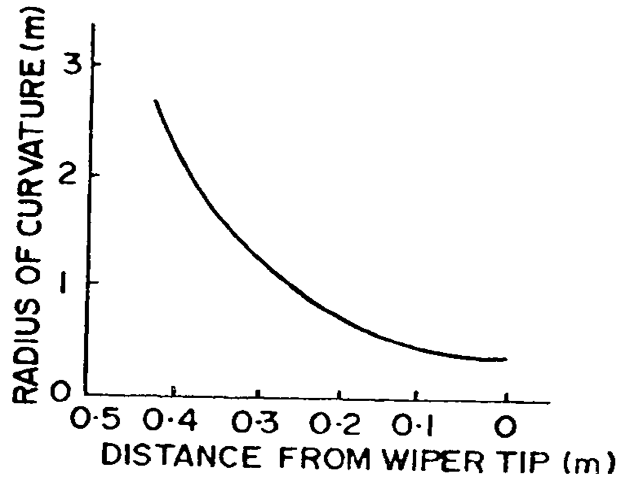

FIG 5

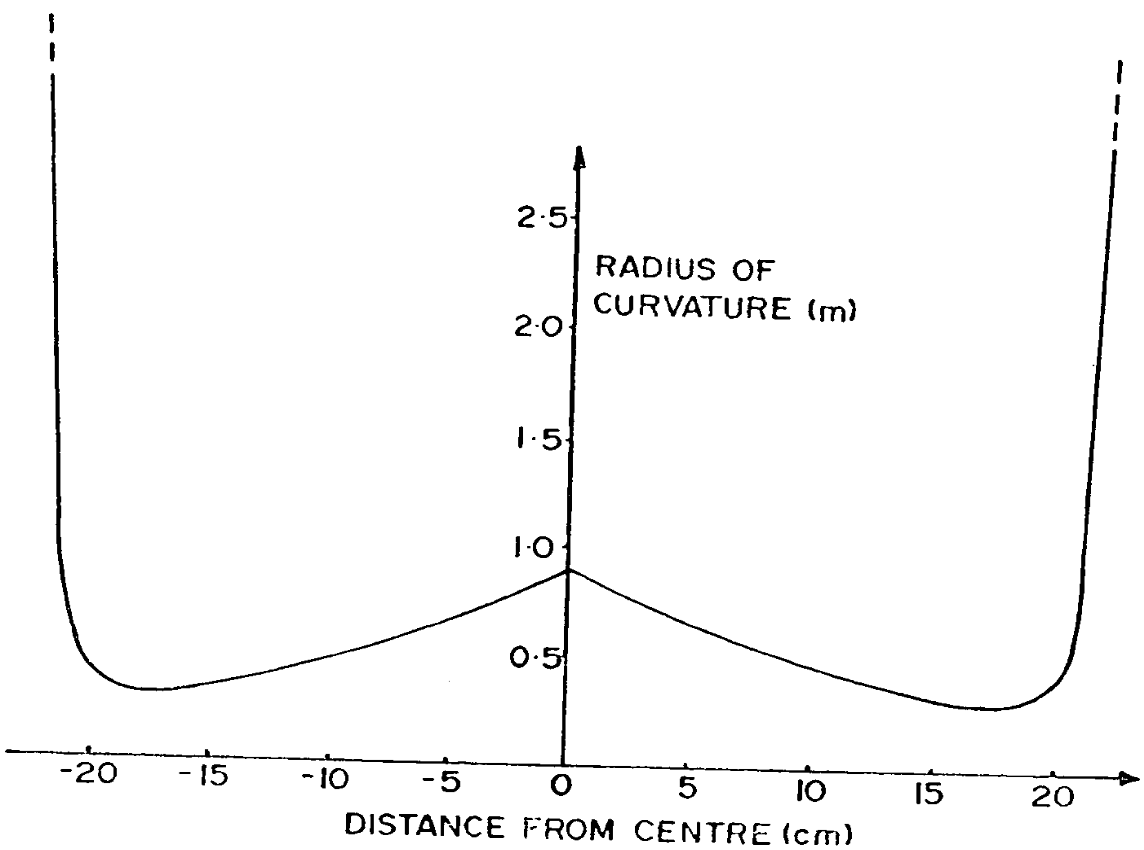

FIG 6

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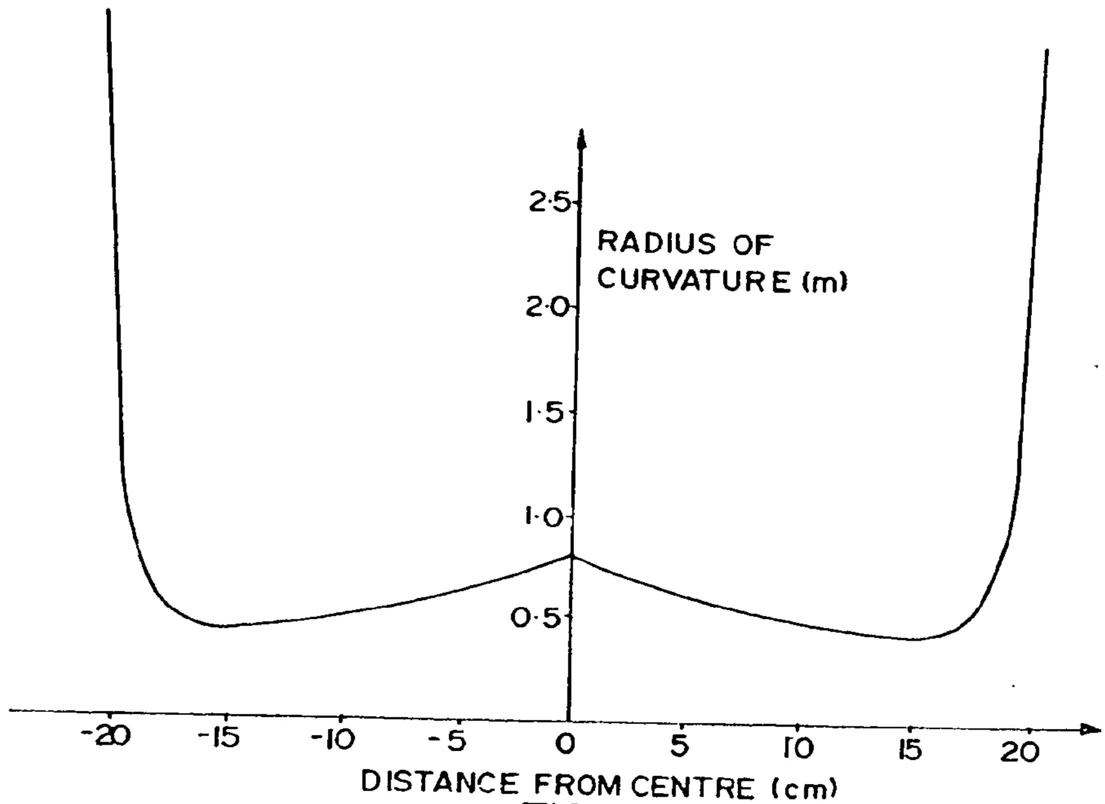

FIG 7

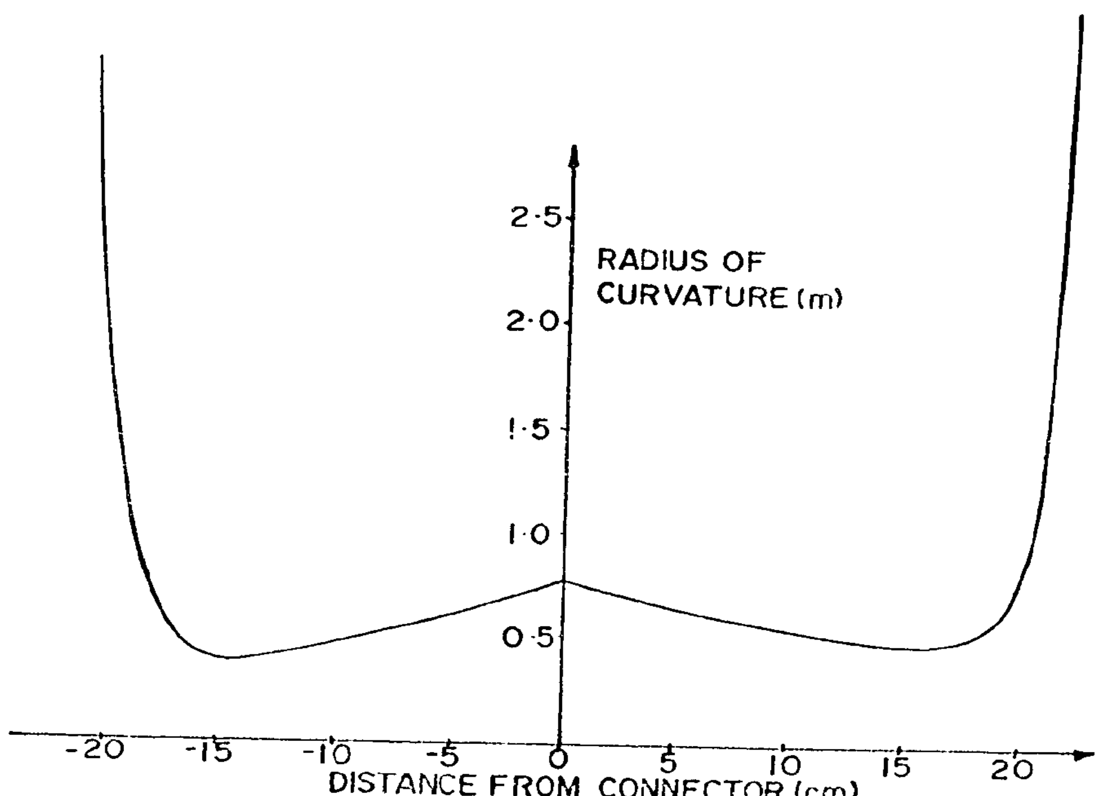

FIG 8

Costco Exhibit 1002, p. 204

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European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 92 30 7416

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.5)
A	GB-A-1 012 902 (APPEL) * the whole document *	1-4,21 22	B60S1/38
A	US-A-4 343 063 (BATT) * abstract; claims 1-7; figures 1,2,4-7,9-11 * * column 2, line 36 - line 57 * * column 3, line 27 - column 5, line 12 *	1-5,7,8 21,22	
A	US-A-3 480 986 (FORSTER) * the whole document *	1-4,6,21 22	
A	FR-A-2 515 121 (ROBERT BOSCH) * figures * * page 1, line 19 - page 2, line 22 * * page 4, line 27 - page 6, line 11 *	1-4,6,21 22	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
B60S

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	03 NOVEMBER 1992	WESTLAND P.G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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T : theory or principle underlying the invention
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& : member of the same patent family, corresponding document

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DE 198 14 610 A 1

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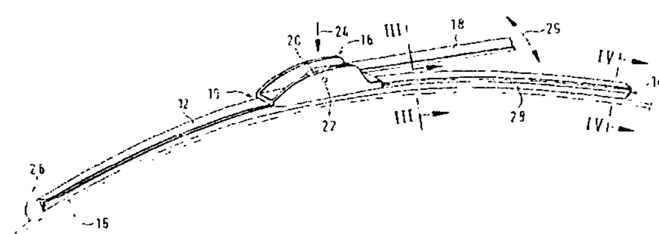
Die folgenden Angaben sind den vom Anmelder eingereichten Unterlagen entnommen

(54) Wischblatt für Scheiben von Kraftfahrzeugen

(57) Es wird ein Wischblatt vorgeschlagen, das zum Reinigen von Scheiben von Kraftfahrzeugen dient. Das Wischblatt (10) ist quer zu seiner Längserstreckung von einem mit diesem verbindbaren, angetriebenen zur Scheibe (15) belasteten Wischerarm (18) hin- und hergehend bewegbar und hat eine an der Scheibe anlegbare langgestreckte Wischleiste (14), an deren von der Scheibe abgewandten Seite ein langgestrecktes, federelastisches, die Verbindungsmittel (16) für den Wischerarm (18) aufweisendes Tragelement (12) zur Verteilung der Anlegekraft über die gesamte Wischleistenlänge längsachsenparallel angeordnet ist. Ein besonders effektiver und geräuscharmer Betrieb der Wischanlage wird erreicht, wenn die Anlegekraft (Pfeil 24) der Wischleiste (14) an der Scheibe (15) in dessen Mittelabschnitt größer ist als an wenigstens einem ihrer beiden Endabschnitte (38 bzw. 138, 139 bzw. 238, 239).



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Beschreibung

Stand der Technik

Bei Wischblättern der im Oberbegriff des Anspruchs 1 bezeichneten Art soll das Tragelement über das gesamte vom Wischblatt bestrichene Wischfeld eine vorbestimmte Verteilung der vom Wischerarm ausgehenden Wischblatt-Anpresskraft – oft auch als Anpreßdruck bezeichnet – an der Scheibe gewährleisten. Durch eine entsprechende Krümmung des unbelasteten Tragelements – also wenn das Wischblatt nicht an der Scheibe anliegt – werden die Enden der im Betrieb des Wischblatts vollständig an der Scheibe angelegten Wischleiste durch das dann gespannte Tragelement zur Scheibe belastet, auch wenn sich die Krümmungsradien von sphärisch gekrümmten Fahrzeugscheiben bei jeder Wischblattposition ändern. Die Krümmung des Wischblatts muß also etwas stärker sein als die im Wischfeld an der zu wischenden Scheibe gemessene stärkste Krümmung. Das Tragelement ersetzt somit die aufwendige Tragbügelkonstruktion mit zwei in der Wischleiste angeordneten Federschienen, wie sie bei herkömmlichen Wischblättern praktiziert wird (DE-OS 15 05 357).

Die Erfindung geht aus von einem Wischblatt nach dem Oberbegriff des Anspruchs 1. Bei einem bekannten Wischblatt dieser Art (DE-PS 12 47 161) sind zur Erzielung einer möglichst gleichmäßigen Druckbelastung des Wischblatts an einer ebenen Scheibe über seine gesamte Länge mehrere Ausgestaltungen des Tragelements als Problemlösung vorgesehen.

Bei einem anderen bekannten Wischblatt gemäß der Gattung des Anspruchs 1 (EP 05 28 643 B1) nimmt – zur Erzielung einer gleichmäßigen Druckbelastung des Wischblatts an sphärisch gekrümmten Scheiben - die Druckbelastung an den beiden Endabschnitten wesentlich zu, wenn das Wischblatt auf eine ebene Scheibe gepreßt wird.

Die in beiden Fällen angestrebte gleichmäßige Druckverteilung über die gesamte Wischblattlänge führt jedoch zu einem schlagartigen Umspringen der zum Wischblatt gehörenden, die eigentliche Wischarbeit ausführenden Wischlippe über deren gesamte Länge aus ihrer einen in ihre andere Schlepplage, wenn das Wischblatt seine Arbeitsrichtung umkehrt. Diese Schlepplage ist unabdingbar für einen effektiven und geräuscharmen Betrieb der Wischanlage. Das schlagartige Umspringen der Wischlippe – welches zwangsläufig mit einer Auf- Abbewegung des Wischblatts verbunden ist – erzeugt jedoch unerwünschte Klopfgeräusche. Auch ist die Abstimmung der Tragelementspannung auf die gewünschte, von Fall zu Fall andersartige Druckverteilung bei sphärisch gekrümmten Scheiben problematisch.

Vorteile der Erfindung

Bei dem erfindungsgemäßen Wischblatt mit den Merkmalen des Anspruchs 1 ergibt sich im Bereich der verminderten Anlegekraft eine steilere Schlepplage der Wischlippe gegenüber dem Bereich mit der größeren Anlagekraft. Diese steilere Stellung der Wischlippe begünstigt deren Umlegevorgang in den Wischrichtungsumkehrpositionen des Wischblatts, welcher dort eingeleitet wird und sich dann in den Bereich mit der größeren Anlegekraft fortsetzt. Dadurch wird das schlagartige Umschnappen der gesamten Wischlippe und das damit verbundene störende Klopfgeräusch vermieden. Auch entfallen die Probleme bei der Auslegung des Tragelements hinsichtlich der Anlagedruckverteilung bei sphärisch gekrümmten Scheiben. Es hat sich nämlich gezeigt, daß mit der Verringerung des Anlegedrucks am Endabschnitt des Wischblatts nicht zwangsläufig auch eine Minderung der Wischqualität einhergeht.

Besonders vorteilhaft ist es, wenn der Anlegedruck der Wischleiste an der Scheibe an deren beiden Endabschnitten kleiner ist als in deren Mittelabschnitt, weil dann der Umlegevorgang der Wischlippe von beiden Enden her erfolgt und dadurch schneller abgeschlossen ist.

Bei besonders problematischen Scheibenkrümmungen kann es zweckdienlich sein, wenn der Anlegedruck der Wischleiste an der Scheibe in deren Mittelabschnitt zumindest annähernd gleichbleibend groß ist und an dem Endabschnitt/den Endabschnitten abfällt.

Eine bevorzugte Ausführung des Tragelements zum Erreichen der angestrebten Verteilung des Anlegedrucks sieht vor, daß das Tragelement an seiner der Scheibe zugewandten Seite eine Hohlkrümmung aufweist, die stärker ist als die stärkste Krümmung der sphärisch gekrümmten Scheibe im Bereich des vom Wischblatt überstreichbaren Wischfeldes und daß die Hohlkrümmung im Mittelabschnitt des Tragelements stärker ist als an dessen Endabschnitt/Endabschnitten.

Weitere vorteilhafte Weiterbildungen und Ausgestaltungen der Erfindung sind in der nachfolgenden Beschreibung eines in der dazugehörigen Zeichnung dargestellten Ausführungsbeispiels angegeben.

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Zeichnung

In der Zeichnung zeigen: **Fig.** 1 eine perspektivische Darstellung eines an der Scheibe angelegten, mit einem zur Scheibe belasteten Wischerarm verbundenen Wischblatts, **Fig.** 2 eine Prinzipdarstellung einer Seitenansicht eines unbelastet auf die Scheibe aufgesetzten Wischblatts, gegenüber **Fig.** 1 verkleinert dargestellt, **Fig.** 3 die Schnittfläche eines Schnitts durch das Wischblatt gemäß **Fig.** 1, entlang der Linie III-III in vergrößerter Darstellung, **Fig.** 4 die Schnittfläche eines Schnitts durch das Wischblatt gemäß **Fig.** 1 entlang der Linie IV-IV in vergrößerter Darstellung, **Fig.** 5 eine graphische Darstellung des Wischblatt-Anlegedrucks über die Wischblattlänge, gemäß einer ersten möglichen Ausführungsform der Erfindung, **Fig.** 6 eine graphische Darstellung des Wischblatt-Anlegedrucks über die Wischblattlänge, gemäß einer anderen möglichen Ausführungsform der Erfindung, **Fig.** 7 eine graphische Darstellung des Wischblatt-Anlegedrucks über die Wischblattlänge, gemäß einer weiteren möglichen Ausführungsform der Erfindung und **Fig.** 8 eine unmaßstäbliche Prinzipdarstellung eines zum Wischblatt gehörenden Tragelements in Seitenansicht.

Beschreibung des Ausführungsbeispiels

Ein in **Fig.** 1 dargestelltes Wischblatt **10** weist ein langgestrecktes, federelastisches Tragelement **12** für eine Wischleiste **14** auf, das in **Fig.** 8 separat dargestellt ist. Wie aus den **Fig.** 1, 3 und 4 ersichtlich ist, sind das Tragelement **12** und die Wischleiste **14** längsachsenparallel miteinander verbunden. An der von der zu wischenden Scheibe **15** – in **Fig.** 1 strichpunktiert gezeichnet – abgewandten Oberseite des Tragelements **12** ist eine Anschlußvorrichtung **16** angeordnet, mit deren Hilfe das Wischblatt **10** mit einem an der Karosserie eines Kraftfahrzeugs geführten, angetriebenen Wischerarm **18** lösbar verbunden werden kann. An der der Scheibe **15** zugewandten Unterseite des Tragelements **12** ist die langgestreckte, gummielastische Wischleiste **14** angeordnet. An dem freien Ende **20** des Wischarms **18** ist ein als Gegenanschlußmittel dienender Haken angeformt, welcher einen zur Anschlußvorrichtung **16** des Wischblatts **10** gehörenden Gelenkbolzen **22** umgreift. Die Sicherung zwischen

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dem Wischerarm **18** und dem Wischblatt **10** wird durch nicht näher dargestellte, an sich bekannte, als Adapter ausgebildete, Sicherungsmittel übernommen. Der Wischerarm **18** und damit auch dessen Hakenende **20** sind in Richtung des Pfeiles **24** zur zu wischenden Scheibe **15** belastet, deren zu wischende Oberfläche in den **Fig.** 1 und 2 durch eine strichpunktierte Linie **26** angedeutet ist. Die Kraft (Pfeil **24**) legt das Wischblatt **10** über dessen gesamte Länge an der Oberfläche **26** der zu wischenden Scheibe **15** an. Da die in **Fig.** 2 dargestellte strichpunktierte Linie **26** die stärkste Krümmung der Scheibenoberfläche im Bereich des Wischfeldes darstellen soll ist klar ersichtlich, daß die Krümmung des mit seinen beiden Enden an der Scheibe anliegenden, noch unbelasteten Wischblatts **10** stärker ist als die maximale Krümmung der sphärisch gekrümmten Scheibe **15**. Unter dem Anpressdruck (Pfeil **24**) legt sich das Wischblatt **10** mit seiner zur Wischleiste **14** gehörenden Wischlippe **28** über seine gesamte Länge an der Scheibenoberfläche **26** an. Dabei baut sich im bandartigen federelastischen Tragelement **12** eine Spannung auf, welche für eine ordnungsgemäße Anlage der Wischleiste **14** bzw. der Wischlippe **28** über deren gesamte Länge an der Kraftfahrzeugscheibe **15** sorgt. Während des Wischbetriebs bewegt der Wischerarm **18** das Wischblatt **10** quer zu dessen Längserstreckung über die Scheibe **15**. Diese Wisch- oder Arbeitsbewegung ist in **Fig.** 1 mit dem Doppelpfeil **29** bezeichnet.

Im folgenden soll nun auf die besondere Ausgestaltung des erfindungsgemäßen Wischblatts näher eingegangen werden. Wie die unmaßstäblich dargestellten **Fig.** 3 und 4 zeigen, ist die Wischleiste **14** an der unteren, der Scheibe **15** zugewandten Bandfläche des Tragelements **12** angeordnet. Mit Abstand von dem Tragelement **12** ist die Wischleiste **14** von ihren beiden Längsseiten her so eingeschnürt, daß in ihrem Längsmittelbereich ein Kippsteg **30** verbleibt, der sich über die gesamte Länge der Wischleiste **14** erstreckt. Der Kippsteg **30** geht in die Wischlippe **28** über, die einen im wesentlichen keilförmigen Querschnitt aufweist. Durch die Anlegekraft (Pfeil **24**) wird das Wischblatt beziehungsweise die Wischlippe **28** gegen die zu wischende Oberfläche **26** der Scheibe **15** gedrückt, wobei sie unter dem Einfluß der Wischbewegung – von der in den **Fig.** 3 und 4 speziell die eine der beiden gegenläufigen Wischbewegungen (Doppelpfeil **29**) betrachtet wird und die durch den Richtungspfeil **32** angedeutet ist – in eine sogenannte Schlepplage kippt, in der sich die Wischlippe an dem am Tragelement **12** gehaltenen Teil der Wischleiste **14** über ihre gesamte Länge abstützt. Dieser Abstützung welche in den **Fig.** 3 und 4 mit dem Pfeil **34** gekennzeichnet ist erfolgt stets – in Abhängigkeit von der jeweiligen Wischrichtung (Doppelpfeil **29** bzw. Pfeil **32**) an der in der jeweiligen Wischrichtung hintenliegenden Oberkante der Wischlippe **28**, so daß diese stets in einer sogenannten Schlepplage über die Scheibe geführt wird. Diese Schlepplage ist für einen effektiven und geräuscharmen Betrieb der Wischvorrichtung notwendig. Die Umkehrung der Schlepplage erfolgte in der sogenannten Umkehrposition des Wischblatts **10**, wenn dieses seine Wischbewegung (Doppelpfeil **29**) umkehrt. Dabei führt das Wischblatt eine Auf- Abbewegung aus, welche durch das Umkippen der Wischlippe **28** bedingt ist. Die Aufbewegung erfolgt entgegen Richtung des Pfeiles **24** und somit auch entgegen der Anlegekraft. In der entgegen dem Pfeil **32** gerichteten anderen Wischbewegung ergibt sich somit ein Spiegelbild der **Fig.** 3 und 4.

Um ein möglichst geräuscharmes Umlegen der Wischlippe **28** aus ihrer einen Schlepplage in ihre andere Schlepplage zu erreichen, wird das zur Verteilung der Anlegekraft (Pfeil **24**) dienende Tragelement **12** so ausgelegt, daß der Anlegedruck der Wischleiste **24** beziehungsweise der Wischlippe **28** an der Scheibenoberfläche **26** in deren Mittelabschnitt **36** (**Fig.** 8) größer ist als an wenigsten einen der beiden Endabschnitten **38**. Dieser Grundgedanke kann beispielsweise so umgesetzt werden, wie dies in den graphischen Darstellungen gemäß den **Fig.** 5 bis 7 aufgezeigt ist.

Gemäß **Fig.** 5 ist das Tragelement **12** so ausgelegt, daß über die Länge **40** des Wischblatts gesehen dessen Mittelbereich **36** eine annähernd gleichstarke Anlegekraft (Linie **44**) vorhanden ist und daß diese Anlegekraft **44** an den beiden Endabschnitten **38** des Wischblatts stark abfällt. Die strichpunktierte Linie **42** soll eine mögliche Lage des Gelenkbolzens **22**, das heißt den Angriffspunkt der vom Wischerarm ausgehenden Anlegekraft zeigen.

Bei einer anderen Ausführungsform (**Fig.** 6) ist das Tragelement **12** so ausgelegt, daß über die Länge **140** des Wischblatts gesehen die Anlegekraft **24** ausgehend von dem einen Ende **138** des Wischblatts bis weit über dessen Anlenkpunkt (Linie **142**) hinaus gleichbleibend groß ist (Linie **144**), bis sie im Bereich des anderen Ende **139** des Wischblatts stark abfällt. In **Fig.** 6 ist der mögliche Anlenkpunkt des Wischblatts am Wischerarm mit **142** bezeichnet worden.

Eine weitere, in **Fig.** 7 dargestellte mögliche Auslegung des erfindungsgemäßen Wischblatts sieht vor, daß der Anlegedruck oder die Anlegekraft (**244**) der Wischlippe **28** an der Scheibenoberfläche **26** im Mittelbereich **242** des Wischblatts – wo sich der Anlenkpunkt des Wischerarms **18** befindet – im wesentlichen gleich groß ist und daß sie zum einen Ende **238** des Wischblatts leicht abfällt, während sie im Bereich des anderen Endes **239** des Wischblatts erheblich geringer wird. Bei dieser Auslegung des Wischblatts ist der Angriffspunkt **243** des Wischerarms **18** am Wischblatt wie bei der Auslegung gemäß **Fig.** 6 außerhalb der Mitte der Wischblattlänge **240** angeordnet. Eine solche Positionierung der Anlenkstelle kann unter Umständen natürlich auch bei Wischblättern die gemäß **Fig.** 5 ausgelegt sind angewendet werden. Die verschiedenen Auslegungen des Wischblatts können durch bestimmte Scheibentypen, die sich beispielsweise durch die Art der sphärischen Krümmungen der Scheiben voneinander unterscheiden, bedingt sein.

Fig. 8 zeigt einen möglichen Krümmungsverlauf des Tragelements **12**, der eine Druckverteilung der Wischlippe **28** an der Scheibe **15** ergeben kann, wie sie in **Fig.** 5 graphisch dargestellt ist. Bei diesem federelastischen Tragelement **12**, das unbelastet eine stärkere Hohlkrümmung gegenüber der Scheibe aufweist als diese im Bereich des vom Wischblatt überstrichenen Wischfeldes gekrümmt ist, ist der Krümmungsverlauf so ausgeführt, daß dieser im Mittelabschnitt **36** des Tragelements stärker ist als an dessen Endabschnitten **38**. Zur Erlangung der angestrebten Anlegekraftverteilung ist es jedoch auch denkbar, die Endabschnitte **38** des Tragelements **12** im Querschnitt so zu reduzieren, daß eine vergleichbare Wirkung erreicht wird.

Selbstverständlich läßt sich diese Möglichkeit auch mit entsprechend abgestimmten Veränderungen des Krümmungsverlaufs des Tragelements **12** kombinieren.

Durch die Verringerung der Anlegekraft der Wischlippe **28** an der Scheibenoberfläche **26** im Bereich eines Wischblattendes oder an beiden Wischblattenden wird ein schlagartiges Umspringen oder Umschnappen der Wischlippe **28** aus ihrer einen Schlepplage in ihre andere Schlepplage vermieden. Vielmehr erfolgt beim erfindungsgemäßen Wischblatt ein vergleichsweise sanftes Umlegen der Wischlippe vom Wischblattende aus fortschreitend zur Wischlippenmitte beziehungsweise bis zum anderen Wischlippenende. Die **Fig.** 3 und 4 zeigen in Verbindung mit **Fig.** 1, daß auch bei sphärisch gekrümmten Scheiben die geringer belasteten Endabschnitte der Wischlippe **28** noch wirksam an der Scheibenoberfläche anliegen. Dies zeigt ein Vergleich der

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Fig. 3 und 4, aus dem klar ersichtlich ist, daß im geringer belasteten Endbereich (Fig. 4) die Wischlippe 28 steiler zur Scheibenobenfläche 26 steht als in deren Mittelabschnitt (Fig. 3) wo die größere Anlegekraft zur Wirkung kommt. Dieses steilere Anstellen der Wischlippe 28 begünstigt den Beginn des Umlegens der Wischlippe, wenn der Gegenlauf der Wischbewegung (Doppelpfeil 29) einsetzt.

Allen Ausführungsbeispielen ist gemeinsam, daß der Anlegedruck (Pfeil 24) der Wischleiste 14 an der Scheibe 15 in deren Mittelabschnitt 36 größer ist als an wenigstens einem ihrer beiden Endabschnitte 38. Dies gilt auch dann, wenn – abweichend vom gegenständlich gezeigten Wischblatt 10 mit einem einteiligen, als Federschiene dargestelltem Tragelement 12 – das Tragelement mehrteilig aufgebaut ist. Entscheident ist alleine die erfindungsgemäße Verteilung des Anlegedrucks.

Patentansprüche

1. Wischblatt (10) für Scheiben (15) von Kraftfahrzeugen, das quer zu seiner Längserstreckung von einem mit diesem verbindbaren, angetriebenen, zur Scheibe belastenden Wischerarm (18) hin- und hergehend über die Scheibe bewegbar ist und das Wischblatt eine an der Scheibe anlegbare, langgestreckte Wischleiste (14) hat, an deren von der Scheibe abgewandten Seite ein langgestrecktes, federelastisches, die Verbindungsmittel (16) für den Wischerarm aufweisendes Tragelement (12) zur Verteilung der Anlegekraft (Pfeil 24) über die gesamte Wischleistenlänge (40) längsachsenparallel angeordnet ist, **dadurch gekennzeichnet**, daß die Anlegekraft (Pfeil 24) der Wischleiste (14) an der Scheibe (15) in dessen Mittelabschnitt (36) größer ist als an wenigstens einem ihrer beiden Endabschnitte (38, bzw. 138, 139 bzw. 238, 239).

2. Wischblatt nach Anspruch 1, dadurch gekennzeichnet, daß die Anlegekraft (Pfeil 24) der Wischleiste (14) an der Scheibe (15) an deren beiden Endabschnitten (38) kleiner ist als in deren Mittelabschnitt (36).

3. Wischblatt nach einem der Ansprüche 1 oder 2, dadurch gekennzeichnet, daß die Anlegekraft (Pfeil 24) der Wischleiste (14) an der Scheibe (15) in deren Mittelabschnitt (36) zumindest annähernd gleichbleibend groß ist und an dem Endabschnitt/den Endabschnitten abfällt.

4. Wischblatt nach einem der Ansprüche 1 bis 3, dadurch gekennzeichnet, daß das Tragelement (12) an seiner der Scheibe (15) zugewandten Seite eine Hohlkrümmung aufweist, die stärker ist als die stärkste Krümmung der sphärisch gekrümmten Scheibe (15) im Bereich des vom Wischblatt (10) überstreichbaren Wischfeldes und daß die Hohlkrümmung im Mittelabschnitt (36) des Tragelements (12) stärker ist als an dessen Endabschnitt/Endabschnitten (38).

Hierzu 3 Seite(n) Zeichnungen

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Nummer: DE 198 14 610 A1
Int. Cl.[6]: B 60 S 1/38
Offenlegungstag: 7. Oktober 1999

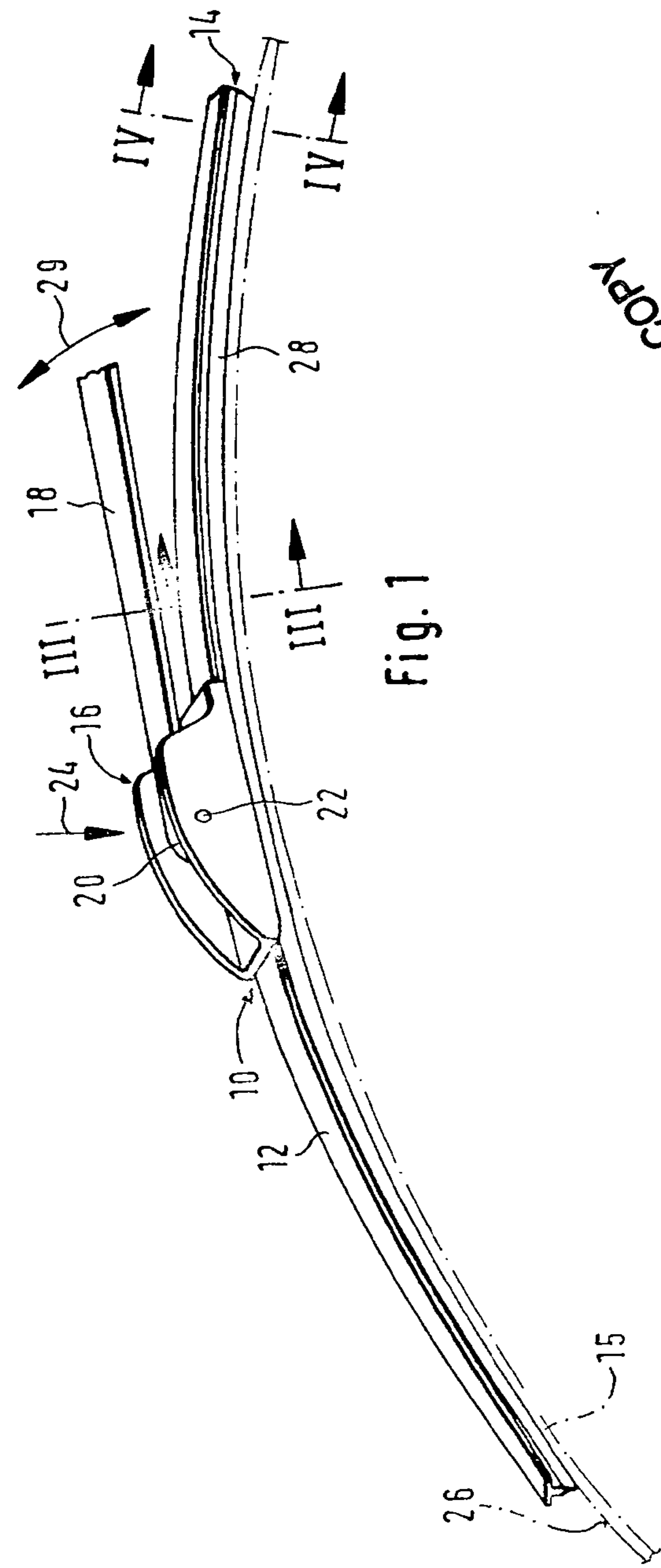

Fig. 1

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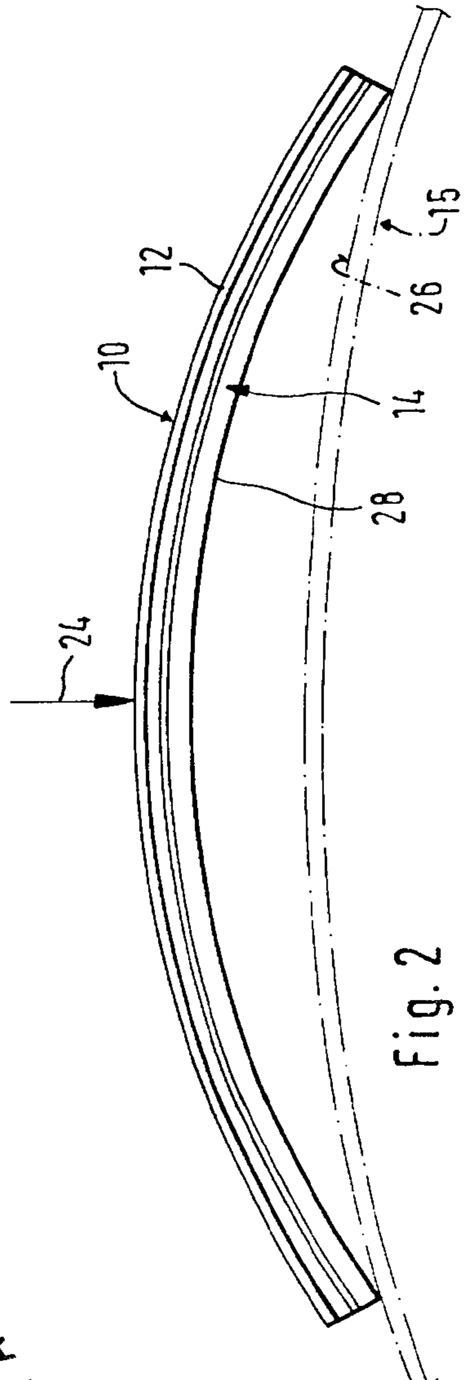

Fig. 2

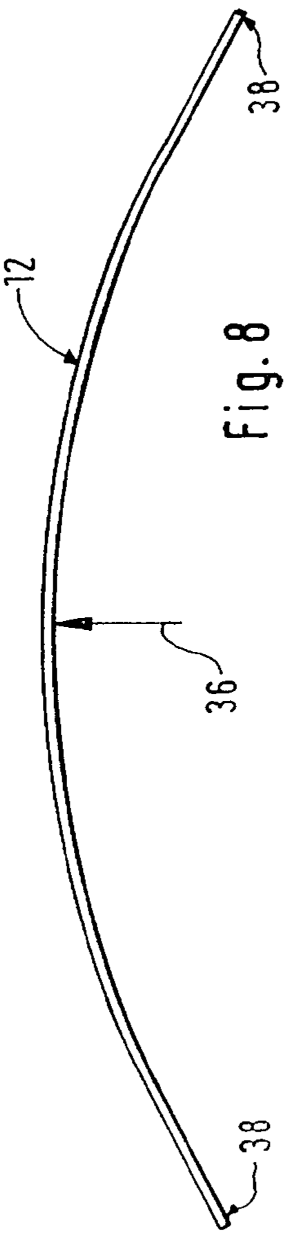

Fig. 8

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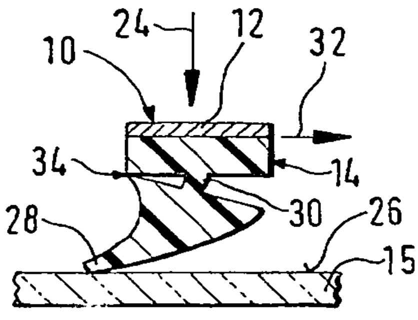

Fig. 3

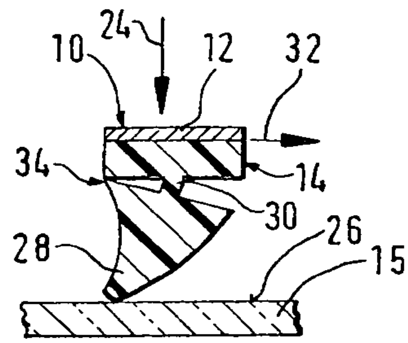

Fig. 4

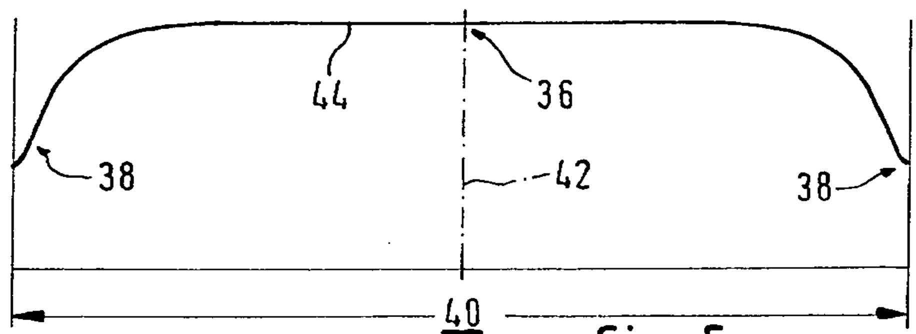

Fig. 5

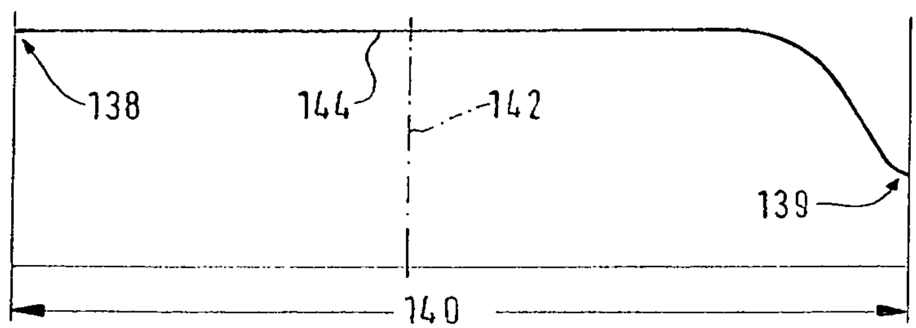

Fig. 6

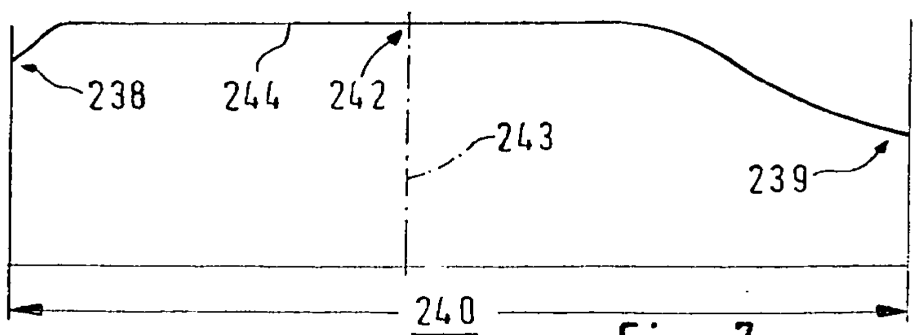

Fig. 7

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Scheibenwischer, insbesondere für Kraftfahrzeuge

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Die Erfindung bezieht sich auf Scheibenwischer, insbesondere für Kraftfahrzeuge, mit einem federnden Wischblatt, das aus einer biegsamen Federschiene, an der etwa in der Mitte der Wischerarm angeschlossen ist und deren Querschnitt nach den Enden zu verringert ist, und einem mit der Federschiene verbundenen Wischgummi od. dgl. besteht und eine gleichsinnige, jedoch stärkere Krümmung als die Scheibe aufweist.

Zur Verwendung an gekrümmten Windschutzscheiben sind Scheibenwischer bekannt, deren Wischblätter aus Gummi an je zwei Bügeln lose befestigt sind, die wiederum an einem Bügel angelenkt sind, in dessen Mitte der Betätigungsarm angreift. Zur Befestigung des Wischblattes an den beiden Bügeln dient eine Federschiene, in welche das Wischblatt eingeschoben ist und die eine zu der Krümmung der Scheibe gleichsinnige oder gegensinnige Krümmung aufweist, um ein besseres Anliegen des Wischblattes an der gekrümmten Scheibe zu ermöglichen. Diesem Zweck dienen auch beispielsweise Zugfedern, die zwischen den Bügeln angeordnet sind, um insbesondere die Enden des Wischblattes gegen die Scheibenoberfläche ziehen zu können. Ferner hat man auch die Breite der Federschiene zum Halten des Wischblattes gegen die Enden zu verringert, um die Enden biegsamer zu gestalten und ein besseres Anliegen zu ermöglichen. Diese Maßnahmen haben sich aber als unzureichend erwiesen, da die Anordnung der Bügel insbesondere eine verhältnismäßig große Steifigkeit der Enden des Wischblattes zur Folge hatte. Ferner wird zur Herstellung dieser bekannten Scheibenwischer eine verhältnismäßig große Anzahl von Einzelteilen benötigt, für deren Montage Spezialmaschinen erforderlich sind. Ferner ist die Bauhöhe infolge der Bügel verhältnismäßig groß, so daß die Wischer bei starkem Fahrtwind zum Abheben neigen, da der Wind eine verhältnismäßig große seitliche Angriffsfläche findet.

Ferner sind für gewölbte Windschutzscheiben Scheibenwischer bekannt, bei denen der Wischerarm etwa in der Mitte unmittelbar an dem Wischer angelenkt ist. Damit kann zwar eine erhebliche Zahl von Einzelteilen eingespart werden. Andererseits mußte jedoch Vorsorge getroffen werden, ein möglichst gleichmäßiges Anliegen des Wischers an der Scheibe zu vermitteln. Hierfür ist es beispielsweise bekannt, auf der Rückseite des Wischblattes aus Gummi wendelförmige Federn anzuordnen, durch deren Elastizität das Wischblatt gegen die Scheibe gedrückt werden soll. Eine gleichmäßige Flächenpressung des Wischblattes gegen die Scheibe läßt sich

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aber auch hiermit nicht erzielen, auch wenn die Krümmung des Blattes im unbelasteten Zustand kleiner als die Wölbung der Scheibe ist.

Bei einer anderen bekannten Ausführung wird die Druckverteilung sowie die Biegsamkeit der Enden des Wischblattes dadurch verbessert, daß über eine Federschiene, an welcher das Wischblatt befestigt ist, eine zweite, kürzere Federschiene gelegt wird. Der Angriffspunkt des Wischerarmes ist etwa in der Mitte des Wischblattes gelegen. Die beiden Federschienen weisen ebenfalls eine Krümmung im unbelasteten Zustand auf, die kleiner als die Scheibenwölbung ist und sind mit einem Gummiüberzug versehen. Dadurch leidet aber die freie Beweglichkeit der beiden Federschienen gegeneinander. Ferner läßt sich mit dieser bekannten Querschnittsverringerung der Federschiene vom Angriffspunkt des Wischerarmes gegen die Enden zu eine gleichmäßige Flächenpressung nicht erzielen.

Der Erfindung liegt deshalb die Aufgabe zugrunde, einen Scheibenwischer bei einem geringstmöglichen Bauaufwand derart auszubilden, daß die Flächenpressung des Wischblattes gegen die Scheibe konstant ist.

Erfindungsgemäß ist diese Aufgabe bei einem Scheibenwischer der eingangs genannten Art dadurch gelöst, daß zur Erzielung einer gleichbleibenden Flächenpressung des Wischblattes gegen die Scheibe der Krümmungsradius der Federschiene im unbelasteten Zustand, die vom Angriffspunkt des Wischerarmes nach beiden Enden fortschreitende Querschnittsverringerung und der Elastizitätsmodul des Materials der Federschiene in Abhängigkeit von der Länge so aufeinander abgestimmt sind, daß die Federkonstante von den Enden zum Angriffspunkt des Wischerarmes mit dem Quadrat der Entfernung von den Enden zunimmt.

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Der erfindungsgemäße Scheibenwischer weist somit lediglich eine einzige Federschiene auf, an der das Wischblatt befestigt ist. Dazu kommt noch ein an der Federschiene befestigter Halter, an der der Wischerarm angreift. Die Herstellung der Federschiene sowie die Montage des Wischers kann in besonders einfacher Weise erfolgen. Außerdem weist der erfindungsgemäße Scheibenwischer eine sehr niedrige Bauhöhe auf, so daß ein Abheben bei starkem Fahrtwind auch bei den üblichen Andruckkräften des Wischerarmes in der Größenordnung von etwa 11 g/cm der Blattlänge vermieden ist. Im Gegensatz zu den bekannten Scheibenwischern mit Bügeln können im Winterbetrieb Eis und Schnee, die sich an dem Scheibenwischer ansetzen, diesen nicht behindern.

Der Erfindung liegt die Überlegung zugrunde, daß die Flächenpressung des Wischblattes gegen die Scheibe bei einem Wischer mit etwa in der Mitte liegendem Angriffspunkt des Wischerarmes dann konstant ist, wenn die Federkonstante der Federschiene von den Enden zum Angriffspunkt des Wischerarmes mit dem Quadrat der Entfernung von den Enden zunimmt. Somit verändert sich die Federkonstante parabolisch.

In vorteilhafter Ausgestaltung der Erfindung verjüngt sich die Breite der Federschiene zu den Enden hin parabelförmig. In weiterer vorteilhafter Ausgestaltung kann aber auch die Dicke der Federschiene zu den Enden hin stetig abnehmen. Weitere Ausgestaltungen der Erfindung sind in den übrigen Unteransprüchen gekennzeichnet.

Mehrere Ausführungsbeispiele der Erfindung sind nachstehend an Hand der Zeichnung näher erläutert. Es zeigt

Fig. 1a bis 1c eine Darstellung zur Erläuterung der Erfindung,

Fig. 2a bis 2c eine erste Ausführungsform der Federschiene mit veränderlicher Breite,

Fig. 3a bis 3c eine zweite Ausführungsform der Federschiene mit veränderlicher Dicke,

Fig. 4 eine Draufsicht auf ein Wischerblatt mit einer Federschiene gemäß Fig. 2,

Fig. 5 eine Seitenansicht des Wischerblattes nach Fig. 4,

Fig. 6 einen Schnitt längs der Linie 6-6 in Fig. 4,

Fig. 7 einen Schnitt durch eine Federschiene gemäß Fig. 2 mit geklebtem Wischblatt und

Fig. 8 einen Schnitt durch eine Federschiene gemäß Fig. 3 mit angeklebtem Wischblatt.

Der Versuch, mit einer einfachen Federschiene einen im wesentlichen gleichmäßigen Druck zu schaffen, wird am besten verständlich, wenn zunächst einmal die Bedingungen betrachtet werden, welche auf einer flachen Windschutzscheibenoberfläche einen gleichmäßigen Druck erzeugen würden. Nach den Fig. 1a bis 1c könnte eine gleichmäßige Druckbelastung über die Länge einer Federschiene **20** mit gleichmäßiger Breite **21** und gleichmäßiger Stärke **22** dadurch erreicht werden, daß der Federschiene eine Parabelform im unbelasteten Zustand gegeben wird, deren Hauptachse senkrecht zu einer Tangente im Angriffspunkt des Wischerarmes der Federschiene liegt. Bei einer Bewegung der Federschiene senkrecht auf eine flache Windschutzscheibenoberfläche **25** würden bei zunehmendem Druck auf den Angriffspunkt des Wischerarmes die Enden **26** eine Anfangsberührung bei fortschreitender Anpassung der Federschiene an die Windschutzscheibe von den Enden in Richtung auf die Mitte zu herstellen, wie es in den Fig. 1b und 1c dargestellt ist. Die freie, unbelastete Parabelform, die erforderlich ist, um bei einer gegebenen Gesamtbelastung P im Angriffspunkt des Wischerarmes eine vollständig gleichmäßige Druckverteilung zu erzielen, ist von der Länge, der Stärke, der Breite und dem Elastizitätsmodul des verwendeten Materials abhängig. Bei einem gegebenen Elastizitätsmodul erfordern verhältnismäßig dünnere oder schmälere Ausschnitte eine verhältnismäßig größere Durchbiegung und tiefere freie Parabelform, um eine gegebene gleichmäßige Druckbelastung zu erzeugen.

Gemäß Fig. 2a bis 2c weist der freigeformte Längsabschnitt zur Erzeugung einer gleichmäßigen Lastverteilung eine Verminderung der Breite **27** *a* der Federschiene **27** von einem Maximum am Angriffspunkt **29** des Wischerarmes zu einem Minimum an den Enden **28** auf, wobei diese Verjüngung die Form von Parabelbögen hat, deren Hauptachsen senkrecht zu den Enden **28** der Federschiene **27** liegen (siehe auch Fig. 4, Federschiene **36** und Enden **39**). Die Krümmung der Federschiene **27** im unbelasteten Zustand ist dann nicht mehr parabelförmig wie in Fig. 1, sondern kreisbogenförmig, so daß sich wiederum die Federschiene **27** von den Enden **28** her bei zunehmender Druckbelastung im Angriffspunkt **29** des Wischerarmes zu diesem hin auf die Scheibe auflegt, wie es in den Fig. 2b und 2c gezeigt ist. Im vollkommen abgeflachten Zustand ist sowohl die Biegebeanspruchung als auch die Druckbelastung der Federschiene **27** je Einheit überall gleichmäßig, im Gegensatz zu der erörterten Parabelform der Federschiene mit gleichmäßiger Breite, bei der die Biegebeanspruchung ungleichmäßig ist und ihren Höchstwert im Angriffspunkt des Wischerarmes hat.

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Die Fig. 3a bis 3c zeigen, daß ein ähnliches Ergebnis erzielt werden kann, wenn man eine Federschiene **32** mit gleichmäßiger Breite **31** vorsieht, welche eine gleichmäßig verminderte Dicke **33**, und zwar von einem Maximum am Angriffspunkt **34** des Wischerarmes zu einem Minimum an jedem Ende **35** hat. Auch in diesem Fall führt eine kreisbogenförmige Krümmung zu einem gleichmäßig fortschreitenden »Anpassen« von den Enden **35** zum Angriffspunkt **34** des Wischerarmes bei gleichmäßiger Drucklastberührung auf der Länge der Federschiene **32** von einer am Angriffspunkt **34** des Wischerarmes aufgebrachten Last P gemäß der Darstellung in den Fig. 3b und 3c.

Die Wirkung dieser Verjüngung kann auch dadurch hergestellt werden, daß man das Federausgangsmaterial von gleichmäßiger Stärke mit einer Verstärkungsrippe oder Rippen (nicht gezeigt) mit fortschreitend zunehmender Tiefe von den Enden zum Angriffspunkt des Wischerarmes hin, die parallel zur Längsmittellinie der Federschiene gebildet sind, vorsieht. Es können aber auch Flansche (nicht gezeigt) mit von den Enden her zunehmender Flanschhöhe an den Rändern der Federschiene gebildet werden, um einen fortschreitend zunehmenden Widerstand gegenüber einer Biegung von den Enden zum Angriffspunkt des Wischerarmes vorzusehen.

Es ist offenbar auch möglich, diese verschiedenen Ausführungsmöglichkeiten zur Schaffung einer einzigen Federschiene mit gleichmäßiger Druckbelastung beim Andrücken gegen eine flache Windschutzscheibe in verschiedenen Weisen zu kombinieren. Welche

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Ausführung auch immer benutzt wird, es wird immer die Kombination eines biegsamen Wischerblattes aus Gummi mit einer Federschiene sein, welche die endgültige Druckkennlinie zwischen dem Wischerblatt und der Windschutzscheibenoberfläche bestimmt. Aus diesem Grund muß die Form und der Querschnitt des biegsamen Wischerblattes aus Gummi bei der Bestimmung der richtigen Maße der Ausführung zusätzlich zu der Federschiene auch mit in Betracht gezogen werden.

Infolge der parabelförmigen Verringerung der Federschienenbreite nach Fig. 2 bzw. der gleichmäßigen Verringerung der Federschienendicke nach Fig. 3 nimmt die Federkonstante von den Enden zum Angriffspunkt des Wischerarmes im wesentlichen mit dem Quadrat der Entfernung von den Enden zu. Wird die Federschiene mit Rippen oder Flanschen versehen, so muß ebenfalls dieses Kriterium erfüllt sein. Dann ist die Flächenpressung des Wischblattes gegen die Scheibe konstant. Anders ausgedrückt, nimmt das Biegemoment der Federschiene von den Enden zum Angriffspunkt des Wischerarmes mit dem Quadrat der Entfernung von jedem Ende zu.

Bei gekrümmten Windschutzscheiben läßt sich eine im wesentlichen gleichmäßige Druckbelastung dadurch erzielen, daß zu der Kurvenform, welche auf einer flachen Oberfläche eine gleichmäßige Druckbelastung erzeugt, die zusätzliche Kurve der gekrümmten Windschutzscheibenoberfläche hinzugefügt wird. Auf diese Weise vermittelt eine einfache Federschiene auf jeder beliebigen durchschnittlich oder stark gekrümmten Fläche oder bei einem mittleren Krümmungsabschnitt einer verschieden stark gekrümmten Windschutzscheibe einen gleichmäßigen Druck. Wenn der Wischer innerhalb eines erheblich veränderlichen Krümmungsbereiches arbeiten muß, kann ein vollständig gleichmäßiger Druck nur für eine bestimmte Krümmung vorgesehen werden, wobei der Wischerarm eine feste, vorbestimmte Gesamtdruckbelastung ausübt, Druckveränderungen jedoch auf verschiedene Weisen vermindert werden, so daß der Wischer vollständig zufriedenstellend arbeitet. Ein Weg besteht darin, eine gleichmäßige Druckkurve zwischen den äußeren Werten der größten und kleinsten Kurvenkonturen, die der Wischer überstreicht, anzunehmen; ein anderer Weg besteht darin, ein Federmaterial zu verwenden, welches einen hohen Elastizitätsmodul, eine hohe Ermüdungsfestigkeit und ein hohes Maß der freien Krümmung für die erwünschte Gesamtbelastung hat, so daß die Federkonstante ein Minimum bildet und die Veränderungen in der Krümmung der Windschutzscheibe ein Mindestbruchteil der gesamten Durchbiegung sind. Die Federkonstante ist das Verhältnis der Last zur Durchbiegung.

Nach den Fig. 4 bis 6 kann eine Federschiene **36** der in den Fig. 2a bis 2c beschriebenen Art ein bekanntes Wischblatt **37** aus Gummi aufnehmen, indem ein Schlitz **38** vorgesehen wird, der sich fast über die ganze Länge erstreckt und kurz vor dem Ende **39** aufhört, um eine mit einem Flansch versehene Rippe **40** des Wischblattes **37** aufzunehmen, die sich von ihm forterstreckt. Die Seiten der Federschiene **36** können gegen Federkraft auseinandergehalten werden, um die Befestigung des Wischblattes **37** zu ermöglichen, bevor die Befestigungsschelle **41** *a* des Wischerarmes durch Niete **42** daran befestigt wird, wodurch ein dauerhafter Zusammenbau zum Halten des Wischblattes **37** in seiner Stellung vorgesehen wird. Gemäß der Darstellung in Fig. 5 haben die Federschiene **36** *a* und das Wischblatt **37** *a* eine freie Kreisbogenform, die einen gleichmäßigen Berührungsdruck über die gesamte Berührungslänge mit einer flachen Windschutzscheibe **43** vorsieht, wenn sie von dem Wischerarm (nicht gezeigt) ganz heruntergedrückt wird.

Fig. 7 zeigt eine Abwandlung in der Einzelausführung eines Gummiwischblattes und der Betätigungsmittel, bei welcher eine Federschiene **45**, die so ähnlich ausgebildet ist wie diejenige der Fig. 4 bis 6, ein Wischblatt **46** aufweist, das in bekannter Weise durch Verkleben bei **47** daran befestigt ist. Die Abwandlung gemäß der Fig. 8 zeigt ein Wischblatt **48**, das in ähnlicher Weise durch Verkleben bei **49** an einer Federschiene **50** mit verminderter Dicke gemäß der Darstellung in den Fig. 3a bis 3c befestigt ist.

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Patentansprüche:

1. Scheibenwischer, insbesondere für Kraftfahrzeuge, mit einem federnden Wischblatt, das aus einer biegsamen Federschiene, an der etwa in der Mitte der Wischerarm angeschlossen ist und deren Querschnitt nach den Enden zu verringert ist, und einem mit der Federschiene verbundenen Wischgummi od. dgl. besteht und eine gleichsinnige, jedoch stärkere Krümmung als die Scheibe aufweist, dadurch gekennzeichnet, daß zur Erzielung einer gleichbleibenden Flächenpressung des Wischblattes gegen die Scheibe der Krümmungsradius der Federschiene (**27**, **32**, **36**) im unbelasteten Zustand, die vom Angriffspunkt (**29**, **34**, **41**) des Wischerarmes nach beiden Enden fortschreitende Querschnittsverringerung und der Elastizitätsmodul des Materials der Federschiene in Abhängigkeit von der Länge so aufeinander abgestimmt sind, daß die Federkonstante von den Enden zum Angriffspunkt des Wischerarmes mit dem Quadrat der Entfernung von den Enden zunimmt.

2. Scheibenwischer nach Anspruch 1, dadurch gekennzeichnet, daß sich die Breite (**27** *a*) der Federschiene (**27**) zu den Enden (**28**) hin parabelförmig verjüngt.

3. Scheibenwischer nach Anspruch 1, dadurch gekennzeichnet, daß die Dicke (**33**) der Federschiene (**32**) zu den Enden (**35**) hin stetig abnimmt.

4. Scheibenwischer nach den Ansprüchen 1 bis 3, dadurch gekennzeichnet, daß die Steifigkeit der Federschiene in an sich bekannter Weise durch Rippen oder Flansche verändert werden kann.

5. Scheibenwischer nach den Ansprüchen 1 bis 4, dadurch gekennzeichnet, daß die Krümmung der Federschiene im unbelasteten Zustand kreisbogenförmig ist.

In Betracht gezogene Druckschriften:
Französische Patentschriften Nr. 820 156, 1 033 521, 1 039 421, 1 124 116, 1 145 640, 1 217 680;
britische Patentschrift Nr. 593 775.

Hierzu 1 Blatt Zeichnungen

709 620/311 7. 67 © Bundesdruckerei Berlin

BNSDOCID <DE___1247161B1_I_>

Nummer: 1 247 161
Int. Cl.: B 62 d
Deutsche Kl.: 63 c - 82
Auslegetag: 10. August 1967

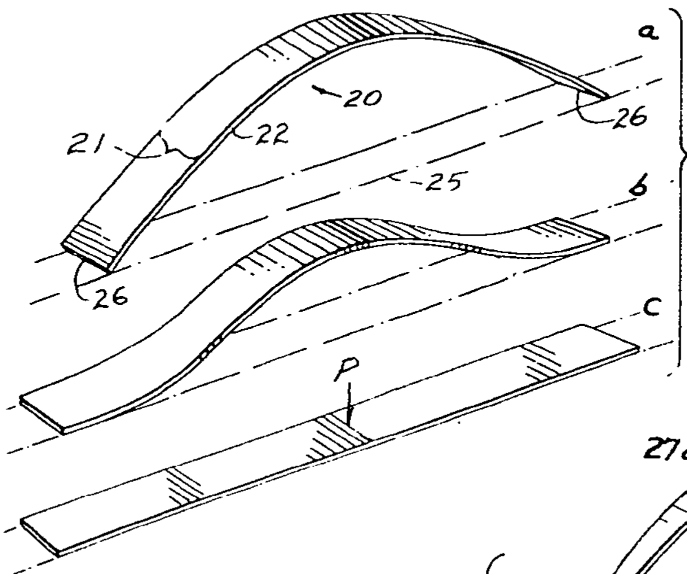

FIG. 1

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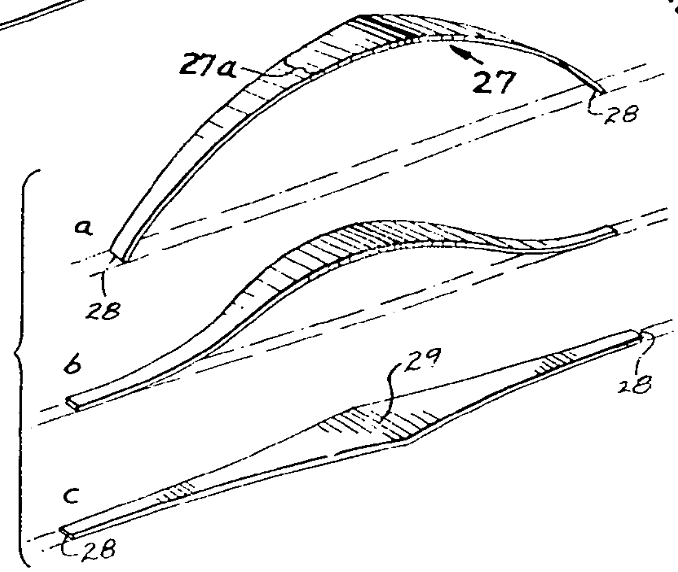


FIG. 2

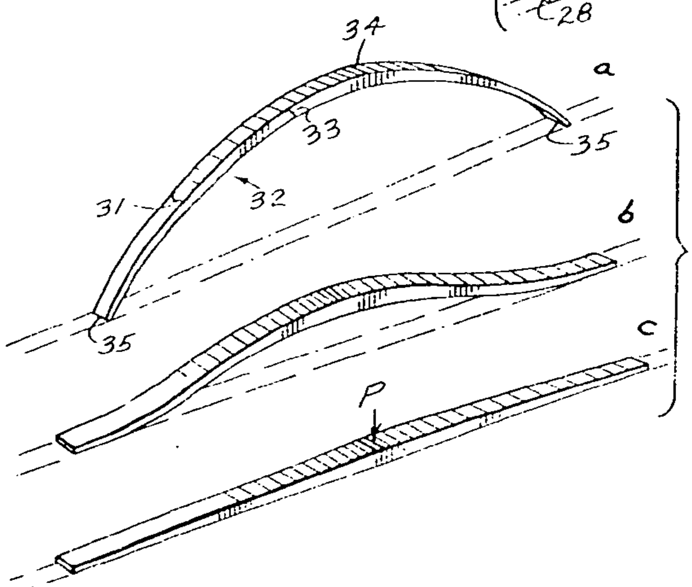


FIG. 3

BNSDOCID: <DE___1247161B1_I_>

Nummer: 1 247 161
Int. Cl.: B 62 d
Deutsche Kl.: 63 c - 82
Auslegetag: 10. August 1967

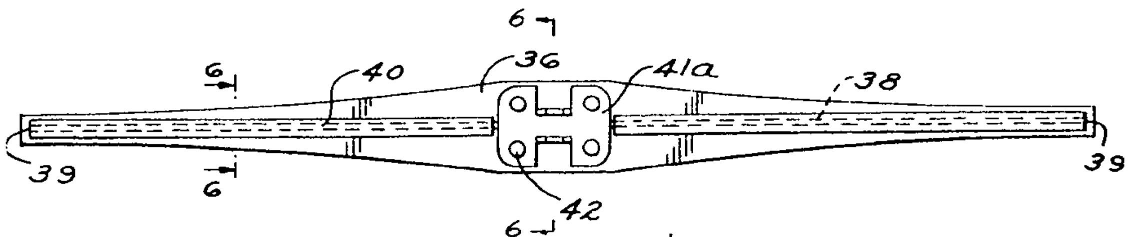


FIG. 4

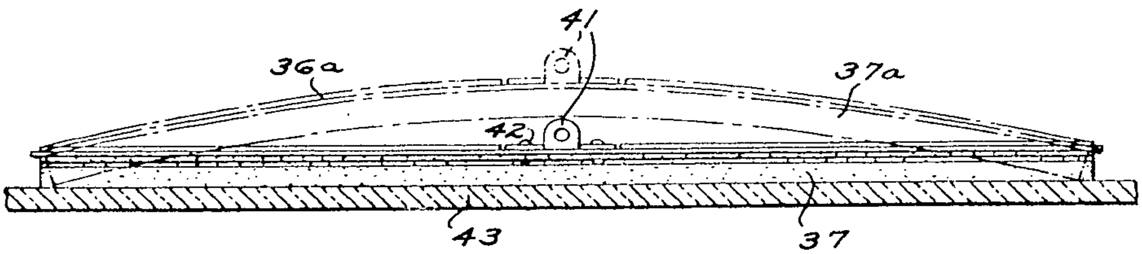


FIG. 5

FIG. 7

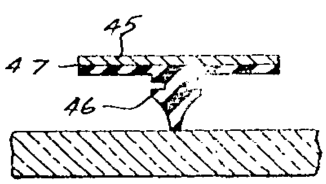


FIG. 6

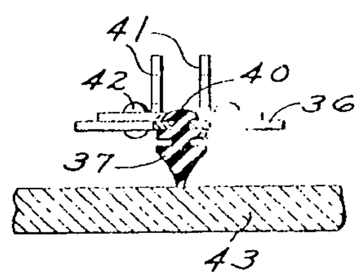
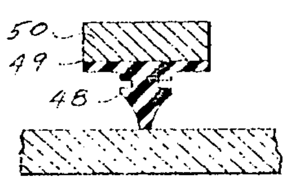


FIG. 8



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JC04 Rec'd PCT/PTO 0 6 APR 2001

PCT

SAH #7 6.21.01

OIPE APR 0 6 2001 PATENT & TRADEMARK OFFICE

TRANSMITTAL OF INFORMATION DISCLOSURE STATEMENT (Under 37 CFR 1.97(b) or 1.97(c))

Docket No. 1524

Re. Application Of: DE BLOCK

Serial No.	Filing Date	Examiner	Group Art Unit
09/786,852	03/09/2001	GRAham	1744

Title: WIPER BLADE FOR WINDSHIELDS, EXPECIALLY OF MOTOR VEHICLES, AND METHOD FOR SUCH A WIPER BLADE

Address to:
Assistant Commissioner for Patents
Washington, D.C. 20231

37 CFR 1.97(b)

1. ☒ The Information Disclosure Statement submitted herewith is being filed within three months of the filing of a national application; within three months of the date of entry of the national stage as set forth in 37 CFR 1.491 in an international application; or before the mailing date of a first Office Action on the merits, whichever event occurs last.

37 CFR 1.97(c)

2. ☐ The Information Disclosure Statement submitted herewith is being filed after three months of the filing of a national application, or the date of entry of the national stage as set forth in 37 CFR 1.491 in an international application; or after the mailing date of a first Office Action on the merits, whichever occurred last but before the mailing date of either:

   1. a Final Action under 37 CFR 1.113, or

   2. a Notice of Allowance under 37 CFR 1.311,

   whichever occurs first.

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Also submitted herewith is:

☐ a certification as specified in 37 CFR 1.97(e);

OR

☐ the fee set forth in 37 CFR 1.17(p) for submission of an Information Disclosure Statement under 37 CFR 1.97(c).

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TRANSMITTAL OF INFORMATION DISCLOSURE STATEMENT
(Under 37 CFR 1.97(b) or 1.97(c))

Docket No.
1524

OIPE APR 0 6 2001 TRADEMARK OFFICE

In Re Application Of: DE BLOCK

Serial No.	Filing Date	Examiner	Group Art Unit
09/786,852	03/09/2001		

Title: WIPER BLADE FOR WINDSHIELDS, EXPECIALLY OF MOTOR VEHICLES, AND METHOD FOR

Payment of Fee

(Only complete if Applicant elects to pay the fee set forth in 37 CFR 1.17(p))

☐ A check in the amount of is attached.

☒ The Assistant Commissioner is hereby authorized to charge and credit Deposit Account No. 19-4675 as described below. A duplicate copy of this sheet is enclosed.

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- ☐ Credit any overpayment.
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I certify that this document and fee is being deposited on APRIL 4, 2001 with the U.S. Postal Service as first class mail under 37 C.F.R. 1.8 and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

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UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner:. Group: Attorney Docket # 1524

Applicant(s) : DE BLOCK, P.

Serial No. : 09/786,852

Filed : 03/09/2001

For : WIPER BLADE FOR WINDSHIELDS...

INFORMATION DISCLOSURE STATEMENT

April 3, 2001

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Honorable Commissioner of Patents
and Trademarks
Washington, D.C. 20231

S I R S:

_____ In accordance with the Duty of Disclosure, Applicant(s) submit(s) herewith a copy of a Foreign Search Report in a counterpart application and copies of the reference(s) indicated therein.

_____ In the event that the Foreign Search Report is in a foreign language, a translation thereof is herewith submitted.

__X__ Attached hereto is a FORM PTO 1449 listing the references.

__X__ Attached hereto is a copy of a reference cited in the specification of the application as filed. The specification itself recites the relevance of these documents.

_____Applicant petitions for consideration of this Information Disclosure Statement since it is being submitted after receipt of an office action. It is respectfully requested that the required fee be charged to the account of the undersigned: 19-4675.

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_____ Attached hereto are copies of references cited which may be pertinent to this application. Since the references are in the English language, no statement of relevancy is submitted.

_____ Attached hereto is a copy of the Office Action issued in the corresponding German application, together with a translation thereof and copies of the references cited therein. A list of the cited references is also attached.

_____ Attached hereto copies of references cited which may be pertinent to this application. An English translation of the references is also attached.

_____Attached hereto is a Statement of Relevancy and copies of references cited therein.

_____ The relevancy of each reference can be found in the English language Abstract attached thereto

Respectfully submitted,

Michael J. Striker
Attorney for Applicant(s)
Reg. No. 27233

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(51) Int. Cl.: B 60 p

BUNDESREPUBLIK DEUTSCHLAND

DEUTSCHES PATENTAMT

(52) Deutsche Kl.: 63 c, 39

(10) (11) Offenlegungsschrift 1 505 357

(21) Aktenzeichen: P 15 05 357.3 (B 80245)

(22) Anmeldetag: 23. Januar 1965

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Ausstellungspriorität: —

(30) Unionspriorität

(32) Datum: —

(33) Land: —

(31) Aktenzeichen: —

---

(54) Bezeichnung: Fahrzeug zur Beförderung von pulverigem Schüttgut

(61) Zusatz zu: —

(62) Ausscheidung aus: —

(71) Anmelder: Blötz, Otto, 3300 Braunschweig

Vertreter: —

(72) Als Erfinder benannt: Erfinder ist der Anmelder

Benachrichtigung gemäß Art. 7 § 1 Abs. 2 Nr. 1 d. Ges. v. 4. 9. 1967 (BGBl. I S. 960): 10. 5. 1968

DT 1 505 357

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⊙ 5. 69 909 822/734 3 80

PATENTANWALT
DR.-ING. HELMUT JOOSS

1505357

33 BRAUNSCHWEIG, den 19.4.1965
STEINWEG (… Rathaus)
RUF 23430
NACH BÜROSCHLUSS 24980

Dr. Expl.

Otto Blötz
Braunschweig, Böcklerstraße 21/22

"Fahrzeug zur Beförderung von pulverigem Schüttgut"

Patentbeschreibung.

Die Erfindung betrifft ein Fahrzeug zur Beförderung von körnigem oder pulverigem Schüttgut, insbesondere Zement, Mehl o.dgl.

Anfangs hatte man versucht, für den Transport derartiger Güter offene Lastkraftwagen zu verwenden. Das Entladen dieser Fahrzeuge verursachte aber scheinbar unüberwindliche Hindernisse. Die Ladung einfach auf die Erde zu schütten, war meist wegen der dadurch bedingten Staubentwicklung undurchführbar. Das Leerschaufeln dagegen verteuerte die Transportkosten so wesentlich, daß man sich nach anderen Transportmöglichkeiten umsehen mußte.

So wurden schließlich Silofahrzeuge konstruiert, die im wesentlichen aus einem oder mehreren, gegebenenfalls kippbaren Druckkesseln bestehen und durch an dem vorderen Silo-Ende eingeblasene Druckluft entleert werden. Infolge des cirka 2 atü betragenden Überdrucks wurde die pulverige Ladung aus einem am Siloausgang vorgesehenen Rohrstutzen über eine Förderleitung in einen Bunker gedrückt.

Aber auch diese Transportmittel zeigten in der Praxis verschiedene Nachteile, die insbesondere ihren wirtschaftlichen Einsatz stark beeinträchtigten. So sind diese Lastkraftwagen ihrer speziellen Ausbildung wegen ausschließlich zum Transport pulveri-

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riger Schüttgüter geeignet. Infolge dieser Einseitigkeit müssen die Silofahrzeuge nach ihrer Entladung die Heimfahrt meist leer antreten, da nur in den seltensten Fällen geeignetes Material für die Rückfahrt zur Verfügung steht. So muß z.B./der ein Kalksandsteinwerk mit losem Kalk beliefernde Transportunternehmer für seine vielen Lastkraftwagen meist eine Leerrückfahrt in Kauf nehmen, da die zum Versand bereitliegenden Steine mit den Spezialfahrzeugen nicht transportiert werden können.

Die beteiligten Kreise scheinen sich mit diesem gewaltigen wirtschaftlichen Nachteil abgefunden zu haben, indem sie einmal die Transportkosten entsprechend hoch berechnen, zum anderen aber einen zusätzlichen Fuhrpark anschaffen, von dem die mit Silofahrzeugen nicht zu erfüllenden Aufgaben übernommen werden können.

Darüberhinaus aber bedeuten die langen Entladezeiten der genannten Fahrzeuge einen zusätzlichen Nachteil. Um den Aufwand der benötigten Luftkompressoranlage in wirtschaftlich vertretbaren Grenzen zu halten, kann bei einem verwendeten Überdruck von etwa 2 atü der Durchmesser des Materialauslaßrohres nur verhältnismäßig klein sein. Neben dem genannten Nachteil können dadurch auch Verstopfungen o.dgl. begünstigt werden.

Alle diese Nachteile werden erfindungsgemäß in einfacher und vollkommener Weise durch einen Kipper vermieden, dessen Wagenkasten unter seiner der Kippachse benachbarten und zu dieser parallel liegenden Kante eine als Auslaß dienende, in einen Luftförderkanal mündende Zellenradschleuse trägt.

Bei Verwendung des Fahrzeugs als Zugmaschine für einen Anhänger kann die mit dem Luftförderkanal versehene Zellenradschleuse vorteilhaft an die Rückseite des Wagenkastens verschwenkt und dort festgelegt werden, um die Anhängerkupplung freizugeben. Somit ergibt sich eine Kombination von Silo-Fahrzeug, Hinterkipper

/der

und

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und Stückgut-Lastkraftwagen.

Um mit möglichst geringem Aufwand eine hohe Förderleistung zu erzielen und dennoch eine Entmischung der zu fördernden körnigen oder mehligen Güter, wie beispielsweise Futtermittel, zu vermeiden, ist es zweckmäßig, den Luftförderkanal für einen im Niederdruckbereich liegenden Druck, vorzugsweise 0,6 atü, auszulegen.

Durch den Einbau sich automatisch öffnender Trennwände im Wagenkasten ist es möglich, mehrere verschiedenartige Schüttgüter gleichzeitig zu befördern, die sich wegen der selbsttätigen Reinigung der Förderrohre auch nicht untereinander vermischen können.

In der Zeichnung ist eine als Beispiel dienende Ausführungsform der Erfindung dargestellt.

Es zeigen:

Fig. 1 eine Seitenansicht des Fahrzeugs und

Fig. 2 in Vergrößerung den Ausfall der Zellenradschleuse.

Danach trägt der Wagenkasten 1 eines Kippers 2 unter seiner der Kippachse 3 benachbarten und zu dieser parallel liegenden Kante 4 eine als Auslaß dienende, in einen Luftförderkanal 5 mündende Zellenradschleuse 6. Diese kann durch einen nicht dargestellten Ölmotor bekannter Bauart angetrieben sein.

Der geringe Luftdruck von cirka 0,6 atü ermöglicht es, den Durchmesser des Luftförderkanals 5 verhältnismäßig groß zu wählen, wodurch sich die Entladezeiten wesentlich verkürzen.

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An das freie Ende des Kanals 5 wird die zu einem Speicherbunker führende Leitung 7 angeschlossen.

Das durch den Pfeil A (s.Fig.2) gekennzeichnete Schüttgut gelangt also über die Zellenradschleuse 6 in den Luftförderkanal 5, von wo es mittels der Förderluft (Pfeil B) durch die Leitung 7 in den Speicherbunker gefördert wird.

Beim Einbau von sich automatisch nacheinander öffnenden Trennwänden 8 im Wagenkasten 1 können verschiedenartige Schüttgüter gleichzeitig befördert werden.

Dr. Expl

Patentansprüche.

1. Fahrzeug zur Beförderung von körnigem oder pulverigem Schüttgut, insbesondere Zement, Mehl o.dgl., gekennzeichnet durch einen Kipper (2), dessen Wagenkasten (1) unter seiner der Kippachse (3) benachbarten und zu dieser parallel liegenden Kante (4) eine als Auslaß dienende, in einen Luftförderkanal (5) mündende Zellenradschleuse (6) trägt.

2. Fahrzeug nach Anspruch 1, dadurch gekennzeichnet, daß die mit dem Luftförderkanal (5) versehene Zellenradschleuse (6) an die Rückseite des Wagenkastens (1) verschwenkbar und dort festlegbar ist.

3. Fahrzeug nach Anspruch 1 oder 2, dadurch gekennzeichnet, daß der Luftförderkanal (5) für einen im Niederdruckbereich liegenden Druck, vorzugsweise um 0,6 atü ausgelegt ist.

4. Fahrzeug nach Anspruch 1, 2 oder 3, gekennzeichnet durch automatisch sich nacheinander öffnende Trennwände (8) im Wagenkasten (1).

909822/0734

(Dr. Jooß)
Patentanwalt

Kl.

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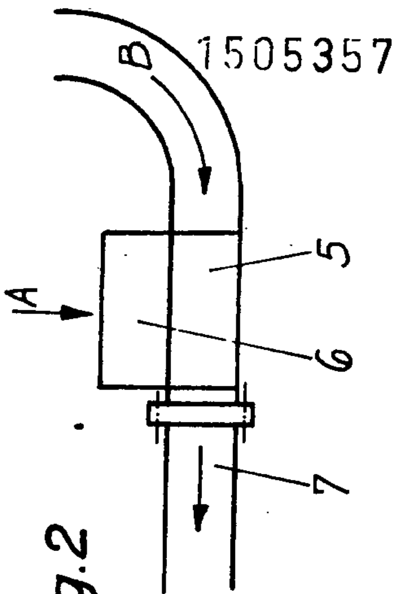

Fig.2

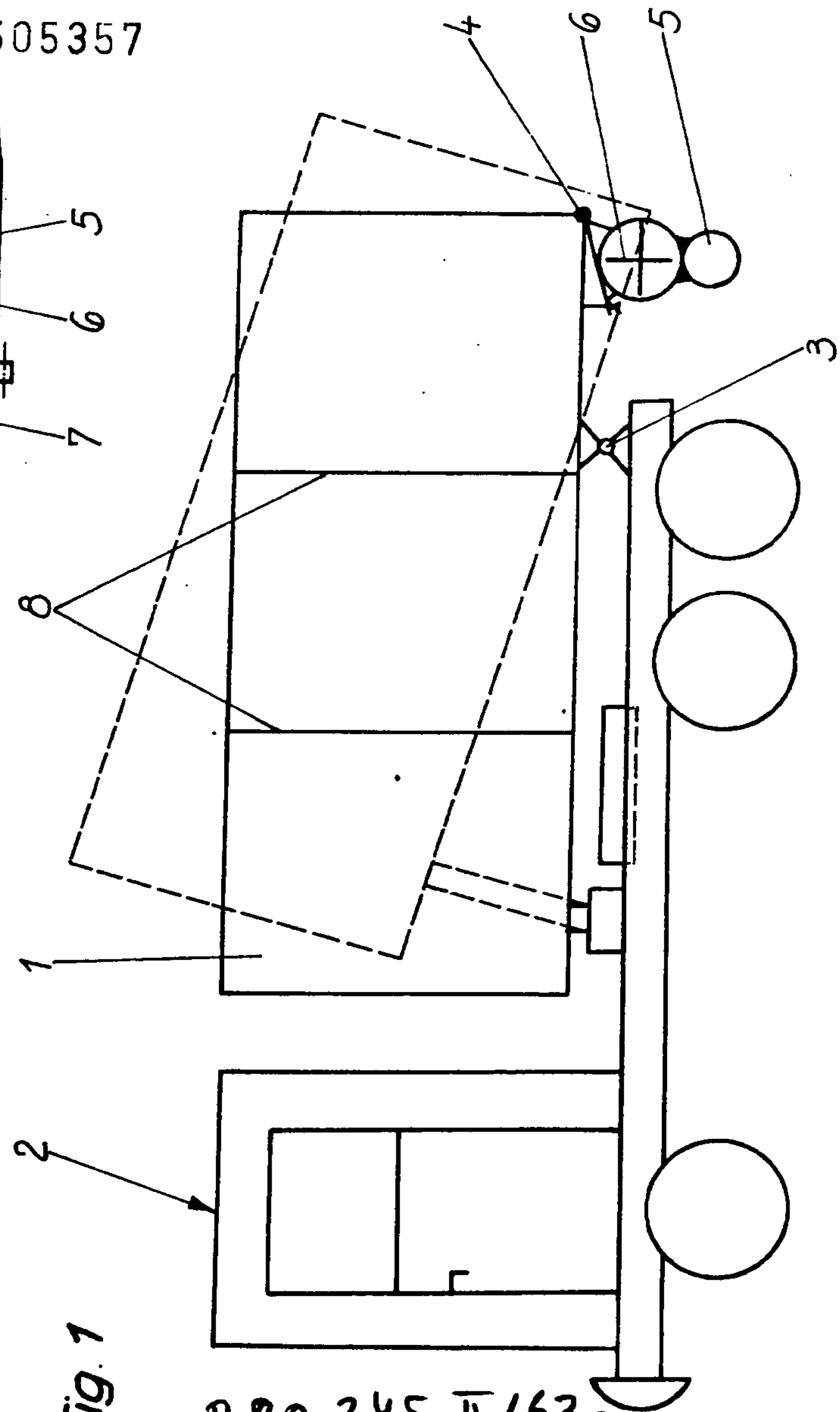

Fig.1

B 80 245 II/63c
-39

Otto Blötz, Braunschweig, Böcklerstraße 21/22

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UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents, Box PCT
United States Patent and Trademark Office
Washington, D.C. 20231
www.uspto.gov

U.S. APPLICATION NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
09/786852	DE BLOCK	P 1524

STRIKER STRIKER & STENBY
103 EAST NECK ROAD
HUNTINGTON, NY 11743

INTERNATIONAL APPLICATION NO.	
PCT/DE00/02168	
I.A. FILING DATE	PRIORITY DATE
06 JUL 00	09 JUL 99

DATE MAILED: 26 APR 2001

NOTIFICATION OF MISSING REQUIREMENTS UNDER 35 U.S.C. 371 IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

1. The following items have been submitted by the applicant or the IB to the United States Patent and Trademark Office as ☐ a Designated Office (37 CFR 1.494) ☒ an Elected Office (37 CFR 1.495):

☒ U.S. Basic National Fee.
☐ Indication of Small Entity Status.
☒ Copy of the international application.
☒ Translation of the international application into English.
☒ Oath or Declaration of inventors(s).
☐ Translation of Article 19 amendments into English.
☐ Copy of Article 19 amendments.
☐ Other:
☒ Priority Document.
☒ The International Preliminary Examination Report in English and its Annexes, if any.
☐ Translation of Annexes to the International Preliminary Examination Report into English.

2. ☐ Applicant has requested early processing under 35 U.S.C. 371(f) but has not filed the following indicated items and/or the indicated items in paragraph 3 below. The Basic National Fee and the copy of the international application must be filed prior to 20 or 30 months from the priority date to avoid abandonment.

☐ U.S. Basic National Fee. ☐ Copy of the international application.

3. The following items **MUST** be furnished within the period set forth below in order to complete the requirements for acceptance under 35 U.S.C. 371:

☐ a. Translation of the application into English. A processing fee will be required if submitted later than the appropriate 20 or 30 months from the priority date.
  ☐ The current translation is defective for the reasons indicated on the attached Notice of Defective Translation.

☐ b. Processing fee for providing the translation of the application and/or the Annexes later than the appropriate 20 or 30 months from the priority date (37 CFR 1.492(f)).

☒ c. Oath or declaration of the inventors, in compliance with 37 CFR 1.497(a) and (b), properly identifying the application (preferably by the International application number and international filing date). A surcharge will be required if submitted later than the appropriate 20 or 30 months from the priority date.
  ☒ The current oath or declaration does not comply with 37 CFR 1.497(a) and (b) for the reasons indicated ~~on the attached PCT/DO/EO/917~~. unexecuted

☒ d. Surcharge for providing the oath or declaration later than the appropriate 20 or 30 months from the priority date (37 CFR 1.492(e)).

4. Additional claim fees of $__________ as a ☐ large entity ☐ small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due (37 CFR 1.492(g)). See attached PTO-875.

5. ☐ Applicant has not submitted the required sequence listing pursuant to 37 CFR 1.821-1.825. See attached PCT/DO/EO/920.

ALL OF THE ITEMS SET FORTH IN 3(a)-3(d), 4 AND 5 ABOVE MUST BE SUBMITTED WITHIN TWO (2) MONTHS FROM THE DATE OF THIS NOTICE OR BY 22 OR 32 MONTHS (where 37 CFR 1.495 applies) FROM THE PRIORITY DATE FOR THE APPLICATION, WHICHEVER IS LATER. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

6. If box 3a or 3c is checked, a translation of the Annexes MUST be submitted no later than the time period set above or the Annexes will be cancelled. A processing fee will be required if submitted later than 20 or 30 months from the priority date.

7. ☐ The Article 19 amendments are cancelled since a translation was not provided by the appropriate 20 (37 CFR 1.494(d)) or 30 (37 CFR 1.495(d)) months from the priority date.

Applicant is reminded that any communication to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above. (37 CFR 1.5)

A copy of this notice MUST be returned with this response.

Enclosed: ☐ PCT/DO/EO/917 ☐ Notice of Defective Translation
☐ PTO-875 ☐ PCT/DO/EO/920

India Evans
Telephone: 703-305-2936

FORM PCT/DO/EO/905 (March 2001)

(12) NACH DEM V RAG ÜBER DIE INTERNATIONALE ZUSA ENARBEIT AUF DEM GEBIET DES PATEN ESENS (PCT) VERÖFFENTLICHTE INTERNATIONALE ANMELDUNG

(19) Weltorganisation für geistiges Eigentum
Internationales Büro

(43) Internationales Veröffentlichungsdatum
18. Januar 2001 (18.01.2001)

PCT

(10) Internationale Veröffentlichungsnummer
WO 01/03982 A1

(51) Internationale Patentklassifikation[7]: B60S 1/38

(21) Internationales Aktenzeichen: PCT/DE00/02168

(22) Internationales Anmeldedatum: 6. Juli 2000 (06.07.2000)

(25) Einreichungssprache: Deutsch

(26) Veröffentlichungssprache: Deutsch

(30) Angaben zur Priorität:
199 31 858.1 9. Juli 1999 (09.07.1999) DE
199 31 856.5 9. Juli 1999 (09.07.1999) DE
199 31 857.3 9. Juli 1999 (09.07.1999) DE
100 32 048.1 5. Juli 2000 (05.07.2000) DE

(71) Anmelder *(für alle Bestimmungsstaaten mit Ausnahme von US)*: **ROBERT BOSCH GMBH** [DE/DE]; Postfach 30 02 20, D-70442 Stuttgart (DE).

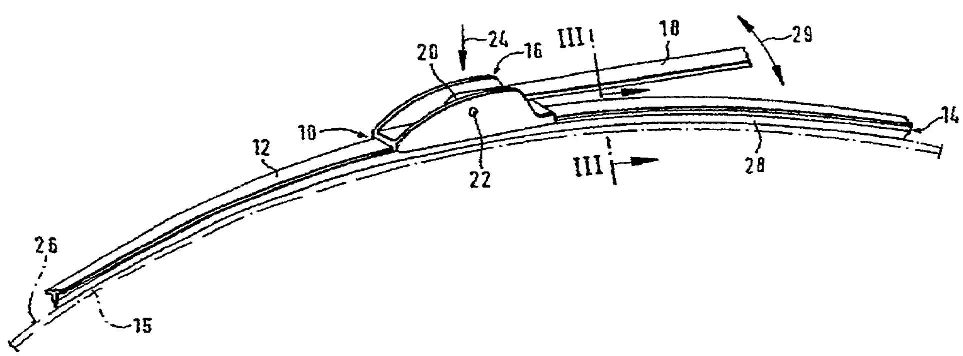
(72) Erfinder; und
(75) Erfinder/Anmelder *(nur für US)*: **DE BLOCK, Peter** [BE/BE]; Pandputweg 5, B-3545 Halen (BE).

(81) Bestimmungsstaaten *(national)*: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN,

[Fortsetzung auf der nächsten Seite]

(54) Title: WIPER BLADE FOR WINDSHIELDS, ESPECIALLY AUTOMOBILE WINDSHIELDS, AND METHOD FOR THE PRODUCTION THEREOF

(54) Bezeichnung: WISCHBLATT FÜR SCHEIBEN, INSBESONDERE VON KRAFTFAHRZEUGEN, SOWIE VERFAHREN ZUM HERSTELLEN EINES SOLCHEN



(57) Abstract: The invention relates to a wiper blade for windshields, especially automobile windshields, comprising at least one support element, a support element (12), a wiper strip (14) and connecting means (16) for a wiper arm (18). The support element (12) is a long flat rod to which the wiper strip (14) and the connecting means (16) are fixed. According to the invention, the flat rod has a cross-sectional profile (40), whereby $F_{wf} * L^2 / 48 * E * I_{zz} < 0.009$ when F_{wf} is the pressure force exerted on the wiper blade or the pressure force for which the wiper blade was originally intended, L represents the length of the wiper blade, E stands for the elasticity module of the flat rod material and I_{zz} is the moment of inertia of the cross-sectional profile around the z axis (perpendicular to an s axis associated with the flat rod and perpendicular to the y axis).

(57) Zusammenfassung: Die Erfindung betrifft ein Wischblatt für Scheiben, insbesondere von Kraftfahrzeugen, mit mindestens einem Tragelement (12), einer Wischleiste (14) und einem Verbindungsmittel (16) für einen Wischerarm (18). Das Tragelement (12) ist ein langgestreckter Flachbalken, an dem die Wischleiste (14) und das Verbindungsmittel (16) befestigt sind. Es wird vorgeschlagen, dass der Flachbalken ein Querschnittsprofil (40) aufweist, bei dem $F_{wf} * L^2 / 48 * E * I_{zz} <0{,}009$ sind, wenn F_{wf} die auf das Wischblatt ausgeübte Auflagekraft oder die Auflagekraft ist, für die das Wischblatt ursprünglich ausgelegt wurde, L die Länge des Wischblatts, E der Elastizitätsmodul des Flachbalkenwerkstoffs und I_{zz}

[Fortsetzung auf der nächsten Seite]

WO 01/03982 A1

JC13 Rec'd PCT/PTO 0 9 MAR 2001

FORM PTO-1390 (Modified) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE
(REV 10-95)

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER
1524

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR
09/786852

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/DE 00/02168	JULY 6, 2000	JULY 9, 1999

TITLE OF INVENTION
WIPER BLADE FOR WINDSHIELDS, ESPECIALLY OF MOTOR VEHICLES, AND METHOD FOR PRDUCING SUCH A WIPER BLADE

APPLICANT(S) FOR DO/EO/US
Peter DE BLOCK

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
   - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   - b. ☒ has been transmitted by the International Bureau.
   - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   - b. ☐ have been transmitted by the International Bureau.
   - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   - d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 18 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
    A **SECOND** or **SUBSEQUENT** preliminary amendment.
16. ☐ A substitute specification.
17. ☐ A change of power of attorney and/or address letter.
18. ☒ Certificate of Mailing by Express Mail
19. ☐ Other items or information:

EF 215953499 US

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PCTUS1/REV03

JC02 Rec'd PCT/PTO 09 MAR 2001

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/786852	PCT/DE 00/02168	1524

		CALCULATIONS	PTO USE ONLY
20. The following fees are submitted:. **BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :**			
☐ Search Report has been prepared by the EPO or JPO	**$930.00**		
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482)	**$720.00**		
☐ No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2))	**$790.00**		
☒ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO	**$1,070.00**		
☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4)	**$98.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =		**$1,000.00**	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).		**$0.00**	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	18 - 20 =	0	x $18.00	**$0.00**	
Independent claims	7 - 3 =	4	x $80.00	**$320.00**	
Multiple Dependent Claims **(check if applicable).**			☐	**$0.00**	
	TOTAL OF ABOVE CALCULATIONS =			**$1,320.00**	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) **(check if applicable).**			☐	**$0.00**	
	SUBTOTAL =			**$1,320.00**	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +				**$0.00**	
	TOTAL NATIONAL FEE =			**$1,320.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).**			☐	**$0.00**	
	TOTAL FEES ENCLOSED =			**$1,320.00**	
				Amount to be: refunded	$
				charged	$

☐ A check in the amount of to cover the above fees is enclosed.

☒ Please charge my Deposit Account No. **19-4675** in the amount of **$1,320.00** to cover the above fees. A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **19-4675** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

STRIKER, STRIKER & STENBY
103 EAST NECK ROAD
HUNTINGTON, NEW YORK 11743

SIGNATURE

MICHAEL J. STRIKER
NAME

27233
REGISTRATION NUMBER

MARCH 9, 2001
DATE

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09/786852
JC02 Rec'd PCT/PTO 09 MAR 2001

UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner: Group: Attorney Docket # 1524

Applicant(s) : DE BLOCK, P.

Serial No. :

Filed : Simultaneously

For : WIPER BLADE FOR WINDSHIELDS, ESPECIALLY OF MOTOR VEHICLES, AND METHOD FOR PRODUCING SUCH A WIPER BLADE

SIMULTANEOUS AMENDMENT

March 9, 2001

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

S I R S:

Simultaneously with filing of the above identified application please amend the same as follows:

In the Claims:

Cancel all claims without prejudice.

Add the following claims as attached.

REMARKS:

This Amendment is submitted simultaneously with filing of the above identified application.

With the present Amendment applicant has amended the claims so as to eliminate their multiple dependency.

Consideration and allowance of the present application is most respectfully requested.

Respectfully submitted,

Michael J. Striker
Attorney for Applicant(s)
Reg. No. 27233

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Claims

19. A wiper blade for windows, in particular of motor vehicles, with at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, characterized in that the support element (12) has a cross sectional profile in which

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0.009,$$

where F_{wf} is the contact force exerted on the wiper blade by the wiper arm (18) or is the contact force for which the wiper blade was originally designed, L is the length of the support element (12), E is the elasticity modulus of the support element (12), and I_{zz} is the moment of inertia of the cross sectional profile around the z-axis perpendicular to an s-axis, which adapts along with the support element (12), and perpendicular to a y-axis.

20. The wiper blade according to claim 19, characterized in that

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0.005.$$

21. The wiper blade according to claim 19, characterized in that the support element (12) has an essentially rectangular cross sectional profile (40), with an essentially constant width b and an essentially constant thickness d.

22. The wiper blade according to claim 19, characterized in that the support element (12) is comprised of at least two individual bars (42, 44) and that the widths (b1, b2) of the individual bars (42, 44) add up to a total width b.

23. The wiper blade according to claim 19, characterized in that the width b and the thickness d of the support element (12) are selected so that

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0.009 .$$

24. The wiper blade according to claim 19, characterized in that the width b and the thickness d of the flat bar are selected so that

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0.005 .$$

25. A wiper blade for windows, in particular of motor vehicles, with at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated,

flat bar to which the wiper strip (14) and the connecting device (16) are attached, in particular according to one of the preceding claims, characterized in that the support element (12) has a cross sectional profile (40) which produces a lateral deflection angle of at least one of the support element ends in relation to the longitudinal span of the support element of $\gamma < 0.5°$, in particular $< 0.3°$ against the window (26), when the wiper blade is moved on the window (26) lateral to its longitudinal span, and the friction coefficient between the window (26) and the wiper strip (14) is approximately 1.

26. A wiper blade for windows, in particular of motor vehicles, with at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, in particular according to one of the preceding claims, characterized in that the support element has a length L, a width b, and a thickness d such that

$$20L^2 < bd^2 < 40L^2$$

in which L is given in meters and b and d are given in millimeters.

27. The wiper blade according to claim 26, characterized in that the support element is comprised of two spring bars whose widths are added to each other.

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28. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), has values such that the second derivative of the curvature as a function of this coordinate (s) is essentially proportional to a contact force distribution p (s), which is produced when the wiper blade (10) is pressed against a flat window (15), and that the contact force distribution decreases toward at least one end.

29. The wiper blade according to claim 28, characterized in that

$$\frac{d^2K(s)}{ds^2} = \frac{d^2M(s)}{ds^2} * E * I = \frac{p(s)}{E*I}$$

s = coordinate along the support element

K(s) = curvature of the support element

M(s) = bending moment

E = elasticity modulus

I = surface moment of inertia of the support element in relation to the neutral axis

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p(s) = specific force per unit length = contact force distribution.

30. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), has values such that the second derivative of the curvature as a function of this coordinate (s) minus the second derivative of the curvature of the window (15) decreases from a middle region (40) toward the ends.

31. The wiper blade according to claim 30, characterized in that the middle region (40) is the location of the connecting device (16).

32. The wiper blade according to one of claim 30, characterized in that

$$\frac{d^2K(s)}{ds^2} = \frac{p(s)}{E*I} + \frac{d^2K_{window}(s)}{ds^2}$$

s = coordinate along the support element

$K(s)$ = curvature of the support element

$M(s)$ = bending moment

E = elasticity modulus

I = surface moment of inertia of the support element in relation to the neutral axis

$p(s)$ = specific force per unit length = contact force distribution.

33. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), has values such that the contact force distribution p (s), which prevails when the wiper blade (10) is pressed against a flat window (15) is greater in a region (40) approximately halfway between the center and the end of the wiper blade (10) than it is at the end of the wiper blade (10).

34. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the

support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), has values such that the contact force distribution p (s), which prevails when the wiper blade (10) is pressed against the window (15) to be wiped, is greater in a region (40) approximately halfway between the center and the end of the wiper blade (10) than it is at the end of the wiper blade (10).

35. A method for producing a wiper blade according to claim 19, characterized by means of the following process steps:
determination of the length L and adapted contact force F_{wf} required for the window to be wiped,
determination of the width b and the thickness d,
determination of the curvature progression K(s),
bending of the support element,
connection of the support element, wiper strip, and connecting device.

36. The method according to claim 35, characterized by means of the following process steps:

- determination of the length L and the cross sectional profile, particularly the width b and the thickness d by means of experimental values,
- determination of a contact force F_{wf} and a contact force distribution p for a flat window, which assures a favorable wiping quality, likewise by means of experimental values,

- measurement of the curvature progression K_{window} of the window,
- double derivation of this curvature progression K_{window} of the window as a function of a coordinate that adapts along with the curvature,
- calculation of the second derivative of the curvature progression K(s) of the support element according to the above relation,
- double integration yields the desired curvature progression K(s) of the support element.

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Wiper Blade for Windshields, Especially of Motor Vehicles, and Method for Producing Such a Wiper Blade

Prior Art

In wiper blades of the type described in the preamble to claim 1, the support element should assure a predetermined distribution of the wiper blade pressing force - often also called pressure - applied by the wiper arm against the window, over the entire wiping zone that the wiper blade sweeps across. Through an appropriate curvature of the unstressed support element - i.e. when the wiper blade is not resting against the window - the ends of the wiper strip, which is placed completely against the window during the operation of the wiper blade, are loaded in the direction of the window by the support element, which is then under stress, even when the curvature radii of spherically curved vehicle windows change in every wiper blade position. The curvature of the wiper blade must therefore be slightly sharper than the sharpest curvature measured in the wiping zone of the window to be wiped. The support element thus replaces the costly support bracket design that has two spring strips disposed in the wiper strip, which is the kind used in conventional wiper blades (DE-OS 15 05 357).

The invention is based on a wiper blade as generically defined by the independent claims. In a known wiper blade of this type (DE-PS 12 47 161), a number of embodiments of the support elements are provided as a solution to the problem of producing the most uniform possible pressure load of the wiper blade over its entire length against a flat window.

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In another known wiper blade of this generic type (EP 0 528 643 B1), in order to produce a uniform pressure load of the wiper blade against spherically curved windows, the pressure load increases significantly in the two end sections when the wiper blade is pressed against a flat window.

The uniform pressure distribution over the entire wiper blade length that is sought in both cases, however, leads to an abrupt flipping over of the wiper lip, which belongs to the wiper blade and performs the actual wiping function, over its entire length, from its one drag position into its other drag position when the wiper blade reverses its working direction. This drag position is essential for an effective, quiet operation of the wiper system. The abrupt flipping over of the wiper lip, however, - which is inevitably connected with an up and down motion of the wiper blade - generates an undesirable tapping noise. In addition, the matching of the support element tension to the desired pressure distribution, which differs from case to case, is problematic with spherically curved windows.

EP 0 594 451 describes flat bar wiper blades with a varying profile, which should not to exceed a particular lateral deflection when a test force is applied to them. To that end, an extremely complex interrelationship among internal parameters that characterize the spring bar are used to determine a quantity which should not exceed a certain threshold value. The equation given permits only complex and incomplete conclusions to be reached regarding the actual quantities to be entered. The other data relate to an unstressed wiper blade so that it is hardly possible to draw conclusions as to the quality of a wiper blade during operation.

In addition, putting the teaching of the known prior art to use turns out to be difficult since the available parameters cannot be applied directly to wiper blades to be newly manufactured.

Advantages of the Invention

The wiper blade according to the invention, with the features of the main claim, has the advantage of an entirely favorable wiping quality because among other things, a rattling of the wiper blade across the window - the so-called slip-stick effect - is prevented. This results from the knowledge that for the slip-stick effect, attention must be paid particularly to the lateral deflection angle and less so to the absolute lag, i.e. the absolute deflection of the tips under stress. It is therefore advantageous if the wiper blade is designed so that the lateral deflection of the ends of the wiper blades, which lag behind during operation, does not exceed a lateral deflection angle of a particular magnitude. From the quantity discovered for this angle, important parameters can then be derived for the wiper blade, which have a simple relation to one another and which, in this relation, should not exceed an upper limit of 0.009. With the aid of this relation and the upper limit indicated, cross sectional profiles for the support element can be very simply determined, which then produce a favorable wiping result. In particular, wiper blades with a constant cross section over their lengths are particularly easy to produce in this manner.

Advantageous improvements and embodiments of the wiper blade according to the invention are possible by means of the measures disclosed in the remaining claims.

The wiping quality increases further if the proportion of the product of the contact force and the square of the length to the product of 48 times the elasticity modulus of the support element and the I_{zz} moment of inertia does not exceed an upper limit of 0.005.

Particularly useful cross sectional profiles are rectangular in design and have an essentially constant width and an essentially constant thickness over the length of the wiper blade. The support element can also be comprised of individual bars which are disposed laterally next to one another or one on top of another and their overall width or their overall thickness are respectively added together to produce an overall width and/or an overall thickness. With such a rectangular cross sectional profile, the moment of inertia I_{zz} can be entered as $d*b^3/12$, where the overall thickness and the overall width are entered as d and b, respectively. This produces an easy-to-apply relation via which the support element can be optimized for the wiper blades if the given upper limits of 0.009 and particularly 0.005 are not exceeded.

Particularly if more complex cross sectional profiles are chosen for the support element, which vary, for example, over the length of the wiper blade or have a ladder-type structure or the like, a favorable wiping quality can nevertheless be achieved if consideration is given to the fact that the lateral deflection angle γ does not exceed a

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magnitude of 0.5° and in particular 0.3° during operation of the wiper blade. These specifications apply for an average friction value μ of 1 and must be correspondingly increased or decreased when there are higher or lower friction values.

The lateral deflection angle γ is the angle at which the tangent to the support element end intersects the axis extending in the longitudinal direction of the support element. In a first approximation, this angle can also be understood to be the angle enclosed by the axis extending in the longitudinal span direction of the support element and a straight line passing through a support element end and the fulcrum point of the wiper arm on the support element.

Very good wiping results can be achieved if the width b and the thickness d remain in a definite proportion to the overall length of the support element. In particular, the product of the width and the square of the thickness should not exceed 40 times the square of the length and should not be less than 20 times the square of the length. The widths and/or the thicknesses of combined support elements are respectively added together to produce an overall width and overall thickness, which is then taken into consideration.

The wiper blade according to the invention, with the features of claim 10, has the advantage that only one parameter has to be varied in order to adjust the outwardly decreasing contact force distribution. The curvature or the curvature progression along the support element can be preset in freely programmable bending machines. As a result, short trial runs can also be carried out to optimize the contact force distribution and therefore the curvature progression rapidly and without a great deal of expense. It is particularly advantageous if the coordinate that governs the curvature progression extends along the inertial element. This eliminates the need for complex reverse calculations in a Cartesian coordinate system in which each change in a position x requires a shifting of the subsequent "x values".

The mathematical association between the second derivative of the curvature as a function of the adapted coordinate and the contact force progression likewise as a function of the adapted coordinate is particularly simple if the elasticity modulus of the support element material and the surface moment of inertia of the support element are constant over its length. With a preset contact pressure distribution, the curvature can then be directly calculated through double integration or also numerically.

An optimal adaptation of such a wiper blade to windows with a complex curvature progression is also possible if the curvature of the window is subtracted from the curvature of the support element or the second derivative of the curvature of the window is subtracted from the second derivative of the curvature of the support element. In this instance, a contact force distribution can be preset in the same way that is desirable for a wiper blade that is pressed against a flat window. The difference between the second derivatives of the respective curvatures is then once more proportional to this contact force distribution.

A wiper blade according to the invention, with the features of claim 15, excels in that without special adaptation, an excellent wiping result is achieved for

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average window types. The very simple steps taken result in the fact that the contact force distribution fulfills the requirements in most cases. The support points mentioned above are sufficiently precise to use as the basis for a curvature progression to be maintained.

A wiper blade according to claim 15 is optimized through the steps taken in claim 16. Even with complex window curvature progressions, the wiping quality can be increased by presetting the contact force distribution to particular support points. It is nevertheless possible to design the wiper blade without complex calculations. The curvature progression can be essentially predetermined and can be optimized by means of simple trials. An excellent wiping quality is assured as long as the prerequisites are met that the contact force distribution that prevails when the wiper blade is pressed against the window to be wiped is greater in a region approximately halfway between the center and the end of the wiper blade than it is at the end of the wiper blade.

In a method according to the invention for producing such a wiper blade, the individual parameters are selected in accordance with the teaching according to the invention and the support element is pre-curved so that its curvature progression fulfills at least one of the conditions mentioned above. As a result, it is particularly favorable to bend the support element first and then to put it together with the wiper strip and the connecting element. However, it is also possible to attach the connecting element to the support element first and then to add the wiper strip.

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Drawings

Fig. 1	is a perspective representation of a wiper blade that is placed against the window and is connected to a wiper arm which is loaded toward the window,
Fig. 2	is a schematic side view of a wiper blade, which is placed in an unstressed state against the window, in a reduced scale compared to Fig. 1,
Fig. 3	shows the sectional plane of an enlarged section through the wiper blade according to Fig. 1, along the line III - III,
Figs. 4 and 5	show a variant of Fig. 3,
Figs. 6 and 7	show a wiper blade in a different embodiment, with a coordinate system sketched in,
Figs. 8 and 9	respectively show calculated and measured values for the contact force distribution plotted over the length of the wiper blade, and
Fig. 10	is a schematic side view, not to scale, of a support element belonging to the wiper blade.

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Description of the Exemplary Embodiment

A wiper blade 10 shown in Fig. 1 has an elongated, spring elastic support element 12, which is also referred to as a flat bar, for a wiper strip 14, which is shown separately in Fig. 10. As shown in Figs. 1, 3, and 4, the support element 12 and the wiper strip 14 are connected to each other with their longitudinal axes parallel. On the top side of the support element 12 remote from the window 15 to be wiped - shown with dot-and-dash lines in Fig. 1 -, there is a connecting mechanism in the form of a connecting device 16 which can detachably connect the wiper blade 10 to a driven wiper arm 18 that is guided on the body of the motor vehicle. The elongated rubber elastic wiper strip 14 is disposed on the underside of the support element 12 oriented toward the window 15.

A hook, which serves as a counterpart connection means, is formed onto the free end 20 of the wiper arm 18 and engages a pivot bolt 22 that is part of the connecting device 16 of the wiper blade 10. The securing between the wiper arm 18 and the wiper blade 10 is achieved by an intrinsically known securing mechanism, which is not shown in detail and is embodied in the form of an adapter.

The wiper arm 18, and therefore also its hook ends 20, is loaded in the direction of the arrow 24 toward the window 15 to be wiped, whose surface to be wiped is indicated with a dot-and-dash line 26 in Figs. 1 and 2. The contact force F_{wf} (arrow 24) places the wiper blade 10 with its entire length against the surface 26 of the window 15 to be wiped.

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Since the dot-and-dash line 26 shown in Fig. 2 is intended to represent the sharpest curvature of the window surface in the vicinity of the wiping zone, it is clear that the curvature of the wiper blade 10, which is as yet unstressed and rests with its two ends against the window, is sharper than the maximal curvature of the spherically curved window 15. When the contact force F_{wf} (arrow 24) is applied, the wiper blade 10 rests with its wiper lip 28, which is part of the wiper strip 14, over its entire length against the window surface 26. This produces a tension in the band-like, spring elastic support element 12, which ensures a proper contact of the wiper strip 14 or rather the wiper lip 28 over its entire length against the vehicle window 15. During wiper operation, the wiper arm 18 moves the wiper blade 10 lateral to its longitudinal span, across the window 15. In Fig. 1, this wiping or working motion is indicated by the double arrow 29.

The particular embodiment of the wiper blade according to the invention will now be discussed in detail below. As shown in Fig. 3, not to scale, the wiper strip 14 is disposed on the lower band surface of the support element 12, oriented toward the window 15. Spaced apart from the support element 12, the wiper strip 14 is indented on its two longitudinal sides so that a tilting hinge 30 remains in its longitudinal center region, which extends over the entire length of the wiper strip 14. The tilting hinge 30 transitions into the wiper lip 28, which has an essentially wedge-shaped cross section. The contact force (arrow 24) presses the wiper blade or rather the wiper lip 28 against the surface 26 of the window 15 to be wiped, and as a result of the wiping motion - of which Fig. 3 particularly shows the one of the two opposite wiping motions (double arrow 29)

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indicated by the direction arrow 32 - the wiper lip 28 tilts into a so-called drag position, in which the wiper lip is supported along its entire length against the part of the wiper strip 14 that is secured to the support element 12. This support, which is indicated with the arrow 34 in Fig. 3, always takes place - depending on the respective wiping direction (double arrow 29 and arrow 32, respectively) - against the upper edge of the wiper lip 28 disposed toward the rear in the respective wiping direction so that the wiper lip 28 is always guided across the window in a so-called drag position. This drag position is required for an effective, quiet operation of the wiper device. The reversal of the drag position takes place at the so-called reversal position of the wiper blade 10, when the blade changes its wiping direction (double arrow 29). As a result, the wiper blade executes an up and down motion which is necessitated by the tilting over of the wiper lip 28. The upward motion occurs counter to the direction of the arrow 24 and consequently also counter to the contact force. In the opposite wiping direction from the arrow 32, a mirror image of Fig. 3 is consequently produced.

Fig. 4, which is an enlarged depiction in comparison to the wiper blade in Fig. 1, shows a cross sectional profile 40 that has a rectangular sectional plane with a width b and a thickness d. In addition, a coordinate system is shown above the support element 12. An s-coordinate, which follows the curvature of the support element 12, is shown as a 3rd coordinate in Fig. 6 and the y- and z-coordinates are perpendicular to it. If the wiper blade 10 is now pressed with a force F_{wf} (arrow 24) against a window 26, particularly by the wiper arm 18, a certain force distribution p(s) is produced, which produces a moment M(s) that is maximal in the center of the support element 12. For a constant contact force distribution

$$p = \frac{F_{wf}}{L}$$

which is favorable for the wiping operation, the moment is

$$M(s) = p * \frac{\left(\frac{L}{2} - s\right)^2}{2}$$

and consequently,

$$M(s) = F_{wf} * \frac{\left(\frac{L}{2} - s\right)^2}{2L}$$

For an outwardly decreasing contact force distribution, which is particularly suitable for tilting wiper lips over, the moment M(s) over its entire length is somewhat less than the moment calculated for a constant force distribution:

$$M(s) < p * \frac{\left(\frac{L}{2} - s\right)^2}{2}$$

If one then assumes that a friction value μ for a dry window is approximately 1, the lateral moment during operation is equal to the bending moment M(s), which in particular is a result of the preset force distribution p(s).

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Based on the lateral bending moment, a lateral deflection angle γ can be inferred, which can be calculated by integration of the individual deflections from the fulcrum point of the wiper arm on the wiper blade to the wiper blade end. In the case of a centrally disposed connecting device 16, the deflection angle is calculated according to the equation:

$$\gamma = \int_0^{L/2} \frac{M(s)}{E * I_{zz}} ds$$

In view of the relation of the moment for a constant contact force distribution, a simple estimate for the angle γ is obtained by:

$$\gamma < \int_0^{L/2} \frac{p(s)\left(\frac{L}{2} - s\right)}{2 * E * I_{zz}} ds$$

Integration yields the equation:

$$\gamma < \frac{p * L^3}{48 * E * I_{zz}} = \frac{F_{wf} * L^2}{48 * E * I_{zz}}$$

Among other things, the invention is based on the knowledge that a favorable wiping quality, particularly due to rattle prevention, is achieved if the angle γ does not exceed the value 0.5° (=0.009 rad) and in particular, 0.3° (=0.005 rad). As a result, a simple relation can be deduced between the contact force and the geometric dimensions of the wiper blade, according to which

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0.009 \text{ ,}$$

in particular < 0.005.

For the most frequently occurring case of a rectangular profile 40, as shown in Fig. 3, the moment of inertia is determined by:

$$I_{zz} = \frac{d * b^3}{12}$$

where d = thickness of the support element
b = width of the support element.

The width b and the thickness d must therefore be selected so that

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0.009 \text{ ,}$$

in particular < 0.005.

If the support element 12 is divided into two separate spring bars 42 and 44, as shown in Fig. 4, then in the above considerations in the first approximation, the width b can be assumed to be the sum of the individual widths b1 and b2: $b = b_1 + b_2$. Hence simple relations between the width and thickness of a support element can also be deduced for systems of this kind.

For the case in which a rectangular cross sectional profile is not selected, it is then necessary to determine the moment of inertia I_{zz} and to correspondingly insert it into the relations mentioned above. Likewise, cross sectional changes over the length of the wiper blade or a non-central fulcrum point of the wiper arm on the wiper blade must also be correspondingly taken into account in the above considerations.

In order to achieve the quietest possible tilting over of the wiper lip 28 from its one drag position into its other drag position, the support element 12 that is used to distribute the contact force (arrow 24) is designed so that the contact force of the wiper strip 24, or rather the wiper lip 28, against the window surface 26 is greater in its middle section 36 (Fig. 11) that in at least one of the two end sections 38.

The distribution of the contact force over the support element occurs as a function of various parameters of the support element such as the cross sectional profile, the cross sectional progression over the length of the support element, or also the radius progression R(s) along the support element. An optimization of the support element in the direction of a predetermined contact force distribution p(s) is therefore very complex. The invention is based on the knowledge that in a support element with an essentially constant, in particular rectangular cross section over the length of the support element, the contact force distribution p(s) can be established by predetermining the curvature K along a coordinate s, which coordinate s extends along the support element. The curvature K(s) is equal to the inverse radius as a function of s:

$$K(s) = \frac{1}{R(s)}$$

In the support element, there is a relation between the bending moment M, the radius R of the support element, its elasticity modulus E, and the surface moment of inertia I prevailing at the respective location. The relation is particularly simple when it is related to the coordinate s, which adapts along with the support elements:

$$K(s) = \frac{M(s)}{E * I}$$

Double differentiation as a function of the location s yields the relation:

$$\frac{d^2K(s)}{ds^2} = \frac{d^2M(s)/ds^2}{E * I}$$

Since the second derivative of the bending moment M as a function of the adaptive coordinate s is equal to the contact force distribution d along the coordinate s, which arises when the support element is pressed against a window, then it follows from this that the second derivative of the curvature K as a function of the adaptive coordinate s coincides with this contact force distribution p against a flat window, with the exception of a constant. The constant depends on the elasticity modulus E as well as on the surface moment of inertia I which for its part, is very simple if the cross section in question is rectangular. When there is a preset, outwardly decreasing contact force distribution p, the curvature profile K(s) can be determined mathematically or by simple experimentation. The geometry

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and therefore the parameters of the support element that are required for manufacture are therefore easy for a specialist to determine.

In order to take into account the shape of the window for which the wiper blade should be used, the above relation should be adjusted such that based on the contact force distribution p along the coordinate s - which distribution is predetermined for a flat window, decreases toward the outside, and is also divided by the elasticity modulus E and the surface moment of inertia I -, the second derivative of the curvature K_{window} of the window as a function of the coordinate s must be added to it:

$$\frac{d^2K(s)}{ds^2} = \frac{p(s)}{E*I} + \frac{d^2K_{window}(s)}{ds^2}$$

By means of this, it is also easy for the specialist to configure a support element for a particular window:

- determination of the length L and the cross sectional profile, particularly the width b and the thickness d by means of experimental values,
- determination of a contact force F_{wf} and a contact force distribution p for a flat window, which assures a favorable wiping quality, likewise by means of experimental values,
- measurement of the curvature progression K_{window} of the window,
- double derivation of this curvature progression K_{window} of the window as a function of a coordinate that adapts along with the curvature,

- calculation of the second derivative of the curvature progression K(s) of the support element according to the above relation,
- double integration yields the desired curvature progression K(s) of the support element.

It has turned out that favorable wiping results can be achieved if the curvature K along the adaptive coordinate s is such that the contact force distribution, which prevails when the wiper blade is pressed against a flat window, is greater in a region approximately halfway between the center and the end of the wiper blade than it is at the end of the wiper blade. Figs. 8 and 9 show this region 40 for one side. The invention is based on the knowledge that the progression of the contact force distribution p in the region 40 is of less significance than the relation between the contact force distribution p in the region 40 to the contact force distribution p at the ends of the wiper blade. The overall length L of a wiper blade is plotted in Figs. 8 and 9, respectively, in which the connecting element 16 is disposed in the center of the wiper blade so that the wiper blade ends each occupy the value 0.5 L.

Very favorable wiping results are achieved if the curvature K along a coordinate s that follows the longitudinal span of the support element 12 has values such that the contact force distribution p that prevails when the wiper blade is pressed against the window to be wiped is greater in the region approximately halfway between the center and the end of the wiper blade than it is at the end of the wiper blade. Although taking into account the window shape for which the wiper blade is provided does in fact limit the blade's general suitability for arbitrary window

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types, it also results in the fact that the selected window is wiped in an optimal manner.

Fig. 10 depicts a possible curvature progression K of the support element 12, which can produce a contact force distribution p of the wiper lip 28 against the window 15, which decreases toward the wiper blade end. With this spring elastic support element 12 which, when unstressed, has a sharper hollow curvature toward the window than this window has in the vicinity of the wiping zone swept by the wiper blade, the curvature progression K is designed so that it is sharper in the middle section 36 of the support element 12 than in its end sections 38.

Reducing the contact force of the wiper lip 28 against the window surface 26 in the vicinity of one wiper blade end or at both wiper blade ends prevents the wiper lip 28 from abruptly flipping over or snapping over as it moves from its one drag position into its other drag position. On the contrary, with the wiper blade according to the invention the wiper lip turns over in a comparatively gentle manner, starting from the end of the wiper blade, moving to the center of the wiper lip, and continuing on to the other end of the wiper lip. In combination with Fig. 1, Fig. 3 shows that even with spherically curved windows, the less intensely stressed end sections of the wiper lip 28 still rest against the window surface in an effective manner.

It is common to all of the exemplary embodiments that the contact force (arrow 24) of the wiper strip 14 against the window 15 is greater in its middle section 36 than in at least one of its two end sections 38. This is also the case when - in contrast to the wiper blade 10 graphically

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represented, with a one-piece support element 12 depicted as a spring strip - the support element is embodied as having several parts. In certain circumstances, however, it can also be necessary to preset other contact force distributions. But even then, wiper blades which produce excellent wiping results can be designed using the relations demonstrated.

As has already been indicated above, with the method according to the invention for producing a wiper blade, first the contour and the curvature progression K are determined and then the support element 12 is put together with the wiper strip 14 and the connecting element 16. If the support element is comprised of two parallel, flat bars, these can preferably be pre-curved with each other, i.e. directly next to each other, which assures a very symmetrical and therefore torsionally stable design of the wiper blade. Later in the process, the two support element halves must then be further processed in order to prevent an inadvertent separation. After the support element has been curved, either the wiper blade is first mounted, for example by means of being glued in place or vulcanized in place, or in particular, when there are two support element halves, by means of insertion of the support element halves into longitudinal grooves of the wiper strip, and then the connecting element is mounted. In particular, if the connecting element is welded on, the wiper strip must only be attached afterward in order to avoid thermal damage to the wiper rubber.

Claims

1. A wiper blade for windows, in particular of motor vehicles, with at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, characterized in that the support element (12) has a cross sectional profile in which

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0.009 \text{ ,}$$

where F_{wf} is the contact force exerted on the wiper blade by the wiper arm (18) or is the contact force for which the wiper blade was originally designed, L is the length of the support element (12), E is the elasticity modulus of the support element (12), and I_{zz} is the moment of inertia of the cross sectional profile around the z-axis perpendicular to an s-axis, which adapts along with the support element (12), and perpendicular to a y-axis.

2. The wiper blade according to claim 1, characterized in that

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0.005 \text{ .}$$

3. The wiper blade according to claim 1 or 2, characterized in that the support element (12) has an essentially rectangular cross sectional profile (40), with

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an essentially constant width b and an essentially constant thickness d.

4. The wiper blade according to one of the preceding claims, characterized in that the support element (12) is comprised of at least two individual bars (42, 44) and that the widths (b1, b2) of the individual bars (42, 44) add up to a total width b.

5. The wiper blade according to one of the preceding claims, characterized in that the width b and the thickness d of the support element (12) are selected so that

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0.009 .$$

6. The wiper blade according to one of claims 1 to 4, characterized in that the width b and the thickness d of the flat bar are selected so that

$$\frac{F_{wf} * L^2}{4 * E * d * b^3} < 0.005 .$$

7. A wiper blade for windows, in particular of motor vehicles, with at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, in particular according to one of the preceding claims, characterized in that the support element (12) has a cross sectional profile (40) which produces a

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lateral deflection angle of at least one of the support element ends in relation to the longitudinal span of the support element of $\gamma < 0.5°$, in particular $< 0.3°$ against the window (26), when the wiper blade is moved on the window (26) lateral to its longitudinal span, and the friction coefficient between the window (26) and the wiper strip (14) is approximately 1.

8. A wiper blade for windows, in particular of motor vehicles, with at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, in particular according to one of the preceding claims, characterized in that the support element has a length L, a width b, and a thickness d such that

$$20L^2 < bd^2 < 40L^2$$

in which L is given in meters and b and d are given in millimeters.

9. The wiper blade according to claim 8, characterized in that the support element is comprised of two spring bars whose widths are added to each other.

10. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the

wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), has values such that the second derivative of the curvature as a function of this coordinate (s) is essentially proportional to a contact force distribution p (s), which is produced when the wiper blade (10) is pressed against a flat window (15), and that the contact force distribution decreases toward at least one end.

11. The wiper blade according to claim 10, characterized in that

$$\frac{d^2K(s)}{ds^2} = \frac{d^2M(s)}{ds^2} * E * I = \frac{p(s)}{E*I}$$

s = coordinate along the support element

K(s) = curvature of the support element

M(s) = bending moment

E = elasticity modulus

I = surface moment of inertia of the support element in relation to the neutral axis

p(s) = specific force per unit length = contact force distribution.

12. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against

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the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), has values such that the second derivative of the curvature as a function of this coordinate (s) minus the second derivative of the curvature of the window (15) decreases from a middle region (40) toward the ends.

13. The wiper blade according to claim 12, characterized in that the middle region (40) is the location of the connecting device (16).

14. The wiper blade according to one of claims 12 or 13, characterized in that

$$\frac{d^2K(s)}{ds^2} = \frac{p(s)}{E*I} + \frac{d^2K_{window}(s)}{ds^2}$$

s = coordinate along the support element

K(s) = curvature of the support element

M(s) = bending moment

E = elasticity modulus

I = surface moment of inertia of the support element in relation to the neutral axis

p(s) = specific force per unit length = contact force distribution.

15. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), has values such that the contact force distribution p (s), which prevails when the wiper blade (10) is pressed against a flat window (15) is greater in a region (40) approximately halfway between the center and the end of the wiper blade (10) than it is at the end of the wiper blade (10).

16. A wiper blade for windows (15), in particular of motor vehicles, with at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), in particular according to one of the preceding claims, characterized in that the curvature along a coordinate (s), which follows the longitudinal span of the support element (12), has values such that the contact force distribution p (s), which prevails when the wiper blade (10) is pressed against the window (15) to be wiped, is greater in a region (40) approximately halfway between the center

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and the end of the wiper blade (10) than it is at the end of the wiper blade (10).

17. A method for producing a wiper blade according to one of the preceding claims, characterized by means of the following process steps:
determination of the length L and adapted contact force F_{wf} required for the window to be wiped,
determination of the width b and the thickness d,
determination of the curvature progression K(s),
bending of the support element,
connection of the support element, wiper strip, and connecting device.

18. The method according to claim 17, characterized by means of the following process steps:

- determination of the length L and the cross sectional profile, particularly the width b and the thickness d by means of experimental values,
- determination of a contact force F_{wf} and a contact force distribution p for a flat window, which assures a favorable wiping quality, likewise by means of experimental values,
- measurement of the curvature progression K_{window} of the window,
- double derivation of this curvature progression K_{window} of the window as a function of a coordinate that adapts along with the curvature,
- calculation of the second derivative of the curvature progression K(s) of the support element according to the above relation,
- double integration yields the desired curvature progression K(s) of the support element.

Abstract

The invention relates to a wiper blade for windows, in particular of motor vehicles, with at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18). The support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached. It is proposed that the flat bar have a cross sectional profile (40) in which $F_{wf} * L^2 / 48 * E * I_{zz} < 0.009$, where F_{wf} is the contact force exerted on the wiper blade or is the contact force for which the wiper blade was originally designed, L is the length of the wiper blade, E is the elasticity modulus of the flat bar material, and I_{zz} is the moment of inertia of the cross sectional profile around the z-axis (perpendicular to an s-axis, which adapts along with the flat bar, and perpendicular to a y-axis).

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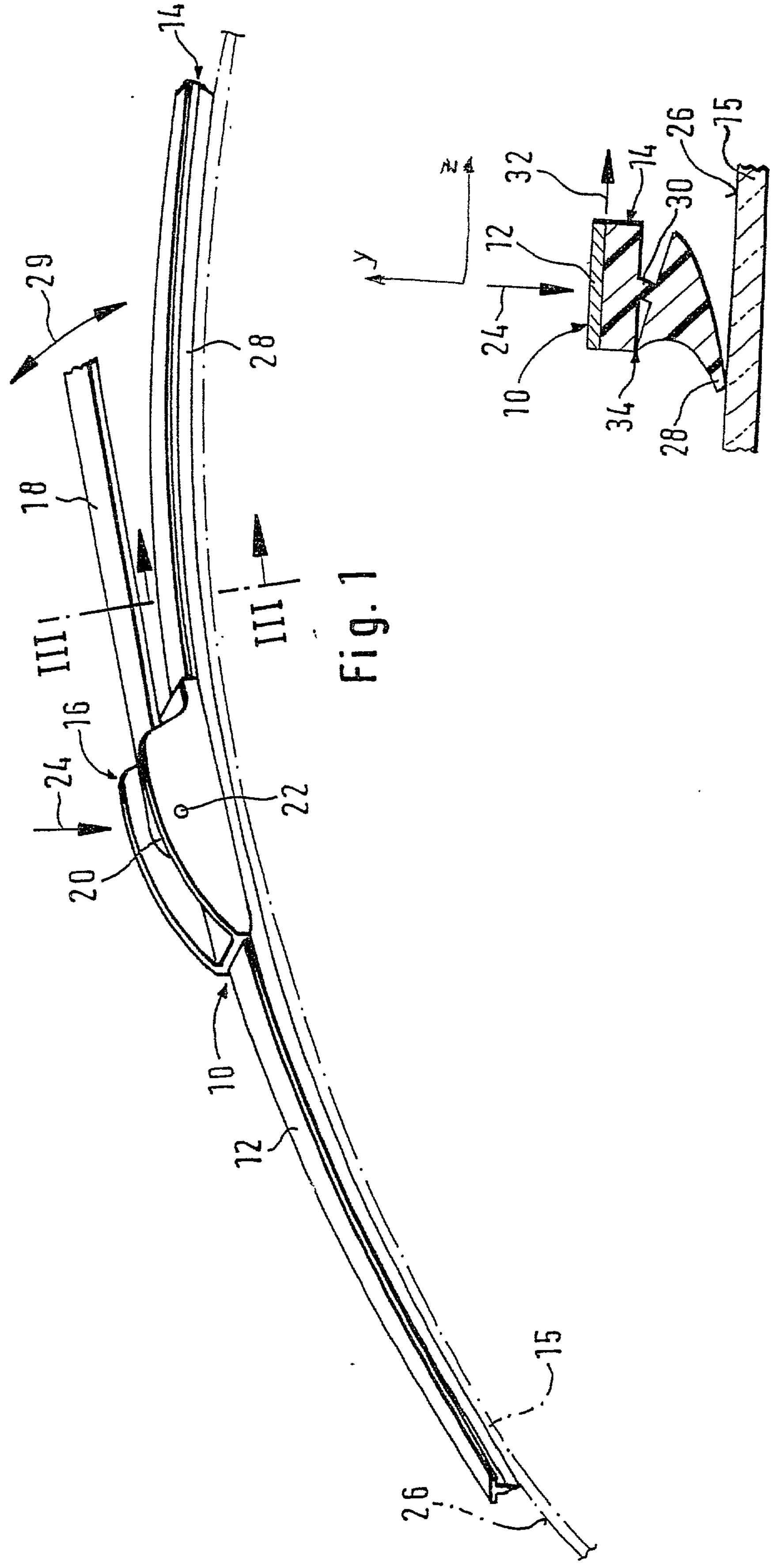

Fig. 1

Fig. 3

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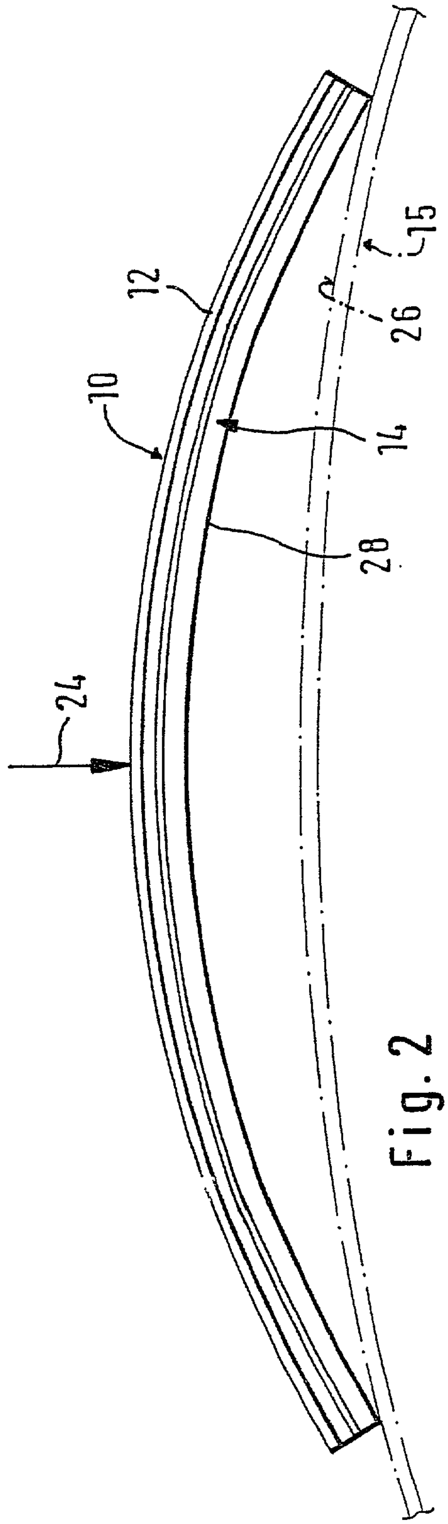

Fig. 2

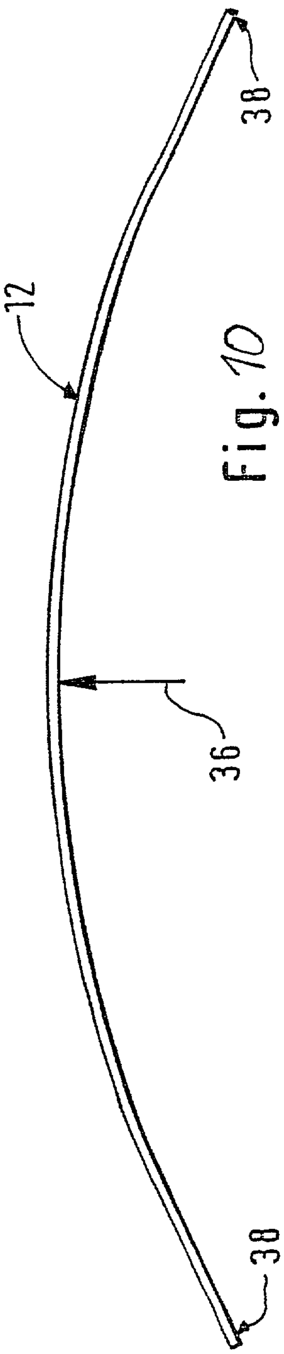

Fig. 10

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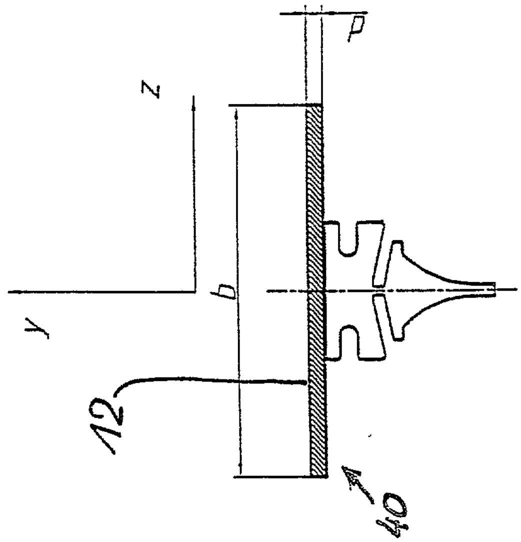

Fig. 4

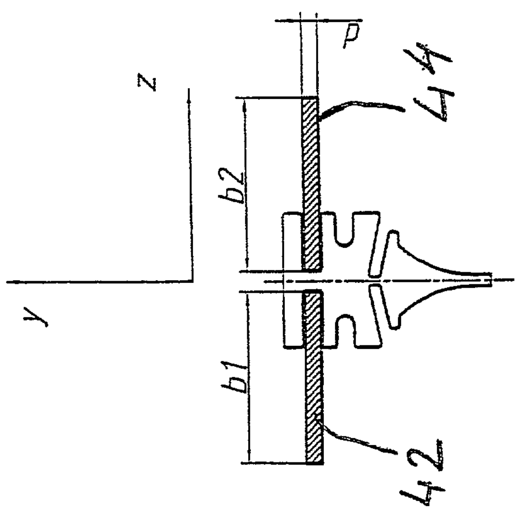

Fig.5

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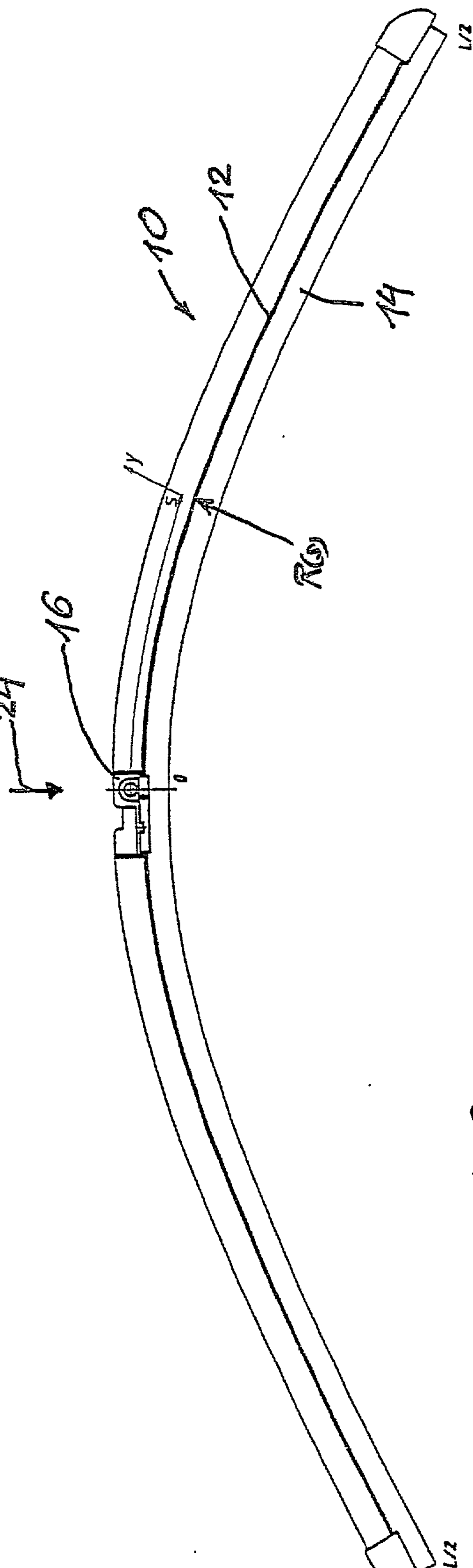

Fig. 6

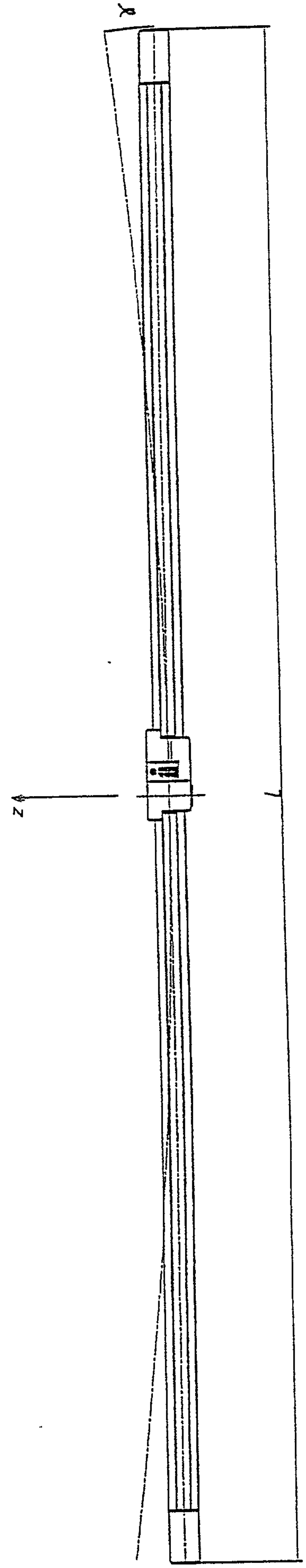

Fig. 7

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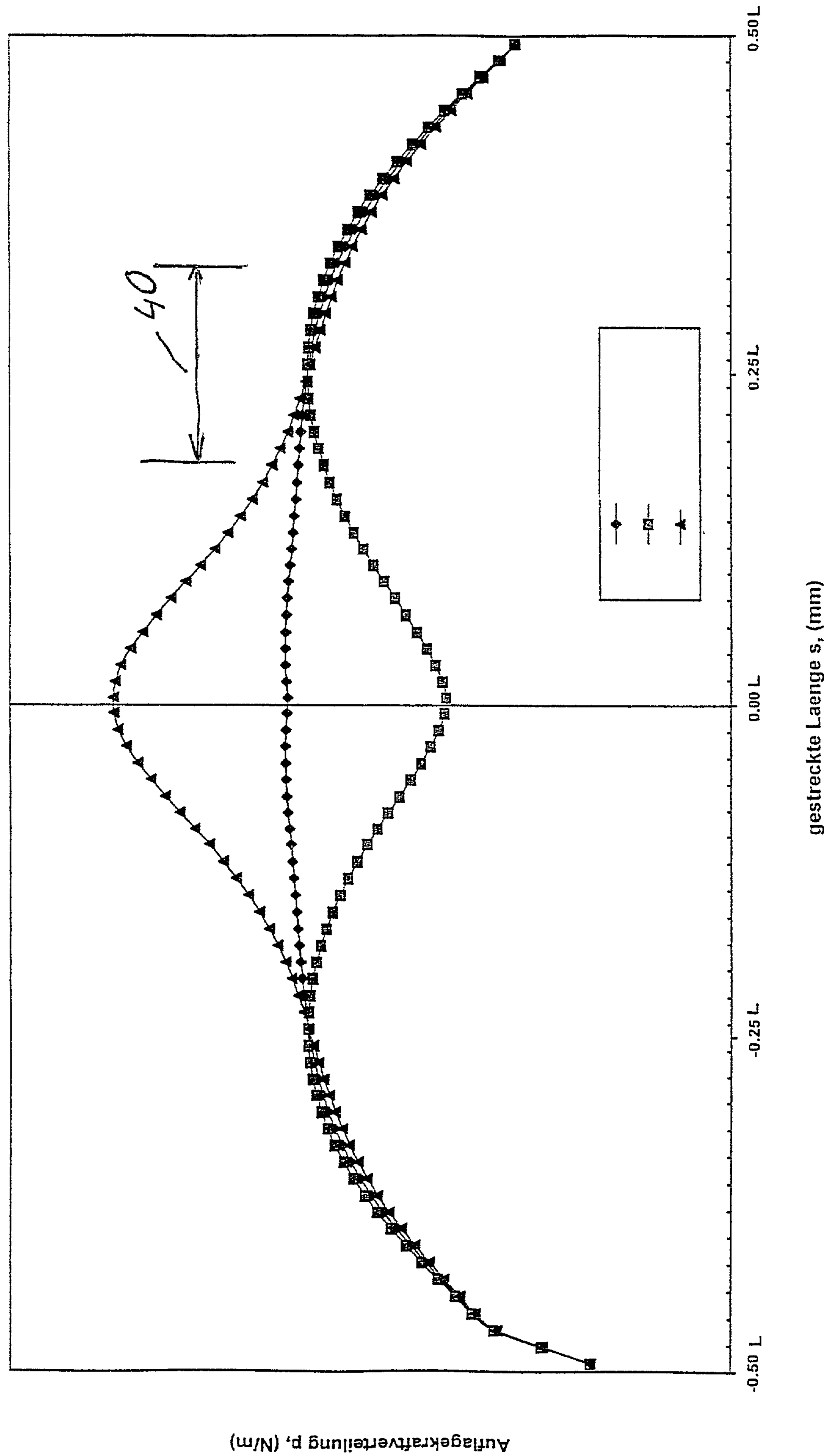

Fig.8

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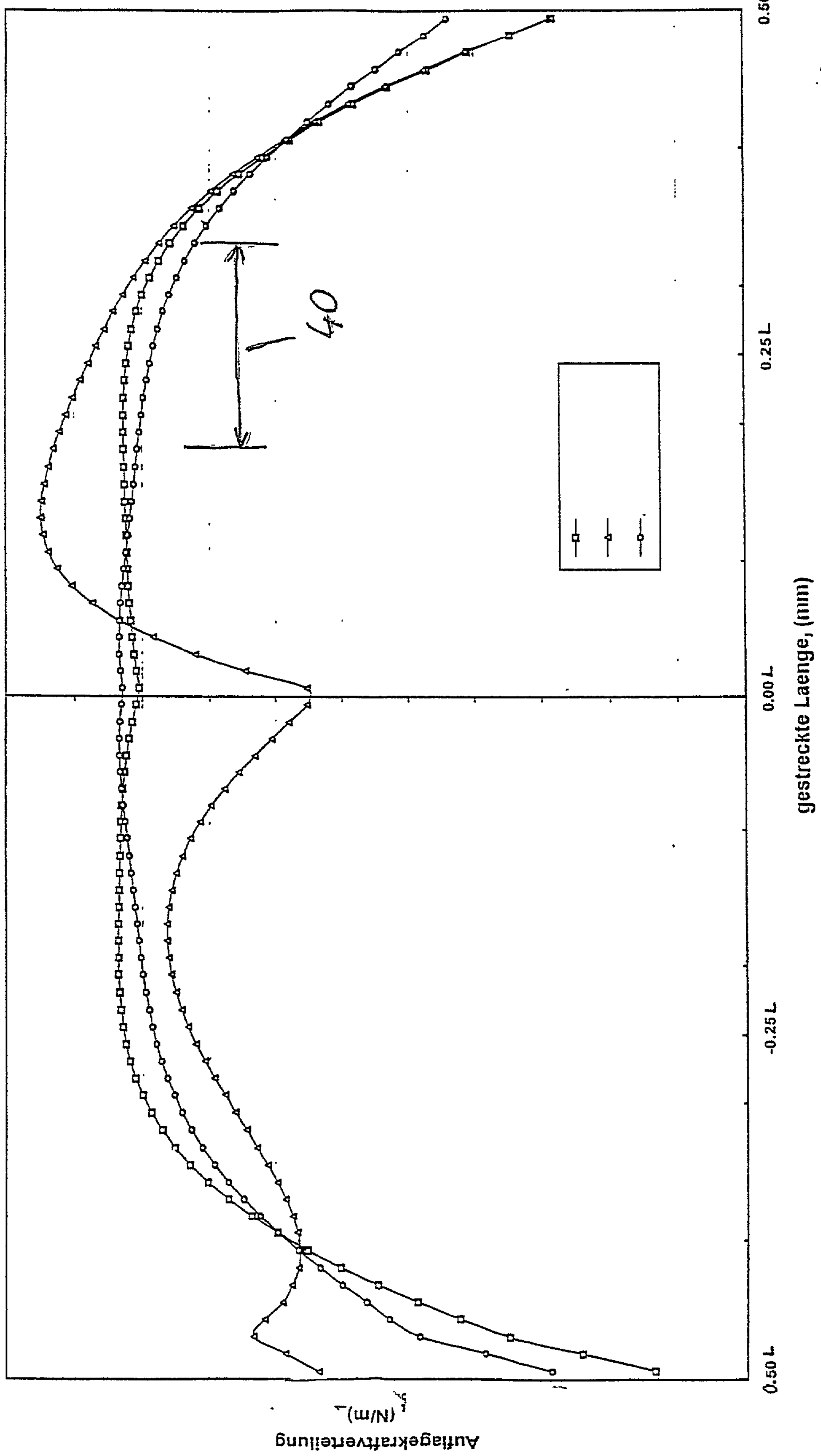

Fig. 9

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DECLARATION AND POWER OF ATTORNEY FOR NATIONAL STAGE OF PCT PATENT APPLICATION

As a below-named inventor, I hereby declare that:

Peter DE BLOCK

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **WIPER BLADE FOR WINDSHIELDS, ESPECIALLY OF MOTOR VEHICLES, AND METHOD FOR PRODUCING SUCH A WIPER BLADE** the specification of which was filed as PCT International Application number PCT/DE 00/02168 on July 6, 2000.

I hereby state that I believe the named inventor or inventors in this Declaration to be the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

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

Prior foreign application(s):			Priority claimed:	
199 31 858.1	GERMANY	JULY 9 , 1999	X	
(Number)	(Country)	(Date filed)	Yes	No
199 31 856.5	GERMANY	JULY 9, 1999	X	
(Number)	(Country)	(Date filed)	Yes	No
199 31 857.3	GERMANY	JULY 9, 1999	X	
(Number)	(Country)	(Date filed)	Yes	No

As a named inventor, I hereby appoint the following attorney to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Michael J. Striker, Reg. No. 27233

Direct all telephone calls to Striker, Striker & Stenby at telephone no.: (631) 549 4700 and address and all correspondence to:

STRIKER, STRIKER & STENBY
103 East Neck Road
Huntington, New York 11743
U.S.A.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment,

09786852

or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statement may jeopardize the validity of the application or any patent issued thereon.

Signature:	Date: 14 03 2001	Residence and Full Postal Address: Pandputweg 5 B-3545 Halen Belgium
Full Name of First or Sole Inventor: Peter DE BLOCK	Citizenship: BELGIAN BEX	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Second Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Third Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Fourth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Fifth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Sixth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Seventh Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Eighth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Ninth Inventor:	Citizenship:	

..08 Rec'd PCT/PTO 03 MAY 2001

#3

UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner: Group: Attorney Docket # 1524

Applicant(s): DE BLOCK, P.

Serial No.: 09/786,852

Filed: 03/09/2001

For : WIPER BLADE FOR WINDSHIELDS, ESPECIALLY OF MOTOR VEHICLES, AND METHOD FOR PRODUCING SUCH A WIPER BLADE

Honorable Commissioner of Patents
and Trademarks
Washington, D.C. 20231

May 1, 2001

Sir:

The subject application was filed without the signature of the inventors.

Declaration papers executed by the inventors are submitted herewith.

It is respectfully requested that the required fee be charged to the account of the undersigned (19-4675).

05/07/2001 UEDUVIJE 00000029 194675 09786852

01 FC:154 130.00 CH

Respectfully submitted,

Michael J. Striker
Attorney for Applicant(s)
Reg. No. 27233

Box: PCT

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231.
On 5/1/01

R. 36343-3

09786852

DECLARATION AND POWER OF ATTORNEY FOR NATIONAL STAGE OF PCT PATENT APPLICATION

As a below-named inventor, I hereby declare that:

Peter DE BLOCK

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **WIPER BLADE FOR WINDSHIELDS, ESPECIALLY OF MOTOR VEHICLES, AND METHOD FOR PRODUCING SUCH A WIPER BLADE** the specification of which was filed as PCT International Application number PCT/DE 00/02168 on July 6, 2000.

I hereby state that I believe the named inventor or inventors in this Declaration to be the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

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

Prior foreign application(s): Priority claimed:

199 31 858.1	GERMANY	JULY 9 , 1999	X	
(Number)	(Country)	(Date filed)	Yes	No
199 31 856.5	GERMANY	JULY 9, 1999	X	
(Number)	(Country)	(Date filed)	Yes	No
199 31 857.3	GERMANY	JULY 9, 1999	X	
(Number)	(Country)	(Date filed)	Yes	No

As a named inventor, I hereby appoint the following attorney to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Michael J. Striker, Reg. No. 27233

Direct all telephone calls to Striker, Striker & Stenby at telephone no.: (631) 549 4700 and address and all correspondence to:

STRIKER, STRIKER & STENBY
103 East Neck Road
Huntington, New York 11743
U.S.A.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment,

or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statement may jeopardize the validity of the application or any patent issued thereon.

Signature:	Date: 14.03.2001	Residence and Full Postal Address: Pandputweg 5 B-3545 Halen Belgium
Full Name of First or Sole Inventor: Peter DE BLOCK	Citizenship: BELGIAN BEX	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Second Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Third Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Fourth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Fifth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Sixth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Seventh Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Eighth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Ninth Inventor:	Citizenship:	

Commissioner for Patents, Box PCT
United States Patent and Trademark Office
Washington, D.C. 20231
www.uspto.gov

U.S. APPLICATION NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
09/786852	DE BLOCK	P 1524

STRIKER STRIKER & STENBY
103 EAST NECK ROAD
HUNTINGTON, NY 11743

INTERNATIONAL APPLICATION NO.	
PCT/DE00/02168	
I.A. FILING DATE	PRIORITY DATE
06 JUL 00	09 JUL 99

DATE MAILED: 21 MAY 2001

NOTIFICATION OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C. 371 AND 37 CFR 1.494 OR 1.495

1. The applicant is hereby advised that the United States Patent and Trademark Office in its capacity as [x] a Designated Office (37 CFR 1.494), [ ] an Elected Office (37 CFR 1.495), has determined that the above-identified international application has met the requirements of 35 U.S.C. 371, and is **ACCEPTED** for national patentability examination in the United States Patent and Trademark Office.

2. The United States Application Number assigned to the application is shown above and the relevant dates are:

05/03/01	05/03/01
DATE OF RECEIPT OF 35 U.S.C. 371(c)(1), (c)(2) and (c)(4) REQUIREMENTS	DATE OF RECEIPT OF ALL 35 U.S.C. 371 REQUIREMENTS

A Filing Receipt (PTO-103X) will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE "FILING DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN ABOVE.** *The filing date of the above-identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363).* Once the Filing Receipt has been received, send all correspondence to the Group Art Unit designated thereon.

3. [ ] A request for immediate examination under 35 U.S.C. 371(f) was received on ______________ and the application will be examined in turn.

4. The following items have been received:
   - [x] U.S. Basic National Fee.
   - [x] Copy of the international application.
   - [ ] Translation of the international application into English.
   - [x] Oath or Declaration of inventors(s).
   - [ ] Copy of Article 19 amendments. [ ] Translation of Article 19 amendments into English.
     The Article 19 amendments [ ] have [ ] not been entered.
   - [ ] The International Preliminary Examination Report in English and its Annexes, if any.
   - [ ] Copy of the Annexes to the International Preliminary Examination Report (IPER).
     [ ] Translation of Annexes to the IPER into English.
     The Annexes [ ] have [ ] not been entered.
   - [x] Preliminary amendment(s) filed 03/09/01 and ______________.
   - [ ] Information Disclosure Statement(s) filed ______________ and ______________.
   - [ ] Assignment document.
   - [ ] Power of Attorney and/or Change of Address.
   - [ ] Substitute specification filed ______________.
   - [ ] Indication of Small Entity Status.
   - [x] Priority Document.
   - [x] Copy of the International Search Report [x] and copies of the references cited therein.
   - [ ] Other:

Applicant is reminded that any communication to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5).

India Evans

Telephone: 703-305-2936

FORM PCT/DO/EO/903 (March 2001)

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 NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/786,852	05/03/2001	Peter De Block	1524	6623

7590 09/10/2003

Striker Striker & Stenby
103 East Neck Road
Huntington, NY 11743

EXAMINER
COLE, LAURA C

ART UNIT	PAPER NUMBER
1744	8

DATE MAILED: 09/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Office Action Summary	Application No.	Applicant(s)
	09/786,852	DE BLOCK, PETER
	Examiner	**Art Unit**
	Laura C Cole	1744

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 May 2001* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *19-36* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *19-36* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *03 May 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 6, 7 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Drawings

2. The drawings are objected to because in Figures 8 and 9 it appears that the axes are labeled in German, not English. A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

3. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(4) because reference character "40" has been used to designate both a profile (Page 14) and a region (Page 18). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

4. The disclosure is objected to because of the following informalities:

Page 1 Paragraph 1 Line 2 reference is made to "claim 1" which is improper.

Page 4 Paragraphs 2 and 3 disclose information about a "proportion" (Paragraph 2 Line 1) being the value of "the contact force and the square of the length to the product of 48 times the elasticity modulus of the support element and the I_{zz} moment of inertia." However, in the specification on Page 13 in the last formula and last paragraph, that same recited formulation is not disclosed as a proportion value but as "a lateral deflection angle γ." It is unclear to the examiner if the values "0.005 and 0.009" are a unitless proportional values or angles in radians.

Page 5 Paragraph 4 Line 2 reference is made to "claim 10" which is improper.

Page 6 Paragraph 4 Line 2 reference is made to "claim 15" which is improper.

Page 7 Paragraph 2 Lines 1-2 reference is made to "claim 15" and "claim 16" which is improper.

Page 14 Paragraph 2 states that a "profile 40" is shown in Figure 3, however "40" is shown in Figures 8 and 9.

Page 14 Paragraph 6 Line 2 states "spring bars 42 and 44" are shown in Figure 4, however "42 and 44" are shown in Figure 5.

Page 15 Paragraph 2 Line 7 states that "a middle section 36" is shown in Figure 11, however there is not a Figure 11.

Appropriate correction is required.

Claim Objections

5. Claim 21 recites the term "essentially" in Lines 2 and 4. It is unclear what is meant by "essentially."

6. Claims 26-34 are objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim 25. See MPEP § 608.01(n). Accordingly, the claims 26-34 have not been further treated on the merits. Further, in Claims 26, 28, 30, 33, and 34 it is confusing to the examiner what is meant by the phrase "according to one of the preceding claims." Are these claims intended to be independent?

7. Claim 28-30 and 32-36 recite a coordinate "(s)" and later disclose a force distribution "p (s)" which is confusing to the Examiner since the parentheses have been used for reference numbers. Further, K(s) and M(s) are also used.

Claim Rejections - 35 USC § 112

The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain 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 same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

8. Claims 26-27 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Claim 26 Lines 10-12 are unclear in that "L" is given in the unit "meters" and that "b and d" are given in the unit of "millimeters." Are the terms $20L^2$, bd^2, and $40L^2$ meant to be numbers in an "absolute value" wherein the relationship between the terms is based on the resultant number? Or does that statement require essentially that the thickness is approximately the same as the length? How would a width and thickness (squared) be of a value greater than the length of the support element (squared)? It is unclear in the specification and in the claims what the appropriate geometric relationship is between the width and thickness of the wiper support element and the length of the support element.

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

9. Claims 19-36 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 19 Line 8, is there meant to be a unit after "0.009"? (Also questioned in the specification).

Claim 19 Lines 10-11, what does "the contact force for which the wiper blade was originally designed" mean?

Claim 19 recites the limitation "the length" in Line 11, "the elasticity modulus" in Line 12, "the moment of inertia" in Line 13, and "the z-axis" in Line 14. There is insufficient antecedent basis for this limitation in the claim.

Claim 20 Line 3, is there meant to be a unit after "0.005"? (Also questioned in the specification).

Claim 23 Line 4, is there meant to be a unit after "0.009"? (Also questioned in the specification).

Claim 24 Line 4, is there meant to be a unit after "0.005"? (Also questioned in the specification).

Claim 25 Lines 6-7 recite "in particular according to one of the preceding claims" which is confusing. Is only some of the structure claimed "according to one of the preceding claims"? Is this claim intended to be an independent claim?

Claim 27 Lines 2-3 recite "two spring bars whose widths are added to each other" which is confusing.

Claim 28 recites the limitation "the longitudinal span" in Line 11 and "the second derivative" in Lines 12-13. There is insufficient antecedent basis for this limitation in the claim.

Claim 29 recites the limitation "the neutral axis" in Line 9. There is insufficient antecedent basis for this limitation in the claim.

Claim 30 recites the limitation "the longitudinal span" in Line 11, "the second derivative" in Lines 12-13, and "the ends" Line 16. There is insufficient antecedent basis for this limitation in the claim.

Claim 31 recites the limitation "the location" in Line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 32 recites the limitation "the neutral axis" in Line 9. There is insufficient antecedent basis for this limitation in the claim.

Claim 33 recites the limitation "the longitudinal span" in Line 11, "the contact force distribution" in Lines 12-13, "the center" Line 15, and "the end" in Line 16 and in Line 17. There is insufficient antecedent basis for this limitation in the claim.

Claim 34 recites the limitation "the longitudinal span" in Line 11, "the contact force distribution" in Lines 12-13, "the center" Line 16, and "the end" in Line 17. There is insufficient antecedent basis for this limitation in the claim.

Claim 35 recites the limitation "the window" in Line 4, "the width" in Line 5, "the thickness" in Line 5, and "the curvature progression" in Line 6. There is insufficient antecedent basis for this limitation in the claim.

Claim 35 recites "A method for producing a wiper blade…" however the steps recited pertain to the support element and the entire assembly. Is the method for producing the wiper blade *assembly*?

Claim 36 recites the limitation "the above relation" in Lines 16-17 and "the desired curvature progression" in Lines 18-19. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. Claims 19-21 and 23-24 are rejected under 35 U.S.C. 102(b) as being anticipated by Swanepoel, USPN 5,485,650 (herein '650).

'650 discloses the invention as is claimed (Figures 1-3), including a support element (12) that is an elongated, flat bar, a wiper strip (14), a connecting device (16), and that the cross sectional profile in which there is a value less than 0.009 and less than 0.005, specifically of that of 0.00014244 when the contact force exerted on the blade is 1 N (Column 3 Line 40), the Length is 450mm (Column 3 Line 30), the modulus of elasticity is 207×10^9 N/m^2 (Column 3 Line 31), and the moment of inertia (I_{zz}) is found by using the values of the width and thickness (Column 3 Lines 32-35) calculated according to that of a rectangular elongated flat bar ($1/12 * d * b^3$) at the center.

Further, the support element has an essentially rectangular cross sectional profile (as seen in Figure 3) with an *essentially* constant width and thickness.

11. Claims 19-21, 23-24, 28, 30, 31, and 33-36 are rejected under 35 U.S.C. 102(b) as being anticipated by Swanepoel, USPN 5,325,564 (herein '564).

'564 discloses the invention as claimed, including a support element (10) that is an elongated, flat bar (Figure 3), a wiper strip (12), a connecting device (14), and that the cross sectional profile in which there is a value less than 0.009 and less than 0.005, specifically that of 0.00962 when the values of contact force exerted on the blade, length, modulus of elasticity, width, and thickness are given in Example 2 (Columns 6 and 7), wherein the moment of inertia (I_{zz}) is found by using the values of the width and thickness calculated according to that of a rectangular elongated flat bar ($1/12 * d * b^3$) at the center. Further, the support element has an essentially rectangular cross sectional profile (Column 2 Lines 36-41) with an *essentially* constant width and thickness. '564 discloses in Column 2 Lines 8-20 and Column 3 Lines 8-12 that the curvature profile has values such that the second derivative of the curvature as a function of a coordinate has a relationship to a contact force distribution, and that the distribution may decrease towards the ends (specifically Column 2 Lines 17-20). In that the curvature is 0 (the window is flat) the curvature follows the longitudinal span of the support element. The connecting device may be located in the center (Figure 4). The characteristics of the wiper blade are produced in the steps of determining a width and thickness, a curvature progression, bending the support element, and connection of the elements (as demonstrated in the Examples). Further in Example 3 the determination of the length and profile may be done by experimental values, a pressure distribution for a flat window found by experimental values (Column 6 Line 1), measurement of the curvature (as mentioned in the previous step, it is a flat window so that the curvature is 0), and calculations in regard to the curvature progression (from Example 1).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

12. Claims 22 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Swanepoel, '564 in view of Appel, USPN 3,192,551.

'564 discloses all elements above, however the support element does not include at least two individual bars.

Appel discloses a windshield wiper blade assembly that includes a number of embodiments relating to the properties of the supporting element (elasticity, curvature, load, length, dimensions) in order to provide a constant loading of pressure throughout the length of the wiper blade (Column 1 Lines 16-41). Further, Figures 6, and 10-15 display two individual bars having separate widths that would add up to a total width when computing the pressure-curvature relationship (Column 2 Lines 37-41). The "gap" between the bars is provided as a securement means of a rib (40) for a wiper blade.

It would have been obvious for one of ordinary skill in the art to modify '564 to have two individual bars as Appel teaches in order to accommodate an alternative method of securing a wiper blade to the support element while maintaining a pressure and geometric relationship.

13. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Swanepoel, '564 in view of Porter, USPN 4,045,838.

Insofar as the specification and claims are understood, '564 includes all elements included above, including that a profile value less than 0.005 and 0.009. Applicant's specification on Page 13 cites that 0.009 (radians) is equivalent to 0.3° and that 0.005 (radians) is equivalent to 0.5°. '564 does not disclose a coefficient of friction.

Porter discloses that it is desirable for a wiper blade (or strip) and a window to have a coefficient of friction of 1.0 or lower (Column 1 Lines 65-68) to diminish the amount of wear on the blade.

It would have been obvious for one or ordinary skill in the art to modify the blade of '564 to have a coefficient of friction such as the range taught by Porter to have a blade that has a longer life of use.

14. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Swanepoel, '650 in view of Appel, USPN 3,192,551.

'650 and Appel disclose all elements above, however '650 does not include a method of producing a wiper blade.

Appel further teaches that the length, force, thickness, and curvature are determined (Column 2 Lines 38-45) and that there is bending of a support element in order to connect the support element, wiper strip, and connecting device (Column 3 Lines 69-73).

It would have been obvious for one of ordinary skill in the art to produce a windshield wiper blade according to such a method to create a blade that has ease of connection to the support element.

Conclusion

15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

DE 195 01 849 discloses a displacement in a wiper blade according to the English translation of the Abstract. Examiner does not currently have an English translation of the disclosure.

16. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Laura C Cole whose telephone number is (703) 305-7279. The examiner can normally be reached on Monday-Thursday, 7am - 4:30pm, alternating Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert Warden can be reached on (703) 308-2920. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

LCC
LCC

Robert J. Warden, Sr.
ROBERT J. WARDEN, SR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

INFORMATION DISCLOSURE CITATION *(Use several sheets if necessary)*	Docket Number (Optional) 1524	Application Number 09/786852
	Applicant(s) DE BLOCK, P.	2 Rec'd PCT/PTO 0 9 MAR 2001
	Filing Date	Group Art Unit

U.S. PATENT DOCUMENTS

*EXAMINER INITIAL	REF	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

	REF	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	Translation YES	Translation NO
LCC		0 594 451 A	04/27/94	EP				✓
LCC		0 528 643 A	02/24/93	EP				✓
LCC		198 14 610 A	10/07/99	DE				✓
LCC		12 47 161 B	08/10/67	DE				✓

OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, Etc.)*

EXAMINER	DATE CONSIDERED
Laura C Cole	9/5/03

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INFORMATION DISCLOSURE CITATION (Use several sheets if necessary)	Docket Number (Optional) 1524	Application Number 09/786,852
	Applicant(s) DE BLOCK	
	Filing Date 03/09/2001	Group Art Unit

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U.S. PATENT DOCUMENTS

*EXAMINER INITIAL	REF	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

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	REF	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	Translation YES	Translation NO
LCC		1 505 357	05/29/69	DE				✓

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OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

EXAMINER Laura C Cole	DATE CONSIDERED 9/5/03

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Notice of References Cited	Application/Control No. 09/786,852	Applicant(s)/Patent Under Reexamination DE BLOCK, PETER	
	Examiner Laura C Cole	Art Unit 1744	Page 1 of 1

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	B	US-4,045,838	09-1977	Porter, Raymond P.	15/250.48
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	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N	DE 195 01 849 A1	08-1995	DE	Nagy, Jozsef	
	O					
	P					
	Q					
	R					
	S					
	T					

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	U	English translation of the Abstract to DE 195 01 849 A1
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

(19) BUNDESREPUBLIK DEUTSCHLAND

DEUTSCHES PATENTAMT

(12) **Offenlegungsschrift**

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(43) Offenlegungstag: 3. 8. 95

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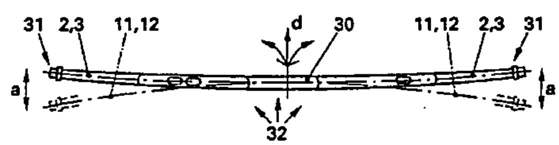
(54) Scheibenwischerblatt

(57) Die Erfindung betrifft einen Scheibenwischerblatt, bei dem ein Scheibenwischergummi an mehreren Stellen von einem Gestell gefaßt und geführt ist.
Scheibenwischerblätter, wie sie insbesondere bei Personenkraftfahrzeugen Verwendung finden, werden gelegentlich in einer in der Horizontalebene gebogenen Form eingesetzt. Hierdurch wird ein besseres Auswischen eines Scheibenbereiches oder eine Anpassung des Scheibenwischerblattes an einen Randbereich der Scheibe erreicht. Bei einer Annäherung des Scheibenwischerblattes an den anderen Randbereich wird dieser aufgrund der hier konkav zum Scheibenrand hin gebogenen Wischerblattform ungenügend gewischt. Mit dem neuen Scheibenwischerblatt soll ein randnahes Wischen an beiden Endstellungen des Scheibenwischers möglich sein.
Bei einem Scheibenwischerblatt, das einen kaskadenartigen Bügelaufbau aus einem großen (19), mittleren (20) und kleinen (21) Bügel aufweist, sind die Gelenke (17, 18), über die die einzelnen Bügel miteinander verbunden sind, nicht nur für eine vertikale Schwenkbewegung, sondern auch für eine begrenzte horizontale Schwenkbewegung (a) ausgelegt. Hierdurch kippen die Enden (11, 12) des Scheibenwischerblatts (2, 3) im Wischbetrieb entgegen der jeweiligen Wischrichtung ab, so daß zum jeweiligen Randbereich hin der Scheibenwischer immer konvex gebogen ist. Die Gelenke (17, 18) können als Langlochgelenke oder Drehgelenke ausgebildet sein.
Die Erfindung eignet sich für Kraftfahrzeuge mit großen, an den ...



DE 195 01 849 A 1

Beschreibung

Die Erfindung betrifft ein Scheibenwischerblatt mit einem Wischergummi und einem den Wischergummi an dessen Endbereichen und mindestens einem mittleren Bereich umfassenden Gestell. "Wischergummi" sind hierbei übliche, eine Scheibe von Wasser freiwischende Mittel.

Scheibenwischerblätter, wie sie beispielsweise in Kraftfahrzeugen und insbesondere in PKW Verwendung finden, werden gelegentlich in einer in der Horizontalebene (Wischebene) gebogenen Form eingesetzt. Hierdurch wird ein besseres Auswischen eines Scheibenbereiches erreicht, wobei die Krümmung des Scheibenwischerblattes entsprechend dem Randbereich der Scheibe, d. h. meist konvex zum Scheibenrand hin, angepaßt ist. Bei einer Annäherung des Scheibenwischerblattes an einen anderen Randbereich der Scheibe wirkt diese Krümmung des Scheibenwischerblattes wenig gefällig und kann unter Umständen dazu führen, daß die vom Scheibenwischerblatt hier überwischte Fläche aufgrund der nun konkav zum Scheibenrand hin gebogenen Wischerblattform ungenügend ist.

Aufgabe der vorliegenden Erfindung ist ein Scheibenwischerblatt, das gekrümmten Randbereichen einer Scheibe, denen es in seinen äußeren Wischerpositionen nächstliegend ist, anpaßbar ist.

Diese Aufgabe wird erfindungsgemäß bei einem eingangs beschriebenen Scheibenwischerblatt dadurch gelöst, daß in dem Gestell eine horizontale reversible Versetzung zwischen den Endbereichen und dem mindestens einen mittleren Bereich vorgesehen ist. Die Versetzung kann dabei beispielsweise über ein Gelenk, ein Spiel oder durch ein flexibles (federndes) Gestell erreicht werden. Aus der EP 0 012 251 A ist zwar ein Scheibenwischerblatt mit Spiel bekannt, dieses bewirkt aber ein Kippen des ganzen Blattes oder Gummis, nicht aber eine Versetzung des mittleren Bereichs gegenüber den Endbereichen.

Üblicherweise hat ein Scheibenwischerblatt, sofern es für eine Scheibenfläche mit wechselnden Krümmungsradien vorgesehen ist, eine reversible Versetzbarkeit zwischen den Endbereichen und dem mittleren Bereich des Wischergummis, die senkrecht zur Wischerebene, d. h. vertikal liegt. Hierdurch kann sich der Wischergummi beim Wischen den unterschiedlichen Krümmungsradien anpassen. Erfindungsgemäß erhält das Scheibenwischerblatt nun eine weitere reversible Versetzung zwischen den Endbereichen und einem mittleren Bereich, die horizontal, d. h. in der Wischerebene und damit senkrecht zu der bekannten Gelenkigkeit des Wischerblattes liegt. Ein Wischergummi, das in einem Scheibenwischerblatt mit den beiden beschriebenen Gelenkigkeiten eingesetzt ist, hat somit eine Bewegungsfreiheit, die in etwa in einem Rotationskörper liegt, der von einer an zwei Punkten festgelegten Schnur beschrieben wird, wobei bei unterschiedlichen Gelenkigkeiten in den beiden Ebenen der Rotationskörper durch einen entsprechenden elipsoiden Körper auszutauschen ist.

Dieser Bewegungsbereich ist meist noch weiter eingeschränkt, d. h. im Querschnitt (zwischen den Endpunkten) von einer oder zwei Seiten, die entsprechend den Gelenkigkeiten in etwa senkrecht zueinander stehen, eingedrückt. Dies kann bis über die Mittelebene hinaus erfolgen, so daß bei einem einseitigen Einschränken der Beweglichkeit ein einem abnehmenden Mond, bis hin zum sichelförmigen Bild, ähnelnder Querschnitt erreicht werden kann.

Anders als bei der reversiblen Versetzung senkrecht zur Wischebene wird bei dem erfindungsgemäßen Scheibenwischerblatt die Versetzung nicht durch den Druck auf die zu wischende Fläche, sondern vorteilhaft durch den Zug des Scheibenwischerblattes über die zu wischende Fläche erreicht. Üblicherweise setzt die Wischkraftübertragung hierbei auch in einem mittleren Bereich des Scheibenwischerblattes an.

Erfindungsgemäß wird die Versetzung vorteilhaft durch mindestens ein horizontal wirkendes Gelenk in dem Gestell erreicht, wobei das horizontal wirkende Gelenk bzw. Gelenke in einem mittleren Bereich des Gestells liegen, so daß die Enden des Wischergummis bezüglich des mittleren Bereichs des Wischergummis versetzbar sind, so daß eine in etwa C-förmige Lage des Wischergummis auf der zu wischenden Fläche erhältlich ist. Grundsätzlich kann eine derartige Anordnung des Wischergummis allein durch ein an nur seinen Endbereichen fixiertes Wischergummi erreicht werden, da einem solchen Wischergummi aber die mittlere Abstützung fehlt, ist dessen Wischverhalten ungenügend.

Um die vertikale Beweglichkeit des Scheibenwischerblattes zu erreichen, wird das Gestell des Scheibenwischerblattes üblicherweise aus Bügeln aufgebaut, die längs des Wischergummis angeordnet und in mehreren Ebenen aufeinanderwirkend angeordnet sind. Ein oder mehrere kleine Bügel greifen dabei mit ihren Enden den Wischergummi und werden selbst in ihren mittleren Bereichen jeweils von einem Ende eines übergeordneten Bügels gegriffen, der ggf. in gleicher Weise mit einem weiter übergeordneten Bügel verbunden sein kann. Ein übergeordneter Bügel kann dabei mit beiden Enden jeweils einen untergeordneten Bügel greifen oder aber mit einem Ende eine Endfunktion eines untergeordneten Bügels ausüben. Die Verbindung Bügelende/mittlerer Bereich ist dabei üblicherweise gelenkig und/oder federnd ausgeführt, so daß der Wischergummi vertikal zur Wischebene der Scheibenkrümmung anpaßbar ist. Erfindungsgemäß sind in einem solchen Scheibenwischerblatt Gelenke und/oder federnde Verbindungen vorgesehen, die auch eine merkliche Versetzung der Wischergummienden bezüglich des mittleren Bereiches zulassen. Für eine besonders vorteilhafte horizontale Versetzung der Endbereiche des Wischergummis bezüglich dessen mittleren Bereich werden mehrere Bügelebenen horizontalgelenkig miteinander verbunden. Geeignete Gelenke sind insbesondere Langlochgelenke und Drehgelenke, wobei die ersteren vorzugsweise an kleinen Bügeln vorgesehen sind, d. h. an solchen, die dem Wischergummi zugeordnet sind, und die Drehgelenke an höhere Bügelebenen gesetzt werden. Die horizontale Versetzung des Wischergummis erreicht vorteilhaft einen minimalen Krümmungsradius (≙ maximale Krümmung) von 500 mm wobei übliche minimale Krümmungsradien im Bereich von 1000 mm bis 4000 mm insbesondere im Bereich 1500 mm bis 3000 mm liegen. Die horizontale Versetzung gehorcht hierbei vorteilhaft der Formel

$$\frac{1}{250} \geq \left| \frac{1}{R_1} - \frac{1}{R_2} \right| \geq \frac{1}{10.000}$$

worin R_1 und R_2 die beiden erreichbaren Krümmungsradien bedeuten. Wenn die Krümmungsradien dabei entgegengesetzt liegen, ist ein R-Wert negativ einzusetzen, so daß sich die beiden Bruchwerte im Endeffekt

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addieren. Vorzugsweise liegen die Endwerte bei maximal 1 : 500 und insbesondere bei maximal 1 : 1000 bzw. minimal bei 1 : 4000 und insbesondere minimal bei 1 : 2500. Radien bedeuten hier, daß die Krümmung des Scheibenwischergummis nicht notwendigerweise ein ideales Kreissegment darstellt, sondern auch symmetrische oder unsymmetrische Abweichungen hiervon miteinschließt, z. B. Hyperbelsegmente. Der Radius steht dann für ein Kreissegment, das dem tatsächlichen Verlauf nahe kommt. Vorteilhaft wird mit einem R-Wert ein in etwa linearer Wischergummiverlauf und insbesondere eine Radiusumkehr erreicht.

Üblicherweise erfolgt die horizontale Versetzung derart, daß in Wischrichtung gesehen der mittlere Bereich des Wischergummis den Endbereichen voraus eilt, also eine nach konvex wirkende Verbiegung in Wischrichtung gesehen erhalten wird. Besonders einfach läßt sich die horizontale Versetzung dabei erreichen, wenn diese mit einer Wischerumkehr des Scheibenwischerblattes gekoppelt ist.

Besonders günstig hat das Scheibenwischerblatt in Ruhestellung in der Wischebene bereits einen gebogenen Verlauf, wobei dieser entsprechend dem Einsatz des Scheibenwischerblattes meist derart geformt ist, daß der Wischergummi in Ruhestellung konvex in Richtung auf einen nächstliegenden Scheibenrand vorgeformt ist.

Im Betrieb ändert dieser Scheibenwischergummi vorzugsweise seine gekrümmte Form in eine im wesentlichen lineare bzw. entgegengesetzt gebogene Form, wobei jeweils eine Form vorteilhaft jeweils einer Wischrichtung zugeordnet ist. Insbesondere erreicht der Wischergummi die lineare oder bezüglich eines nächstliegenden Scheibenrandes konvexe Verlaufsform spätestens in seiner äußersten Wischerposition, wobei er diese Form vorzugsweise bereits zu Beginn oder während des Zueilens auf diese Wischerposition erreicht.

Die Erfindung wird im folgenden anhand eines Ausführungsbeispiels näher beschrieben.

Es zeigen

Fig. 1 den Wischverlauf auf einer Kraftfahrzeugfrontscheibe zweier erfindungsgemäßer Wischer im gegenläufigen Betrieb;

Fig. 2 die horizontale Versetzung eines Scheibenwischerblattes;

Fig. 3 eine Seitenansicht eines Endes des Scheibenwischerblattes aus **Fig.** 2;

Fig. 4 einen Schnitt durch ein Gelenk entlang I-I in **Fig.** 3;

Fig. 5 eine detaillierte Darstellung der Seitenansicht der eingekreisten Gelenke in **Fig.** 3; und

Fig. 6 eine Draufsicht auf das Gelenk gemäß **Fig.** 4.

In **Fig.** 1 liegen auf einer Windschutzscheibe 1 (schematisch dargestellt) Scheibenwischerblätter 2 und 3 die der konvexen Form des unteren Windschutzscheibenrandes 4 in etwa angepaßt sind. Im Wischbetrieb gemäß dem Stand der Technik überstreichen die Scheibenwischerblätter 2 und 3 bei Beibehaltung ihrer Form die Flächen 5 und 6 und erreichen die äußersten Endpositionen 7 und 8. Durch die erfindungsgemäße horizontale Verstellung der Scheibenwischerblätter erreichen diese eine Auflage auf der Windschutzscheibe 1 entsprechend 9 und 10 (gestrichelt dargestellt); hierdurch gelangen die Wischerblätter 2 und 3 in die neuen äußersten Endpositionen 11 und 12, wodurch zusätzlich die Flächen 13 und 14 überstrichen (gewischt) werden. Hierdurch ergibt sich nicht nur eine bessere Wischfläche, d. h Minimierung der ungewischten Fläche an A-Säulen 15 und 16, sondern auch ein insgesamt gefälligeres Wischfeld. Außerdem wird erreicht, daß abzuwischendes Wasser schon während des Wischbetriebes im wesentlichen aus den gewischten Flächen 5 und 6 herausgeschoben wird, wohingegen durch die konkaven Wischbilder 7 und 8 eine Ansammlung erheblicher Wassermengen in der konkaven Form erfolgt.

Die horizontale Verstellung (Pfeile a) der Wischerblätter von ihren Positionen 2, 3, die die Ruhepositionen darstellen, in die Positionen 11, 12 ist in **Fig.** 2 dargestellt. Die Verstellung a erfolgt dabei über Gelenke **17**, **18** (**Fig.** 3), die einen großen Bügel **19** (Drehgelenk **17**) mit einem mittleren Bügel **20** und den mittleren Bügel **20** mit einem kleinen Bügel **21** (Langlochgelenk **18**) verbinden. Der größere Bügel (**19** oder **20**) greift dabei mit einem seiner Enden in einen mittleren Bereich des kleineren Bügels (**20** oder **21**) und der kleinste Bügel **21** faßt mit seinen Enden **22** ein Wischergummi **23**. Die Gelenke **17** und **18** ermöglichen eine Schwenkbewegung b, die es dem Wischergummi **23** ermöglicht sich der gebogenen Form der Windschutzscheibe **1** anzupassen, und zusätzlich in horizontaler Ebene die Schwenkbewegungen a und c (**Fig.** 6). Für die Schwenkbewegung b sind die Gelenke **17**, **18** (**Fig.** 4, 5) gestiftet (**24**), die horizontale Verstellung c verschiebbar ist. Für eine Verminderung von Reibungsverlusten sitzt der Stift **24** außerdem in einer Kunststoffbuchse **26**, die für den Stift **24** Lagerteile **27**, die den Stift **24** umschließen und in dem Langloch **25** verschwenkbar sind, und zur Bildung eines Drehgelenks einen in dem Bügel **19** gelagerten Gelenkzapfen **28** aufweist. Um eine bessere Führung des Drehgelenks **17** zu erhalten, ist der Bügel **19** im Bereich des Drehgelenks **17** kreisförmig ausgebuchtet (**Fig.** 6) und die Kunststoffbuchse **26** entsprechend eingepaßt.

Im Betrieb greift ein nicht dargestellter Scheibenwischerarm (meist von einer vorbestimmten Seite) in eine Scheibenwischerarmaufnahme **30** um das Scheibenwischerblatt 2, 3 in Richtung d zu führen. Bedingt durch die Reibung an der Windschutzscheibe **1** werden dabei die Enden **31** des Scheibenwischerblattes in den horizontalgelenkigen Aufhängungen **17**, **18** entsprechend a bezüglich der mittleren Bereiche **32** verstellt.

Patentansprüche

1. Scheibenwischerblatt mit einem Wischergummi und einem den Wischergummi an dessen Endbereichen und mindestens einem mittleren Bereich fassenden Gestell, **dadurch gekennzeichnet**, daß in dem Gestell (**19, 20, 21**) eine horizontale reversible Versetzung (a) zwischen den Endbereichen (**31**) und dem mindestens einen mittleren Bereich (**32**) vorgesehen ist.

2. Scheibenwischerblatt nach Anspruch 1, dadurch gekennzeichnet, daß in dem Gestell (**19, 20, 21**) mindestens ein horizontal wirkendes Gelenk (**17, 18**) für die reversible Verstellung (a) vorgesehen ist.

3. Scheibenwischerblatt nach Anspruch 2, dadurch gekennzeichnet, daß in dem Gestell (**19, 20, 21**) längsseits zum Wischergummi (**23**) mindestens ein kleiner Bügel (**21**) vorgesehen ist, dessen Enden (**22**) dem Wischergummi (**23**) zugeordnet sind und der über eines der Gelenke (**18**) mit einem Ende eines übergeordneten Bügels (**20**) des Gestells (**19, 20, 21**) verbunden ist, der längs zum Wischergummi (**23**) angeordnet ist.

4. Scheibenwischerblatt nach Anspruch 3, dadurch gekennzeichnet, daß der übergeordnete Bügel (**20**) in seinem mittleren Bereich über ein weiteres der

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Gelenke (17) mit einem Endbereich eines weiter übergeordneten Bügels (19) des Gestells (19, 20, 21) verbunden ist, der ebenfalls längs zum Wischergummi (23) angeordnet ist.

5. Scheibenwischerblatt nach einem der Ansprüche 2 bis 4, dadurch gekennzeichnet, daß ein oder mehrere Langlochgelenke (18) und/oder ein oder mehrere Drehgelenke (17) für die reversible Versetzung (a) in dem Gestell (19, 20, 21) vorgesehen sind.

6. Scheibenwischerblatt nach Anspruch 5 in Verbindung mit Anspruch 3 und/oder 4, dadurch gekennzeichnet, daß die übergeordneten Bügel (19, 20, 21) miteinander über ein Drehgelenk (17) und/oder ein dem Wischergummi (23) zugeordneter Bügel (21) über ein Langlochgelenk (18) mit dem zugeordneten übergeordneten Bügel (20) verbunden ist.

7. Scheibenwischerblatt nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die horizontale Versetzung (a) in Wischrichtung (d) eine nach konvex wirkende Verbiegung des Wischergummis (23) bedingt.

8. Scheibenwischerblatt nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die horizontale Versetzung (a) mit einer Wischumkehr des Scheibenwischerblattes (2, 3) gekoppelt ist.

9. Scheibenwischerblatt nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß der Wischergummi (23) in Ruhestellung konvex in Richtung auf einen nächstliegenden Scheibenrand (4) vorgeformt ist.

10. Scheibenwischerblatt nach einem der vorhergehenden Ansprüche, dadurch gekennzeichnet, daß die horizontale reversible Versetzung (a) bemessen ist auf einen im wesentlichen linearen oder, bezüglich eines nächstliegenden Scheibenrandes (15, 16) konvexen Verlauf des Wischergummis (23) bei einer äußersten Wischerposition (11, 12).

Hierzu 2 Seite(n) Zeichnungen

Costco Exhibit 1002, p. 302

09/05/2003, EAST Version: 1.04.0000

Nummer: DE 195 01 849 A1
Int. Cl.[6]: B 60 S 1/38
Offenlegungstag: 3. August 1995

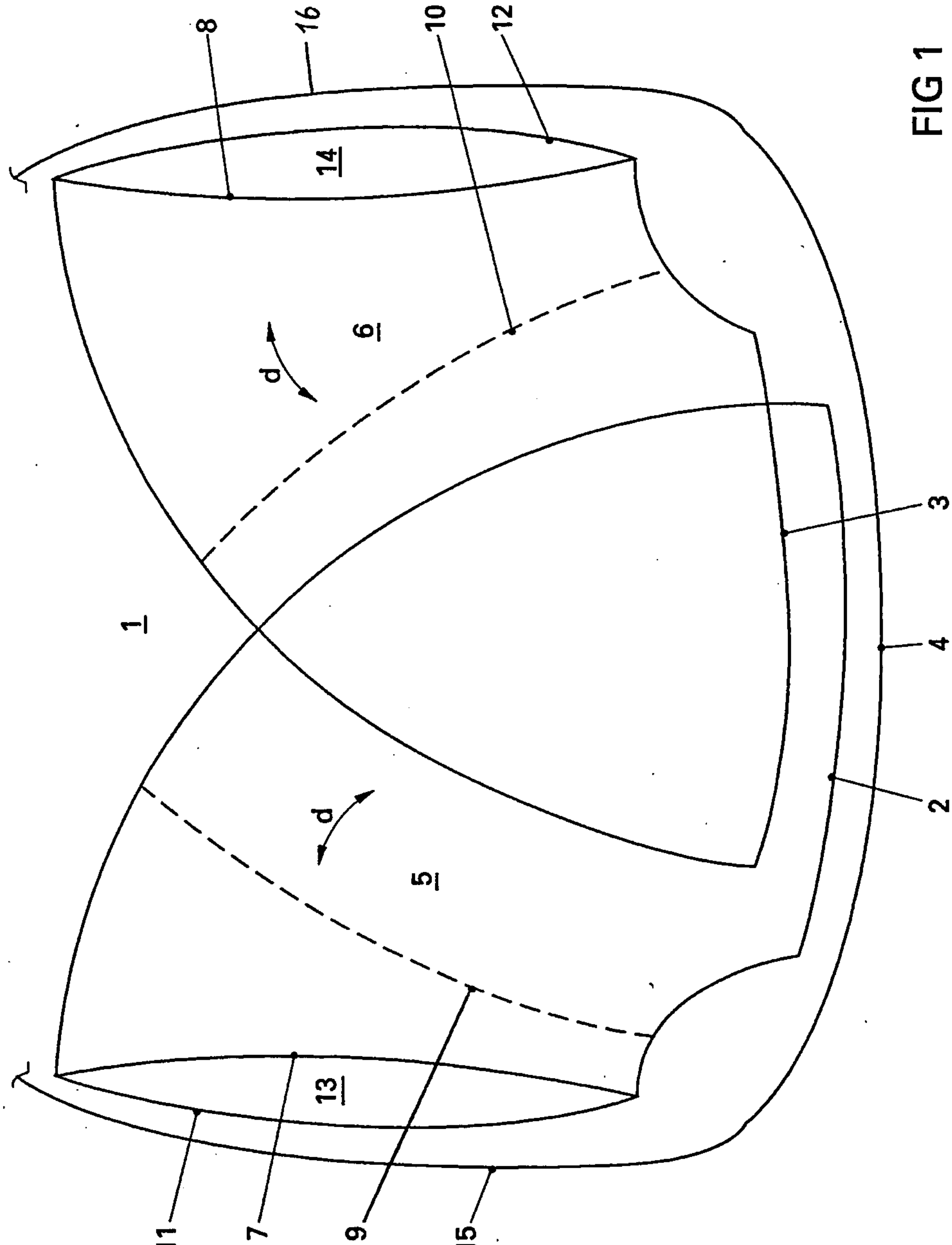

FIG 1

Costco Exhibit 1002, p. 303
09/05/2003, EAST Version: 1.04.0000

Nummer: DE 195 01 849 A1
Int. Cl.⁶: B 60 S 1/38
Offenlegungstag: 3. August 1995

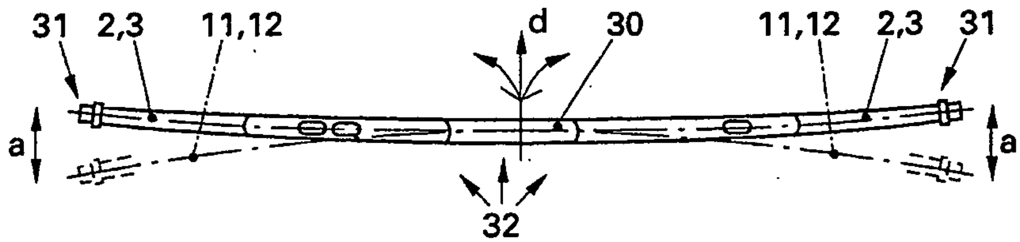

FIG 2

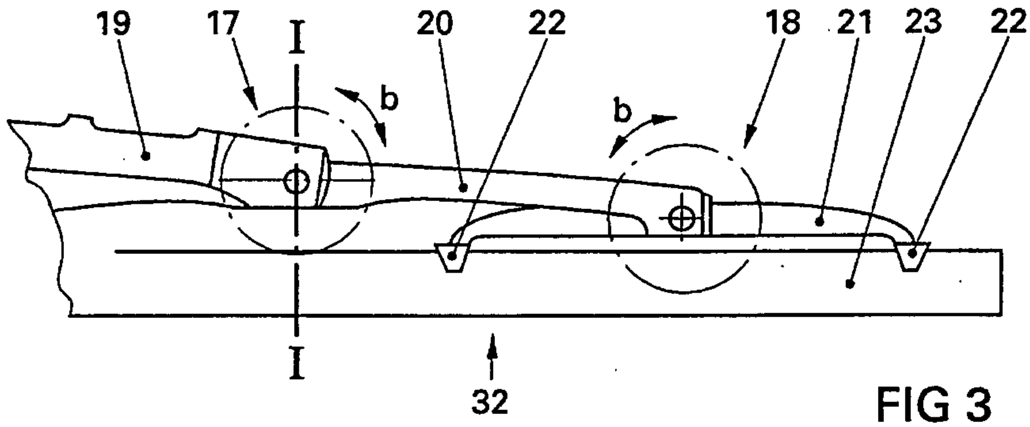

FIG 3

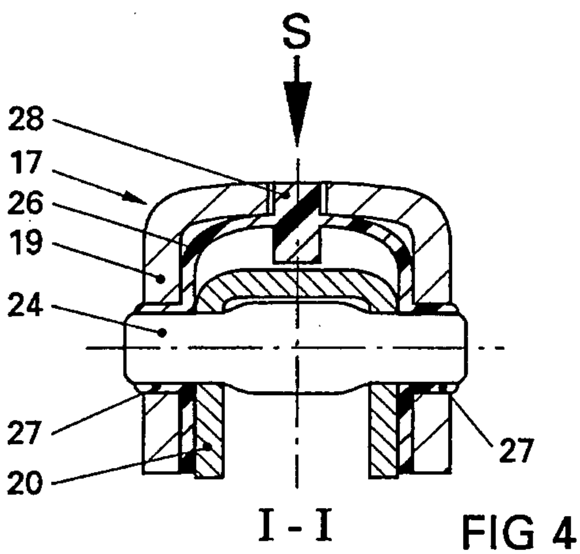

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FIG 4

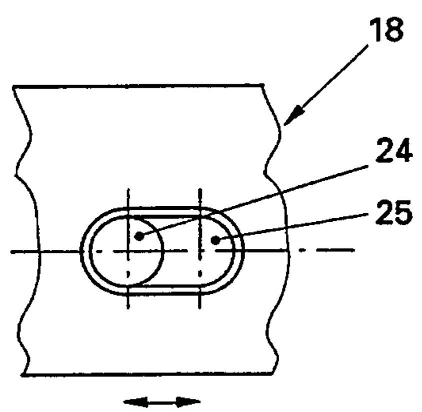

FIG 5

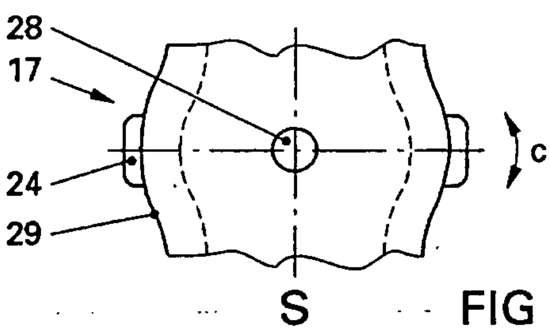

FIG 6

Costco Exhibit 1002, p. 304
09/05/2003, EAST Version: 1.04.0000

PUB-NO: DE019501849A1

DOCUMENT-IDENTIFIER: DE 19501849 A1

TITLE: Windscreen wiper blade for vehicle

PUBN-DATE: August 3, 1995

INVENTOR-INFORMATION:

NAME	COUNTRY
NAGY, JOZSEF	DE

INT-CL (IPC): B60S001/38

EUR-CL (EPC): B60S001/38

ABSTRACT:

A horizontal reversible displacement (a) is provided in the holder (19,20,21) between the end section (31) and at least one of the centre sections (32). At least one horizontal acting pivot (17,18) for the reversible displacement is provided in the holder. At least one small bow (21) is provided in the holder alongside the rubber wiper element (23) and its ends (22) joined to it, and is connected by one of the pivots (18) to one end of a higher bow (20) on the holder

CERTIFICATE OF TRANSMISSION BY FACSIMILE (37 CFR 1.8) Applicant(s): DE BLOCK, P.			Docket No. 1524
Serial No. 09/786,852	Filing Date 05/03/2001	Examiner COLE, L.	Group Art Unit 1744

Invention: WIPER BLADE FOR WINDSHIELDS, ESPECIALLY...

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Examiner: Cole, L. Art Unit: 1744

In re:

Applicant: DE BLOCK, P.

Serial No.: 09/786,852

Filed: May 3, 2001

AMENDMENT

February 9, 2004

Hon. Commissioner of
Patents and Trademarks
Washington, D.C. 20231

Sirs:

Responsive to the Office Action of September 10, 2003, please amend the application as follows:

Amendments to the specification:

On page 1, line 3, please amend the heading as follows:

~~Prior Art~~ Background of the Invention

On page 1, please amend the first paragraph as follows:

In wiper blades of the present invention ~~type described in the preamble to claim 1~~, the support element should assure a predetermined distribution of the wiper blade pressing force – often also called pressure – applied by the wiper arm against the window, over the entire wiping zone that the wiper blade sweeps across. Through an appropriate curvature of the unstressed support element – i.e. when the wiper blade is not resting against the window – the ends of the wiper strip, which is placed completely against the window during the operation of the wiper blade, are loaded in the direction of the window by the support element, which is then under stress, even when the curvature radii of spherically curved vehicle windows change in every wiper blade position. The curvature of the wiper blade must therefore be slightly sharper than the sharpest curvature measured in the wiping zone of the window to be wiped. The support element thus replaces the costly support bracket design that has two spring strips disposed in the wiper strip, which is the kind used in conventional wiper blades (DE-OS 15 05 357).

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On page 3, line 7, please amend the heading as follows:

~~Advantages~~ Summary of the Invention

Please amend the paragraph bridging pages 5-6 as follows:

The wiper blade according to the invention ~~, with the features of claim 10,~~ has the advantage that only one parameter has to be varied in order to adjust the outwardly decreasing contact force distribution. The curvature or the curvature progression along the support element can be preset in freely programmable bending machines. As a result, short trial runs can also be carried out to optimize the contact force distribution and therefore the curvature progression rapidly and without a great deal of expense. It is particularly advantageous if the coordinate that governs the curvature progression extends along the inertial element. This eliminates the need for complex reverse calculations in a Cartesian coordinate system in which each change in a position x requires a shifting of the subsequent "x values".

Please amend the paragraph bridging pages 6-7 as follows:

A wiper blade according to the invention ~~, with the features of claim 15,~~ excels in that without special adaptation, an excellent wiping result is achieved for average window types. The very simple steps taken result in the fact that the contact force distribution fulfills the requirements in most cases. The support points mentioned above are sufficiently precise to use as the basis for a curvature progression to be maintained.

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On page 7, please amend the second paragraph as follows:

~~A wiper blade according to claim 15 is optimized through the steps taken in claim 16.~~ Even with complex window curvature progressions, the wiping quality can be increased by presetting the contact force distribution to particular support points. It is nevertheless possible to design the wiper blade without complex calculations. The curvature progression can be essentially predetermined and can be optimized by means of simple trials. An excellent wiping quality is assured as long as the prerequisites are met that the contact force distribution that prevails when the wiper blade is pressed against the window to be wiped is greater in a region approximately halfway between the center and the end of the wiper blade than it is at the end of the wiper blade.

On page 14, please amend the paragraph contained in lines 3-5 as follows:

For the most frequently occurring case of a rectangular profile 40, as shown in ~~Fig. 3~~ Figures 8 and 9, the moment of inertia is determined by:

On page 14, please amend the fourth paragraph as follows:

If the support element 12 is divided into two separate spring bars 42 and 44, as shown in ~~Fig. 4,~~ Fig. 5, then in the above considerations in the first approximation, the width b can be assumed to be the sum of the individual widths

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b1 and b2: $b = b_1 + b_2$. Hence simple relations between the width and thickness of a support element can also be deduced for systems of this kind.

On page 15, please amend the second paragraph as follows:

In order to achieve the quietest possible tilting over of the wiper lip 28 from its one drag position into its other drag position, the support element 12 that is used to distribute the contact force (arrow 24) is designed so that the contact force of the wiper strip 24, or rather the wiper lip 28, against the window surface 26 is greater in its middle section 36 ~~(Fig. 11) that~~ than in at least one of the two end sections 38.

On page 18, please amend the paragraph contained in lines 6-21 as follows:

It has turned out that favorable wiping results can be achieved if the curvature K along the adaptive coordinate s is such that the contact force distribution, which prevails when the wiper blade is pressed against a flat window, is greater than in a region approximately halfway between the center and the end of the wiper blade than it is at the end of the wiper blade. Figs. 8 and 9 show this region ~~40~~ 50 for one side. The invention is based on the knowledge is of less significance than the relation between e that the progression of the contact force distribution p in the region ~~40~~ 50 to the contact force distribution p at the ends of the wiper blade. The overall length L of a wiper blade is plotted in Figs. 8 and 9, respectively, in which the connecting element 16

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is disposed in the center of the wiper blade so that the wiper blade ends each occupy the value 0.5 L.

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Amendments to the claims:

Claims 1-18: (canceled)

19. (currently amended) A wiper blade for windows ~~, in particular of motor vehicles~~, comprising:

~~with~~ at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, ~~characterized in that~~ wherein the support element (12) has a cross sectional profile in which

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0.009,$$

where F_{wf} is ~~the~~ an actual contact force exerted on the wiper blade by the wiper arm (18) or is ~~the~~ a contact force for which the wiper blade was originally designed, L is ~~the~~ a length of the support element (12), E is ~~the~~ an elasticity modulus of the support element (12), and I_{zz} is ~~the~~ a moment of inertia of ~~the~~ a cross sectional profile around ~~the~~ a z-axis perpendicular to an s-axis, which adapts along with the support element (12), and perpendicular to a y-axis, wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness d.

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20. (currently amended) The wiper blade according to claim 19, ~~characterized in that~~ wherein

$$\frac{F_{wf} * L^2}{48*E*I_{zz}} < 0.005.$$

21. (canceled)

22. (currently amended) The wiper blade according to claim 19, ~~characterized in that~~ wherein the support element (12) is comprised of at least two individual bars (42, 44) and ~~that~~ wherein ~~the~~ widths (b1, b2) of the individual bars (42, 44) add up to a total width b.

23. (currently amended) The wiper blade according to claim 19, ~~characterized in that~~ wherein the width b and the thickness d of the support element (12) are selected so that

$$\frac{F_{wf} * L^2}{4*E*d*b^3} < 0.009.$$

24. (currently amended) The wiper blade according to claim 19, ~~characterized in that~~ wherein the width b and the thickness d of the flat bar are selected so that

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$$\frac{F_{wf} * L^2}{4*E*d*b^3} < 0.005.$$

25. (currently amended) A wiper blade for windows ~~, in particular of motor vehicles~~, comprising: ~~with~~

at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, ~~in particular according to one of the preceding claims,~~

~~characterized in that~~ wherein the support element (12) has a cross sectional profile (40) which produces a lateral deflection angle of at least one of the support element ends in relation to ~~the~~ a longitudinal span of the support element of γ < 0.5° ~~, in particular < 0.3°~~ against the window (26), when the wiper blade is moved on the window (26) lateral to its longitudinal span, and the friction coefficient between the window (26) and the wiper strip (14) is approximately 1, wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness d..

26. (currently amended) A wiper blade for windows, ~~in particular of motor vehicles,~~ ~~with~~ comprising:

at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an

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elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, ~~in particular according to one of the preceding claims,~~ ~~characterized in that~~ wherein the support element has a length L, a width b, and a thickness d such that

$$20L^2 < bd^2 < 40L^2$$

in which L is given in meters and b and d are given in millimeters, wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness d..

27. (currently amended) The wiper blade according to claim 26, ~~characterized in that~~ wherein the support element is comprised of two spring bars, wherein each spring bar has a width and wherein the widths of the spring bars ~~whose widths~~ are added ~~to each other~~ together.

28. (currently amended) A wiper blade for windows (15) ~~, in particular of motor vehicles~~, ~~with~~ comprising:

at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), ~~in particular according to one of the preceding claims,~~

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~~characterized in that~~ wherein the curvature along a coordinate (s), which follows ~~the~~ a longitudinal span of the support element (12), has values such that ~~the~~ a second derivative of the curvature as a function of this coordinate (s) is essentially proportional to a contact force distribution p (s), which is produced when the wiper blade (10) is pressed against a flat window (15), and ~~that~~ wherein the contact force distribution decreases toward at least one end, wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness d..

29. (currently amended) The wiper blade according to claim 28, ~~characterized in that~~ wherein

$$\frac{d^2K(s)}{ds^2} = \frac{d^2M(s)}{ds^2} * E * I = \frac{p(s)}{E * I}$$

s = coordinate along the support element

K(s) = curvature of the support element

M(s) = bending moment

E = elasticity modulus

I = surface moment of inertia of the support element in relation to ~~the~~ a neutral axis

p(s) = specific force per unit length = contact force distribution

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30. (currently amended) A wiper blade for windows (15), ~~in particular of motor vehicles,~~ comprising:

~~with~~ at last one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), ~~in particular according to one of the preceding claims,~~ ~~characterized in that~~ wherein the curvature along a coordinate (s), which follows ~~the~~ a longitudinal span of the support element (12), has values such that ~~the~~ a second derivative of the curvature as a function of this coordinate (s) minus the second derivative of the curvature of the window (15) decreases from a middle region (40) toward ~~the ends~~ end regions, wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness d..

31. (currently amended) The wiper blade according to claim 30, ~~characterized in that~~ wherein the middle region (40) is ~~the~~ a location of the connecting device (16).

32. (currently amended) The wiper blade according to claim 30, ~~characterized in that~~ wherein

$d^2K(s) \quad p(s) \quad d^2\, K_{window}\,(s)$

$\text{-----} = \text{-----} + \text{---------}$

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ds^2 $E * I$ ds^2

s = coordinate along the support element

K(s) = curvature of the support element

M(s) = bending moment

E = elasticity modulus

I = surface moment of inertia of the support element in relation to ~~the~~ a neutral axis

p(s) = specific force per unit length = contact force distribution

33. (currently amended) A wiper blade for windows (15), ~~in particular of motor vehicles,~~ comprising:

~~with~~ at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), ~~in particular according to one of the preceding claims, characterized in that~~ wherein the curvature along a coordinate (s), which follows ~~the~~ a longitudinal span of the support element (12), has values such that ~~the~~ a contact force distribution p(s), which prevails when the wiper blade (10) is pressed against a flat window (15) is greater in a region (40) approximately halfway between ~~the~~ a center and ~~the~~ an end of the wiper blade (10) than it is at

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the end of the wiper blade (10), wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness d..

34. (currently amended) A wiper blade for windows (15), ~~in particular of motor vehicles, with~~ comprising:

at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), ~~in particular according to one of the preceding claims, characterized in that~~ wherein the curvature along a coordinate (s), which follows ~~the~~ a longitudinal span of the support element (12), has values such that ~~the~~ a contact force distribution p (s), which prevails when the wiper blade (10) is pressed against the window (15) to be wiped, is greater in a region ~~(40)~~ approximately halfway between ~~the~~ a center and ~~the~~ an end of the wiper blade (10) than it is at the end of the wiper blade (10), wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness d..

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35. (currently amended) A method for producing a wiper blade assembly according to claim 19, ~~characterized by means of~~ comprising the following ~~process~~ steps:

~~determination of~~ determining the length L and adapted contact force F_{wf} required for the window to be wiped,

~~determination of~~ determining ~~the~~ a width b and ~~the~~ a thickness d,

~~determination of the~~ determining a curvature progression K(s),

bending ~~of~~ the support element,

~~connection of~~ connecting the supporting element, wiper strip, and connecting device.

36. (currently amended) The method according to claim 35, ~~characterized by means of~~ comprising the following ~~process~~ steps:

- ~~determination of~~ determining the length L and the cross sectional profile, particularly the width b and the thickness d by means of experimental values,
- ~~determination of~~ determining a contact force F_{wf} and a contact force distribution p for a flat window, which assures a favorable wiping quality, likewise by means of experimental values,
- ~~measurement of~~ measuring the curvature progression K_{window} of the window,
- double derivation of this curvature progression K_{window} of the window as a function of a coordinate that adapts along with the curvature,

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- ~~calculation of~~ calculating the second derivative of the curvature progression K(s) of the support element according to ~~the~~ an above relation,
- double integration yields ~~the~~ a desired curvature progression K(s) of the support element.

37. (new) The wiper blade according to claim 25, wherein the longitudinal span is < 0.3°.

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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) (Large Entity)	Docket No. 1524

In Re Application Of: **DE BLOCK**

Serial No.	Filing Date	Examiner	Group Art Unit
09/786,852	05/03/2001	COLE, L.	1744

Invention: **WIPER BLADE FOR WINDSHIELDS...**

TO THE COMMISSIONER FOR PATENTS:

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a response to the Office Action of 09/10/2003 (*Date*) in the above-identified application.

The requested extension is as follows (check time period desired):

☐ One month ☒ Two months ☐ Three months ☐ Four months ☐ Five months

from: DECEMBER 10, 2003 (*Date*) until: FEBRUARY 10, 2004 (*Date*)

The fee for the extension of time is $420 and is to be paid as follows:

☐ A check in the amount of the fee is enclosed.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account No. 19-4675

☒ If an additional extension of time is required, please consider this a petition therefor and charge any additional fees which may be required to Deposit Account No. 19-4675

Signature Dated: **FEBRUARY 10, 2004**

I certify that this document and fee is being deposited on with the U.S. Postal Service as first class mail under 37 C.F.R. 1.8 and is addressed to the Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Signature of Person Mailing Correspondence

Typed or Printed Name of Person Mailing Correspondence

cc:

REMARKS

The present amendment is submitted in response to the Office Action dated September 10, 2003, which set a three-month period for response. Filed herewith is a Request for a Two-month Extension of Time, making this amendment due by February 10, 2004.

Claims 19-36 are pending in this application.

In the Office Action, the drawings and specification were objected to for various informalities. Claims 21, 26-30 and 32-36 were objected to for various informalities. Claims 26-27 were rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement. Claims 19-36 stand rejected under 35 U.S.C. 112, second paragraph, as being indefinite. Claims 19-21 and 23-24 were rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,485,650 to Swanepoel (Swanepoel '650). Claims 19-21, 23-24, 28, 30, 31, and 33-36 were rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,325,564 to Swanepoel (Swanepoel '564). Claims 22 and 27 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Swanepoel in view of U.S. Patent No. 3,192,551 to Appel. Claim 25 was rejected under 35 U.S.C. 103(a) as being unpatentable over Swanepoel in view of U.S. Patent No. 4,045,838 to Porter. Claim 35 was rejected under 35 U.S.C. 103(a) as being unpatentable over Swanepoel in view of U.S. Patent No. 3,192,551 to Appel.

In the present amendment, the drawings and specification have been amended to address the noted objections. The claims have been amended

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generally to adopt standard U.S. claim format and to address the various formal objections and rejections under Section 112, second paragraph.

In the Office Action, on page 2, paragraph 4, the Examiner notes that on page 4, paragraphs 2 and 3 and page 13, values were named (0.005 and 0.009), which were designated both as a proportion and as an another. The Applicant notes that an angle reading in radians is a ratio up to 2 pi, and thus represents a proportion.

It is generally known that the ratio information is not described in radians. In the specification, page 13, last paragraph, the practitioner is provided with the interrelationship that the angle gamma is provided in a degree dimension as well as in a radian dimension. Since here the values of 0.009 and 0.005 are mentioned explicitly, for the practitioner, this interrelationship is clear.

With regard to the objection noted on page 4, paragraph 7 of the Office Action, the Applicant respectfully submits that, as with all patent applications, this application is directed to a practitioner of ordinary skill in the relevant art. An average practitioners that when a quantity p(s) is used in a formula that this represents a functional dependency of a quantity p from a quantity s. For the practitioner, it would be clear that this functionalities are not to be confused with the reference numerals, which are used only to designate a coordinate. However, if the Examiner still believes that these designations are confusing, the Applicant can amend the specification further to replace or delete the reference numeral use of (s).

With regard to the rejection under Section 112, paragraph 1, stated on page 4, paragraph 8, the Applicant must again respectfully disagree. It is common to provide value ranges in the form of inequalities, whereby the value ranges themselves are dependent on parameters. In the present case, the practitioner obtains the manufacturing instruction for the spring bars of the wiper blade that the values for the width and the thickness of the spring bars may lie only in ranges, which are determined by the length of the spring bars. These types of relationships are represented in science by means of proportionalities, while in technology, rather, with proportionality constants, which make possible a conversion of one value range into the other, or with dimensionless values, the statement of the dimensions takes place separately. For purposes of clarity of this interrelationship, the Applicant has chosen the latter variation. It is known to represent such dimensionless values, in particular, with tables, in which the values themselves are set forth as simple numbers and the dimensions are provided within the column headings.

Attached hereto is such a table by way of example from a table book dated 1975, in which for various types of wire, the mass in kilograms per meter can be derived, when a quantity (d, a, s) correlated with the wire diameter lies in millimeters.

The practitioner can determined, based on the correlation provided in the specification, for a wiper blade with a length of 700 mm, in which value range the width for the spring bars must lie, when this has a thickness of 1 mm, for example:

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$20 * (0.7)^2 < b * 1^2 < 40 * (0.7)^2$

$9.8 < b < 19.6$

for the width in mm. For the practitioner, this information is clear. Also for the practitioner, claim 27, in view of Figure 5, is also clear.

Claims 19-21 and 23-24 were rejected under Section 102 as being anticipated by the Swanepoel '650 patent. This reference relates to the lateral rigidity of a spring bar for a wiper blade. Accordingly, the force noted in column 3, lines 38-41 of 1 N also presses parallel to the Z axis – that is, parallel to the windshield. This is not the force that presses the wiper arm onto the wiper blade. Since this force is neither disclosed nor suggested in Swanepoel '650, this reference cannot be viewed as anticipatory of the present invention as defined in claim 19.

Swanepoel '650 shows and describes a wiper blade whose spring contact strip tapes continuously from the center to the tips (column three, lines 36 and 37). The width extends from the tip (6 mm) to the center (11) just under 100%; with the tightness (0.22 mm to 1.29 mm), the increase amounts to just under 500%. Thus, Swanepoel fails to show or suggest the substantially constant width and thickness of the present invention.

Thus, the rejection of the claims under Section 102 cannot be maintained. A prior art reference anticipates a claim only if the reference discloses every limitation of the claim. Absence from the reference of any claimed element negates anticipation. ***Row v. Dror***, 42 USPQ 2d 1550, 1553 (Fed. Cir. 1997).

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Claims 19-21, 23-24, 28, 30, 31, and 33-36 were rejected under Section 102 as being anticipated by Swanepoel '564, and example 2 of this reference is specifically noted. Based on the tapered geometry of the spring bars, values between 0.0009 (center) and 0.016 (ends) can be determined. Thus, the wiper blade of example 2 of Swanepoel '564 lies outside of the range provided in the present application. In other words, by the teachings of the present invention, the practitioner would not learn how to design a wiper blade like that described in Swanepoel '564. Swanepoel '564 actually teaches away from the present invention. Thus, the rejection under Section 102 is not proper.

Also, Swanepoel '564 teaches the practitioner to design wiper blades with outwardly increasing spring bars. In example 2 of Swanepoel '564, the width must increase from 6 mm to 11 mm (just under 100% and the thickness increases from 0.43 mm to 1.15 mm (over 160%). Again, no constant thickness and width is provided.

For a prior art reference to anticipate a claim, the reference must disclose each and every element of the claims with sufficient clarity to provide its existence in the prior art. ***Motorola, Inc. v. Interdigital Tech. Corp.***, 43 USPQ 2d 1481, 1490 (Fed. Cir. 1997).

To more clearly define the present invention over the cited references, claim 19 has been amended to add the features of claim 21, which has been canceled. For the practitioner, the limitations "substantially constant" is clear and requires no further explanation. It is clear to the practitioner that an exact dimensional accuracy is only theoretically obtainable. In practice, always

PAGE 23/27 * RCVD AT 2/10/2004 11:19:39 AM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/0 * DNIS:8729306 * CSID:6315490404 * DURATION (mm-ss):04-34

tolerance fluctuations are provided, which by expensive processes can be maintained at a minimum, but which cannot be avoided. In addition, it is also necessary to apply indentations or recesses on a spring band so that end caps, spoilers or the like can be attached. Thus, the width or the thickness, remaining constant, do not essentially affect the geometry and technical behavior of the spring bars.

In paragraph 13 of the Office Action, the limitations of claim 25 are rejected as obvious over Swanepoel '564 and Porter. As previously noted above, the teachings of Swanepoel '564 guide the practitioner away from the present invention. In Porter, only a known friction value is provided. This friction value is provided only for completion of the teachings. This is necessary because the provided maximal deflection depends on the proportions of the window. From the information that the provided deflection should be considered fro a determined friction value, the practitioner obtains a specific teaching. This teachings is neither provided in Swanepoel '564 alone or in combination with Porter.

Since also in Porter, no further teachings are provided which will lead the practitioner to the present invention when combine with Swanepoel '564, the rejection under Section 103 cannot be maintained.

Also for the reasons set forth above with regard to the patentability of claim 19, claim 35, the method claim, also is patentable over the cited references.

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For the reasons set forth above, the Applicant respectfully submits that claims 19-37 are patentable over the cited references. The Applicant further requests withdrawal of the rejections under 35 U.S.C. 102 and 103 and reconsideration of the claims as herein amended.

In light of the foregoing arguments in support of patentability, the Applicant respectfully submits that this application stands in condition for allowance. Action to this end is courteously solicited.

Should the Examiner have any further comments or suggestions, the undersigned would very much welcome a telephone call in order to discuss appropriate claim language that will place the application into condition for allowance.

Respectfully submitted,

Michael J. Striker
Attorney for Applicant
Reg. No.: 27233
103 East Neck Road
Huntington, New York 11743
631-549-4700

PAGE 25/27 * RCVD AT 2/10/2004 11:19:39 AM [Eastern Standard Time] * SVR:USPTO-EFXRF-1/0 * DNIS:8729306 * CSID:6315490404 * DURATION (mm-ss):04-34

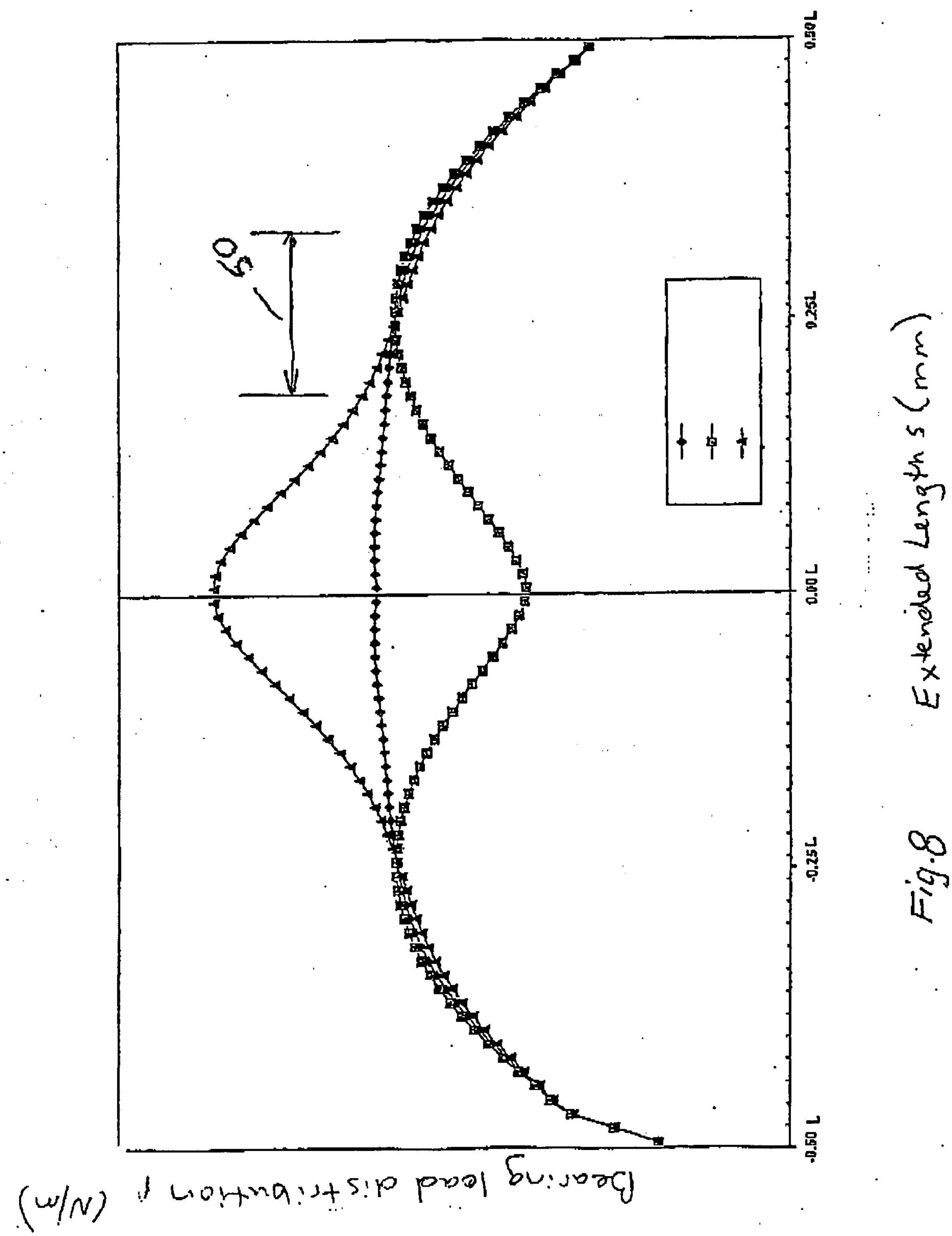
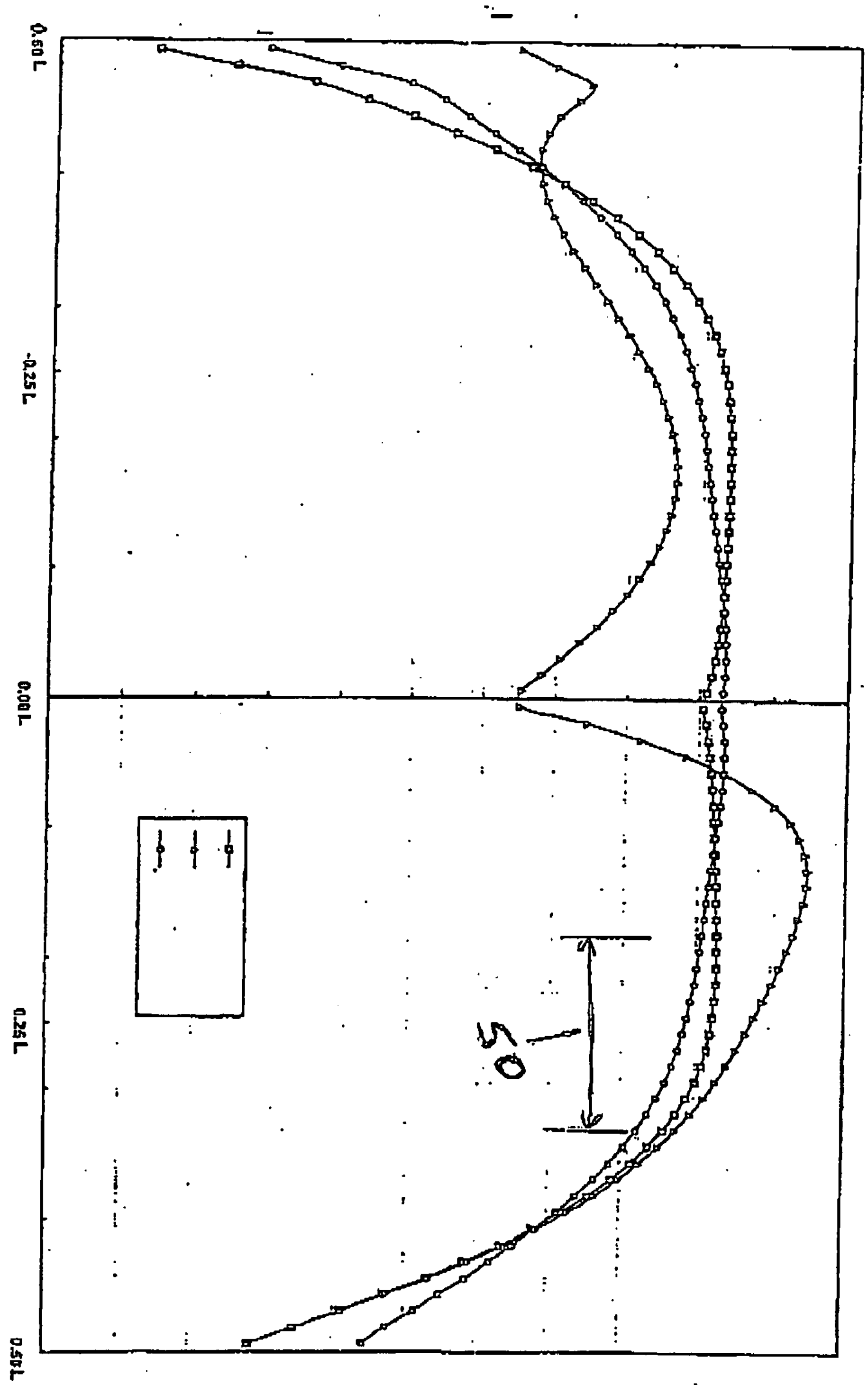

60
0.50 L
0.25L
0.00 L
-0.25L
-0.50 L
Bearing load distribution r (N/m)
Extended Length s (mm)

Fig.8

Bearing load distribution (N/m)

Fig. 9



Extended length (mm)

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UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner: Cole, L. *Art Unit:* 1744

In re:

Applicant: DE BLOCK, P.

Serial No.: 09/786,852

Filed: May 3, 2001

SUPPLEMENTAL AMENDMENT

April 8, 2004

Commissioner for Patents
P. O. Box 1450
Alexandria, Virginia

Sir:

Supplementary to the previous Amendment and in connection with the interview with the Examiner, please amend the application as follows:

PAGE 2/13 * RCVD AT 4/8/2004 11:49:17 AM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/0 * DNIS:8729306 * CSID:631 549 0404 * DURATION (mm-ss):02-52

CERTIFICATE OF TRANSMISSION BY FACSIMILE (37 CFR 1.8) Applicant(s): DE BLOCK			Docket No. 1524
Serial No. 09/786,852	Filing Date 05/03/2001	Examiner COLE, L.	Group Art Unit 1744

Invention: WIPER BLADE FOR WINDSHIELDS, ESPECIALLY...

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I hereby certify that this SUPPLEMENTAL AMENDMENT
(Identify type of correspondence)
is being facsimile transmitted to the United States Patent and Trademark Office (Fax. No. (703) 872 9306)
571 273 1700
on APRIL 8, 2004
(Date)

MICHAEL J. STRIKER
(Typed or Printed Name of Person Signing Certificate)

(Signature)

Note: Each paper must have its own certificate of mailing.

In the claims:

Claims 1-18 cancelled.

19. (currently amended) A wiper blade for windows, comprising:

at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, wherein the support element (12) has a cross sectional profile in which

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0.009,$$

where F_{wf} is an actual contact force exerted on the wiper blade by the wiper arm (18) ~~or is a contact force for which the wiper blade was originally designed~~in condition when it is pressed against a window, L is a length of the support element (12), E is an elasticity modulus of the support element (12), and I_{zz} is a moment of inertia of a cross sectional profile around a z-axis perpendicular to an s-axis, which adapts along with the support element (12), and perpendicular to a y-axis, wherein the support element (12) has a

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substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness d.

20. (Previously presented) The wiper blade according to claim 19, wherein

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0.005.$$

Claim 21 cancelled.

22. (Previously presented) The wiper blade according to claim 19, wherein the support element (12) is comprised of at least two individual bars (42, 44) and wherein widths (b1, b2) of the individual bars (42, 44) add up to a total width b.

Claims 23-24 cancelled.

25. (Previously presented) A wiper blade for windows, comprising: at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an

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elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached,

wherein the support element (12) has a cross sectional profile (40) which produces a lateral deflection angle of at least one of the support element ends in relation to a longitudinal span of the support element of $\gamma < 0.5°$ against the window (26), when the wiper blade is moved on the window (26) lateral to its longitudinal span, and the friction coefficient between the window (26) and the wiper strip (14) is approximately 1, wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness d..

26. (Previously presented) A wiper blade for windows, comprising:

at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, wherein the support element has a length L, a width b, and a thickness d such that

$$20L^2 < bd^2 < 40L^2$$

in which L is given in meters and b and d are given in millimeters, wherein the support element (12) has a substantially rectangular cross

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sectional profile (40), with a substantially constant width b and a substantially constant thickness d..

27. (Previously presented) The wiper blade according to claim 26, wherein the support element is comprised of two spring bars, wherein each spring bar has a width and wherein the widths of the spring bars are added together.

28. (Previously presented) A wiper blade for windows (15), comprising:

at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), wherein the curvature along a coordinate (s), which follows a longitudinal span of the support element (12), has values such that a second derivative of the curvature as a function of this coordinate (s) is essentially proportional to a contact force distribution p (s), which is produced when the wiper blade (10) is pressed against a flat window (15), and wherein the contact force distribution decreases toward at least one end,

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wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness d..

29. (Previously presented) The wiper blade according to claim 28, wherein

$$\frac{d^2K(s)}{ds^2} = \frac{d^2M(s)}{ds^2} * E * I = \frac{p(s)}{E * I}$$

s = coordinate along the support element

K(s) = curvature of the support element

M(s) = bending moment

E = elasticity modulus

I = surface moment of inertia of the support element in relation to a neutral axis

p(s) = specific force per unit length = contact force distribution

30. (Previously presented) A wiper blade for windows (15), comprising:

at last one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support

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element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), wherein the curvature along a coordinate (s), which follows a longitudinal span of the support element (12), has values such that a second derivative of the curvature as a function of this coordinate (s) minus the second derivative of the curvature of the window (15) decreases from a middle region (40) toward end regions, wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness d..

31. (Previously presented) The wiper blade according to claim 30, wherein the middle region (40) is a location of the connecting device (16).

32. (Previously presented) The wiper blade according to claim 30, wherein

$$\frac{d^2K(s)}{ds^2} = \frac{p(s)}{E * I} + \frac{d^2 K_{window}(s)}{ds^2}$$

s = coordinate along the support element

K(s) = curvature of the support element

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M(s) = bending moment

E = elasticity modulus

I = surface moment of inertia of the support element in relation to a neutral axis

p(s) = specific force per unit length = contact force distribution

33. (Previously presented) A wiper blade for windows (15), comprising:

at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), wherein the curvature along a coordinate (s), which follows a longitudinal span of the support element (12), has values such that a contact force distribution p(s), which prevails when the wiper blade (10) is pressed against a flat window (15) is greater in a region (40) approximately halfway between a center and an end of the wiper blade (10) than it is at the end of the wiper blade (10), wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness d..

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34. (Previously presented) A wiper blade for windows (15), comprising:

at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), wherein the curvature along a coordinate (s), which follows a longitudinal span of the support element (12), has values such that a contact force distribution p (s), which prevails when the wiper blade (10) is pressed against the window (15) to be wiped, is greater in a region approximately halfway between a center and an end of the wiper blade (10) than it is at the end of the wiper blade (10), wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness d..

35. (Previously presented) A method for producing a wiper blade assembly according to claim 19, comprising the following steps:

determining the length L and adapted contact force F_{wf} required for the window to be wiped,

determining a width b and a thickness d,

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determining a curvature progression K(s),

bending the support element,

connecting the supporting element, wiper strip, and connecting device.

36. (Previously presented) The method according to claim 35, comprising the following steps:

- determining the length L and the cross sectional profile, particularly the width b and the thickness d by means of experimental values,
- determining a contact force F_{wt} and a contact force distribution p for a flat window, which assures a favorable wiping quality, likewise by means of experimental values,
- measuring the curvature progression K_{window} of the window,
- double derivation of this curvature progression K_{window} of the window as a function of a coordinate that adapts along with the curvature,
- calculating the second derivative of the curvature progression K(s) of the support element according to an above relation,
- double integration yields a desired curvature progression K(s) of the support element.

37. (Previously presented) The wiper blade according to claim 25, wherein the longitudinal span is < 0.3°.

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REMARKS

This Amendment is submitted supplementary to the previous Amendment and in connection with the interview with the Examiner.

During the interview it was determined that claim 19 had to be amended to more clearly define the present invention, and some claims are redundant.

With the present Amendment, claim 19 has been amended and two claims have been canceled.

Reconsideration and allowance of the present application is most respectfully requested.

Should the Examiner require or consider it advisable that the specification, claims and/or drawings be further amended or corrected in formal respects in order to place this case in condition for final allowance, then it is respectfully requested that such amendments or corrections be carried out by Examiner's Amendment, and the case be passed to issue. Alternatively, should the Examiner feel that a personal discussion might be

PAGE 12/13 * RCVD AT 4/8/2004 11:49:17 AM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/0 * DNIS:8729306 * CSID:631 549 0404 * DURATION (mm-ss):02-52

helpful in advancing this case to allowance, he is invited to telephone the undersigned (at 631-549-4700).

Respectfully submitted,

Michael J. Striker
Attorney for Applicants
Reg. No. 27233

PAGE 13/13 * RCVD AT 4/8/2004 11:49:17 AM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/0 * DNIS:8729306 * CSID:631 549 0404 * DURATION (mm-ss):02-52

09/786852

PATENT APPLICATION FEE DETERMINATION RECORD

Effective October 1, 2000

Application or Docket Number: 786852

CLAIMS AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA
TOTAL CLAIMS		
TOTAL CHARGEABLE CLAIMS	7 minus 20=	*
INDEPENDENT CLAIMS	1 minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT		☐

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

SMALL ENTITY TYPE ☐ OR OTHER THAN SMALL ENTITY

SMALL ENTITY RATE	FEE		OTHER THAN SMALL ENTITY RATE	FEE
BASIC FEE		OR	BASIC FEE	$1000
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL		OR	TOTAL	$1000

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 16	Minus	** 20	= /
Independent	* 4	Minus	*** 6	= /
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY RATE	ADDITIONAL FEE		OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	/
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY RATE	ADDITIONAL FEE		OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY RATE	ADDITIONAL FEE		OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. 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 number found in the appropriate box in column 1.

FORM PTO-875 (Rev. 8/00)

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09/786852

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POSITION	INITIALS	ID NO.	DATE
FEE DETERMINATION			
O.I.P.E. CLASSIFIER			
FORMALITY REVIEW			
RESPONSE FORMALITY REVIEW			

INDEX OF CLAIMS

✓	.... Rejected	N	.... Non-elected
=	.... Allowed	I	.... Interference
—	(Through numeral)... Canceled	A	.... Appeal
÷	.... Restricted	O	.... Objected

Claim Final	Claim Original	Date	Claim Final	Claim Original	Date	Claim Final	Claim Original	Date
	1			51			101	
	2			52			102	
	3			53			103	
	4			54			104	
	5			55			105	
	6			56			106	
	7			57			107	
	8			58			108	
	9			59			109	
	10			60			110	
	11			61			111	
	12			62			112	
	13			63			113	
	14			64			114	
	15			65			115	
	16			66			116	
	17			67			117	
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	26			76			126	
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	42			92			142	
	43			93			143	
	44			94			144	
	45			95			145	
	46			96			146	
	47			97			147	
	48			98			148	
	49			99			149	
	50			100			150	

If more than 150 claims or 10 actions staple additional sheet here

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/786,852	05/03/2001	Peter De Block	1524	6623

7590 05/21/2004

Striker Striker & Stenby
103 East Neck Road
Huntington, NY 11743

EXAMINER	
COLE, LAURA C	
ART UNIT	PAPER NUMBER
1744	

DATE MAILED: 05/21/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	09/786,852	DE BLOCK, PETER	
	Examiner	**Art Unit**	
	Laura C Cole	1744	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _08 April 2004_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _19,20,22 and 25-37_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) _19,20,22,25 and 28-37_ is/are allowed.

6)☒ Claim(s) _26 and 27_ is/are rejected.

7)☒ Claim(s) _25-34 and 37_ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _09 March 2001_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. _03312004_ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☒ Other: _"Data Sheet"_.

DETAILED ACTION

Double Patenting

1. Claim 34 is objected to under 37 CFR 1.75 as being a substantial duplicate of claim 33. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Claim Objections

2. Claims 25-34, and 37 are objected to because of the following informalities:

Claims 25, 26, 28, 30, 33, and 34 each have incorrect punctuation ("..") at the end of each of the claims.

Claim 29 is missing a period (".") at the end of the claim.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claim 26 is rejected under 35 U.S.C. 103(a) as being unpatentable over Swanepoel, USPN 5,325,564 in view of Appel, USPN 3,192,551.

Swanepoel discloses the invention as claimed, including a support element (10), a wiper strip (12), a connecting device (14), wherein the support element is an elongated flat bar (Figure 3) to which the wiper strip (12) is attached (see Figures 1-3), wherein the support element has a length, width, and thickness such that $20L^2 < bd^2 < 40L^2$ in which L is given in meters and b and d are given in millimeters, see Column B of the data sheet. The highlighted portion of Column B indicates that over the range of widths (b) and thicknesses (d), the support element of Swanepoel uses width and thickness parameters that fall into the range of $20L^2 < bd^2 < 40L^2$. Further, Swanepoel includes that the support element has a curvature when not loaded by the arm (see Figure 2), wherein the curvature along a coordinate (s) has values such that a second derivative of the curvature as a function of this coordinate (s) is essentially proportional to a contact force distribution p(s) (Column 1 Lines 23-28). Swanepoel does not disclose that the support element has a substantially rectangular cross sectional profile with a substantially constant width b and a substantially constant thickness d.

Appel discloses a windshield wiper blade assembly that includes a number of embodiments relating to the properties of the supporting element (elasticity, curvature, load, length, dimensions) in order to provide a constant loading of pressure throughout the length of the wiper blade (Column 1 Lines 16-41). Appel demonstrates assemblies with support elements of constant widths and thickness (Figure 1) and tapering widths and thickness (Figures 2 and 3).

It would have been obvious for one of ordinary skill in the art to modify Swanepoel and have the support element be a substantially rectangular cross sectional profile with a substantially constant width and thickness, as Appel teaches, in order to provide a substantially uniform pressure on a flat windshield surface. Further it would have been obvious for one of ordinary skill in the art to use values of width and thickness of Swanepoel presents that are in the range of $20L^2 < bd^2 < 40L^2$ to optimize the support element to have a certain critical result. Furthermore, it is not inventive to discover the optimum or workable ranges by routine experimentation. See MPEP 2144.05 II A.

4. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Swanepoel, USPN 5,325,564 in view of Appel, USPN 3,192,551.

Swanepoel and Appel disclose all elements above, however Swanepoel does not include a support element that is comprised of two spring bars that each has a width. In Appel, Figures 6, and 10-15 display two individual bars having separate widths that would add up to a total width when computing the pressure-curvature relationship (Column 2 Lines 37-41). The "gap" between the bars is provided as a securement means of a rib (40) for a wiper blade.

It would have been obvious for one of ordinary skill in the art to modify Swanepoel to have two individual bars as Appel teaches in order to accommodate an alternative method of securing a wiper blade to the support element while maintaining a pressure and geometric relationship.

Allowable Subject Matter

5. Claims 19-20, 22, 25, and 28-37 are allowed.

6. The following is a statement of reasons for the indication of allowable subject matter:

None of the prior art made of record includes a wiper blade comprising a support element, wiper strip, wiper arm, the cross sectional profile in which there is a value less than 0.009 and less than 0.005, or less than 0.5° and less than 0.3°, and in where the force is an actual contact force exerted on the wiper blade by the wiper arm *in condition when it is pressed against a window*. The "force" of Swanepoel is the force to straighten the support element.

Further, none of the prior art made of record includes a support element having a curvature along a coordinate which follows a span of the support element, having values such that a second derivative of the curvature as a function of this coordinate being proportional to a contact force distribution, wherein the contact force distribution *decreases toward at least one end*. Swanepoel discloses the opposite, in that the contact force distribution increases towards at least one end (Column 1 Lines 23-28). Also, none of the prior art includes that the contact force distribution is greater in a region approximately halfway between a center and an end of the wiper blade than it is at the end of the wiper blade.

Applicants Arguments

7. In the response and supplemental response, filed 10 February 2004 and 08 April 2004 respectively, the Applicant contends:

A. In regards to Swanepoel '650, the 1N force is not the force that presses the wiper arm onto the wiper blade.

B. Swanepoel '650 and '564 fail to show or suggest the substantially constant width and thickness.

C. The wiper blade of Swanepoel '564 lies outside of the range provided in the present application.

D. Swanepoel '564 does not provide *substantially* constant width and thickness.

Response to Arguments

8. Applicant's arguments A-D, see responses, filed 10 February 2004 and 08 April 2004, with respect to the rejection(s)of claim(s) 19-37 under 35 U.S.C. 102 (b) to Swanepoel '650 and '564 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Swanepoel ('564) in view of Appel.

Conclusion

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Laura C Cole whose telephone number is (571) 272-1272. The examiner can normally be reached on Monday-Thursday, 7:30am - 5pm, alternating Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert J Warden can be reached on (571) 272-1281. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LCC

LCC

18 May 2004

Terence R. Till
Primary Examiner

Interview Summary	Application No. 09/786,852	Applicant(s) DE BLOCK, PETER	
	Examiner Laura C Cole	Art Unit 1744	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Laura C Cole*.

(2) *Gary Graham*.

(3) *Mr. Zborovsky*.

(4)_____.

Date of Interview: *31 March 2004*.

Type: a)☐ Telephonic b)☐ Video Conference
c)☒ Personal [copy given to: 1)☒ applicant 2)☐ applicant's representative]

Exhibit shown or demonstration conducted: d)☐ Yes e)☒ No.
If Yes, brief description: _____.

Claim(s) discussed: *19-37*.

Identification of prior art discussed: *N/A*.

Agreement with respect to the claims f)☐ was reached. g)☐ was not reached. h)☒ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: *Discussed Amendment of 10 February 2004, clarified equation of Claim 19*.

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

Examiner Note: You must sign this form unless it is an Attachment to a signed Office action.

Examiner's signature, if required

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)
In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

09/786852

ISSUE SLIP STAPLE AREA (for additional cross references)

POSITION	INITIALS	ID NO.	DATE
FEE DETERMINATION			
O.I.P.E. CLASSIFIER			
FORMALITY REVIEW			
RESPONSE FORMALITY REVIEW			

INDEX OF CLAIMS

✓ .... Rejected
= .... Allowed
— (Through numeral)... Canceled
÷ .... Restricted
N .... Non-elected
I .... Interference
A .... Appeal
O .... Objected

Claim Final	Claim Original	Date 4-7-03	Date 5-18-04
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If more than 150 claims or 10 actions
staple additional sheet here

SEARCHED

Class	Sub.	Date	Exmr.
15	250.43	8/28/03	LCC
	250.44		LCC
	250.451		LCC
	250.48		LCC
	250.361		LCC
	250.202		LCC
	250.33		LCC
updated		5/18/04	LCC

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.

SEARCH NOTES
(INCLUDING SEARCH STRATEGY)

	Date	Exmr.
Spoke to G. Graham Class 15	8/28/03	LCC

(RIGHT OUTSIDE)

Data Sheet

based on Swanpoel '564, values from Example 2

Fwf	L (m)	E	d (m)	b (m)	Izz	CLM19		20Lsqd (m)	bdsqd (mm)	40Lsqd (m)	CLM25
6.3	0.44	2.07E+11	0.00043	0.006	7.74E-12	0.01585964	tips	3.872	1.1094	7.744	2.85473542
6.3	0.44	2.07E+11	0.00044	0.006068	8.19E-12	0.01498029		3.872	1.174860274	7.744	2.69645264
6.3	0.44	2.07E+11	0.00045	0.006137	8.67E-12	0.01416242		3.872	1.242739726	7.744	2.54923631
6.3	0.44	2.07E+11	0.00046	0.006205	9.16E-12	0.01340083		3.872	1.313079452	7.744	2.41214946
6.3	0.44	2.07E+11	0.00047	0.006274	9.67E-12	0.01269082		3.872	1.385920547	7.744	2.2843485
6.3	0.44	2.07E+11	0.00048	0.006342	1.02E-11	0.01202818		3.872	1.461304109	7.744	2.16507249
6.3	0.44	2.07E+11	0.00049	0.006411	1.08E-11	0.01140908		3.872	1.539271232	7.744	2.05363384
6.3	0.44	2.07E+11	0.0005	0.006479	1.13E-11	0.01083006		3.872	1.619863013	7.744	1.94941016
6.3	0.44	2.07E+11	0.00051	0.006548	1.19E-11	0.01028798		3.872	1.703120547	7.744	1.85183712
6.3	0.44	2.07E+11	0.00052	0.006616	1.26E-11	0.00978001		3.872	1.78908493	7.744	1.76040226
6.3	0.44	2.07E+11	0.00053	0.006685	1.32E-11	0.00930355		3.872	1.877797258	7.744	1.67463945
6.3	0.44	2.07E+11	0.00054	0.006753	1.39E-11	0.00885625		3.872	1.969298628	7.744	1.59412413
6.3	0.44	2.07E+11	0.00055	0.006822	1.46E-11	0.00843594		3.872	2.063630135	7.744	1.51846902
6.3	0.44	2.07E+11	0.00056	0.00689	1.53E-11	0.00804067		3.872	2.160832874	7.744	1.44732036
6.3	0.44	2.07E+11	0.00057	0.006959	1.6E-11	0.00766864		3.872	2.260947942	7.744	1.38035458
6.3	0.44	2.07E+11	0.00058	0.007027	1.68E-11	0.00731820		3.872	2.364016435	7.744	1.31727535
6.3	0.44	2.07E+11	0.00059	0.007096	1.76E-11	0.00698784		3.872	2.470079448	7.744	1.25781092
6.3	0.44	2.07E+11	0.0006	0.007164	1.84E-11	0.00667618		3.872	2.579178078	7.744	1.20171183
6.3	0.44	2.07E+11	0.00061	0.007233	1.92E-11	0.00638194		3.872	2.69135342	7.744	1.14874875
6.3	0.44	2.07E+11	0.00062	0.007301	2.01E-11	0.00610395		3.872	2.80664657	7.744	1.09871066
6.3	0.44	2.07E+11	0.00063	0.00737	2.1E-11	0.00584113		3.872	2.925098625	7.744	1.05140316
6.3	0.44	2.07E+11	0.00064	0.007438	2.19E-11	0.00559248		3.872	3.046750679	7.744	1.00664697
6.3	0.44	2.07E+11	0.00065	0.007507	2.29E-11	0.00535709		3.872	3.171643829	7.744	0.96427659
6.3	0.44	2.07E+11	0.00066	0.007575	2.39E-11	0.00513411		3.872	3.299819171	7.744	0.92413906
6.3	0.44	2.07E+11	0.00067	0.007644	2.49E-11	0.00492274		3.872	3.431317801	7.744	0.8860929
6.3	0.44	2.07E+11	0.00068	0.007712	2.6E-11	0.00472226		3.872	3.566180814	7.744	0.85000711
6.3	0.44	2.07E+11	0.00069	0.007781	2.71E-11	0.00453200		3.872	3.704449307	7.744	0.81576028
6.3	0.44	2.07E+11	0.0007	0.007849	2.82E-11	0.00435133		3.872	3.846164375	7.744	0.7832398
6.3	0.44	2.07E+11	0.00071	0.007918	2.94E-11	0.00417967		3.872	3.991367114	7.744	0.7523411
6.3	0.44	2.07E+11	0.00072	0.007986	3.06E-11	0.00401648		3.872	4.14009862	7.744	0.72296703
6.3	0.44	2.07E+11	0.00073	0.008055	3.18E-11	0.00386126		3.872	4.292399989	7.744	0.69502722
6.3	0.44	2.07E+11	0.00074	0.008123	3.31E-11	0.00371354		3.872	4.448312317	7.744	0.66843757
6.3	0.44	2.07E+11	0.00075	0.008192	3.44E-11	0.00357289		3.872	4.6078767	7.744	0.64311974
6.3	0.44	2.07E+11	0.00076	0.00826	3.57E-11	0.00343889		3.872	4.771134234	7.744	0.61900068
6.3	0.44	2.07E+11	0.00077	0.008329	3.71E-11	0.00331118		3.872	4.938126014	7.744	0.59601226
6.3	0.44	2.07E+11	0.00078	0.008397	3.85E-11	0.00318939		3.872	5.108893136	7.744	0.57409085
6.3	0.44	2.07E+11	0.00079	0.008466	3.99E-11	0.00307321		3.872	5.283476697	7.744	0.55317703
6.3	0.44	2.07E+11	0.0008	0.008534	4.14E-11	0.00296231		3.872	5.461917792	7.744	0.53321521
6.3	0.44	2.07E+11	0.00081	0.008603	4.3E-11	0.00285641		3.872	5.644257517	7.744	0.51415339
6.3	0.44	2.07E+11	0.00082	0.008671	4.46E-11	0.00275524		3.872	5.830536968	7.744	0.49594289
6.3	0.44	2.07E+11	0.00083	0.00874	4.62E-11	0.00265855		3.872	6.020797241	7.744	0.47853811
6.3	0.44	2.07E+11	0.00084	0.008808	4.78E-11	0.00256609		3.872	6.215079432	7.744	0.46189626
6.3	0.44	2.07E+11	0.00085	0.008877	4.95E-11	0.00247765		3.872	6.413424637	7.744	0.44597726
6.3	0.44	2.07E+11	0.00086	0.008945	5.13E-11	0.00239302		3.872	6.615873951	7.744	0.43074343
6.3	0.44	2.07E+11	0.00087	0.009014	5.31E-11	0.00231200		3.872	6.82246847	7.744	0.41615941
6.3	0.44	2.07E+11	0.00088	0.009082	5.49E-11	0.00223440		3.872	7.033249291	7.744	0.40219197
6.3	0.44	2.07E+11	0.00089	0.009151	5.68E-11	0.00216005		3.872	7.248257509	7.744	0.38880985
6.3	0.44	2.07E+11	0.0009	0.009219	5.88E-11	0.00208880		3.872	7.467534221	7.744	0.37598364
6.3	0.44	2.07E+11	0.00091	0.009288	6.08E-11	0.00202048		3.872	7.691120521	7.744	0.36368566
6.3	0.44	2.07E+11	0.00092	0.009356	6.28E-11	0.00195494		3.872	7.919057506	7.744	0.35188983
6.3	0.44	2.07E+11	0.00093	0.009425	6.49E-11	0.00189206		3.872	8.151386272	7.744	0.34057157
6.3	0.44	2.07E+11	0.00094	0.009493	6.7E-11	0.00183171		3.872	8.388147914	7.744	0.32970771
6.3	0.44	2.07E+11	0.00095	0.009562	6.92E-11	0.00177376		3.872	8.62938353	7.744	0.31927637
6.3	0.44	2.07E+11	0.00096	0.00963	7.14E-11	0.00171809		3.872	8.875134213	7.744	0.30925694
6.3	0.44	2.07E+11	0.00097	0.009699	7.37E-11	0.00166461		3.872	9.125441061	7.744	0.2996299
6.3	0.44	2.07E+11	0.00098	0.009767	7.61E-11	0.00161320		3.872	9.380345169	7.744	0.29037685
6.3	0.44	2.07E+11	0.00099	0.009836	7.85E-11	0.00156378		3.872	9.639887634	7.744	0.28148038
6.3	0.44	2.07E+11	0.001	0.009904	8.1E-11	0.00151624		3.872	9.90410955	7.744	0.27292402
6.3	0.44	2.07E+11	0.00101	0.009973	8.35E-11	0.00147051		3.872	10.17305201	7.744	0.2646922
6.3	0.44	2.07E+11	0.00102	0.010041	8.61E-11	0.00142650		3.872	10.44675612	7.744	0.25677017
6.3	0.44	2.07E+11	0.00103	0.01011	8.87E-11	0.00138413		3.872	10.72526297	7.744	0.24914395
6.3	0.44	2.07E+11	0.00104	0.010178	9.14E-11	0.00134334		3.872	11.00861365	7.744	0.24180032
6.3	0.44	2.07E+11	0.00105	0.010247	9.41E-11	0.00130404		3.872	11.29684927	7.744	0.23472674
6.3	0.44	2.07E+11	0.00106	0.010315	9.69E-11	0.00126617		3.872	11.59001091	7.744	0.2279113
6.3	0.44	2.07E+11	0.00107	0.010384	9.98E-11	0.00122968		3.872	11.88813968	7.744	0.22134273
6.3	0.44	2.07E+11	0.00108	0.010452	1.03E-10	0.00119450		3.872	12.19127666	7.744	0.21501031
6.3	0.44	2.07E+11	0.00109	0.010521	1.06E-10	0.00116058		3.872	12.49946296	7.744	0.20890388
6.3	0.44	2.07E+11	0.0011	0.010589	1.09E-10	0.00112785		3.872	12.81273967	7.744	0.20301377
6.3	0.44	2.07E+11	0.00111	0.010658	1.12E-10	0.00109628		3.872	13.13114789	7.744	0.1973308
6.3	0.44	2.07E+11	0.00112	0.010726	1.15E-10	0.00106581		3.872	13.45472871	7.744	0.19184626
6.3	0.44	2.07E+11	0.00113	0.010795	1.18E-10	0.00103640		3.872	13.78352323	7.744	0.18655185
6.3	0.44	2.07E+11	0.00114	0.010863	1.22E-10	0.00100800		3.872	14.11757254	7.744	0.18143967
6.3	0.44	2.07E+11	0.00115	0.010932	1.25E-10	0.00098057	center	3.872	14.45691774	7.744	0.17650221

REMARKS

The last Office Action has been carefully considered.

It is noted that claim 26 is rejected under 35 U.S.C. 103(a) over the patent to Swanepoel in view of the patent to Appel.

Claim 27 is rejected under 35 U.S.C. 103 over the patent to Swanepoel in view of the patent to Appel.

At the same time, the Examiner indicated the claims 19-20, 22-25 and 28-37 are allowed.

Also, the claims are objected to for formal reasons.

In connection with the Examiner's rejection of the claims, claims 26 and 27 have been canceled without prejudice.

The allowed claims have been retained in the application.

Also, claim 34 has been canceled as required by the Examiner.

Claims 25, 26, 28, 29, 30, 33 and 34 have been amended to eliminate minor inaccuracies in the claims.

It is therefore believed that the present application now contains the claims which can be allowed.

Reconsideration and allowance of the present application is most respectfully requested.

Should the Examiner require or consider it advisable that the specification, claims and/or drawings be further amended or corrected in formal respects in order to place this case in condition for final allowance, then it is respectfully requested that such amendments or corrections be carried out by Examiner's Amendment, and the case be passed to issue. Alternatively, should the Examiner feel that a personal discussion might be helpful in advancing this case to allowance, he is invited to telephone the undersigned (at 631-549-4700).

Respectfully submitted,

Michael J. Striker
Attorney for Applicants
Reg. No. 27233

In the claims:

Claims 1-18 cancelled.

19. (Previously presented) A wiper blade for windows, comprising:

at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, wherein the support element (12) has a cross sectional profile in which

$$\frac{F_{wf} * L^2}{48 * E * I_{zz}} < 0.009,$$

where F_{wf} is an actual contact force exerted on the wiper blade by the wiper arm (18) in condition when it is pressed against a window, L is a length of the support element (12), E is an elasticity modulus of the support element (12), and I_{zz} is a moment of inertia of a cross sectional profile around a z-axis perpendicular to an s-axis, which adapts along with the support element (12), and perpendicular to a y-axis, wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness d.

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20. (Previously presented) The wiper blade according to claim 19, wherein

$$\frac{F_{wf} * L^2}{48*E*I_{zz}} < 0.005.$$

Claim 21 cancelled.

22. (Previously presented) The wiper blade according to claim 19, wherein the support element (12) is comprised of at least two individual bars (42, 44) and wherein widths (b1, b2) of the individual bars (42, 44) add up to a total width b.

Claims 23-24 cancelled.

25. (Currently amended) A wiper blade for windows, comprising:

at least one support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18), wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached,

wherein the support element (12) has a cross sectional profile (40) which produces a lateral deflection angle of at least one of the support

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element ends in relation to a longitudinal span of the support element of $\gamma < 0.5°$ against the window (26), when the wiper blade is moved on the window (26) lateral to its longitudinal span, and the friction coefficient between the window (26) and the wiper strip (14) is approximately 1, wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness ~~d.~~d.

Claims 26-27 cancelled.

28. (Currently amended) A wiper blade for windows (15), comprising:

at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), wherein the curvature along a coordinate (s), which follows a longitudinal span of the support element (12), has values such that a second derivative of the curvature as a function of this coordinate (s) is essentially proportional to a contact force distribution p (s), which is produced when the wiper blade (10) is pressed against a flat window (15),

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and wherein the contact force distribution decreases toward at least one end, wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness ~~d.~~d.

29. (Currently amended) The wiper blade according to claim 28, wherein

$$\frac{d^2K(s)}{ds^2} = \frac{d^2M(s)}{ds^2} * E * I = \frac{p(s)}{E * I}$$

s = coordinate along the support element

K(s) = curvature of the support element

M(s) = bending moment

E = elasticity modulus

I = surface moment of inertia of the support element in relation to a neutral axis

p(s) = specific force per unit length = contact force distribution.

30. (Currently amended) A wiper blade for windows (15), comprising:

at last one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade

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(10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), wherein the curvature along a coordinate (s), which follows a longitudinal span of the support element (12), has values such that a second derivative of the curvature as a function of this coordinate (s) minus the second derivative of the curvature of the window (15) decreases from a middle region (40) toward end regions, wherein the support element (12) has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness ~~d.~~ d.

31. (Previously presented) The wiper blade according to claim 30, wherein the middle region (40) is a location of the connecting device (16).

32. (Previously presented) The wiper blade according to claim 30, wherein

$$\frac{d^2K(s)}{ds^2} = \frac{p(s)}{E * I} + \frac{d^2 K_{window}(s)}{ds^2}$$

s = coordinate along the support element

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Costco Exhibit 1002, p. 367

K(s) = curvature of the support element

M(s) = bending moment

E = elasticity modulus

I = surface moment of inertia of the support element in relation to a neutral axis

p(s) = specific force per unit length = contact force distribution

33. (Currently amended) A wiper blade for windows (15), comprising:

at least one elongated support element (12), a wiper strip (14), and a connecting device (16) for a wiper arm (18) which presses the wiper blade (10) against the window (15) in an operating position, wherein the support element (12) is an elongated, flat bar to which the wiper strip (14) and the connecting device (16) are attached, and which has a curvature when it is not loaded by the wiper arm (18), wherein the curvature along a coordinate (s), which follows a longitudinal span of the support element (12), has values such that a contact force distribution p(s), which prevails when the wiper blade (10) is pressed against a flat window (15) is greater in a region (40) approximately halfway between a center and an end of the wiper blade (10) than it is at the end of the wiper blade (10), wherein the support element (12)

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has a substantially rectangular cross sectional profile (40), with a substantially constant width b and a substantially constant thickness ~~d.~~ d.

Claim 34 cancelled.

35. (Previously presented) A method for producing a wiper blade assembly according to claim 19, comprising the following steps:

determining the length L and adapted contact force F_{wf} required for the window to be wiped,

determining a width b and a thickness d,

determining a curvature progression K(s),

bending the support element,

connecting the supporting element, wiper strip, and connecting device.

36. (Previously presented) The method according to claim 35, comprising the following steps:

- determining the length L and the cross sectional profile, particularly the width b and the thickness d by means of experimental values,
- determining a contact force F_{wf} and a contact force distribution p for a flat window, which assures a favorable wiping quality, likewise by means of experimental values,

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- measuring the curvature progression K_{window} of the window,
- double derivation of this curvature progression K_{window} of the window as a function of a coordinate that adapts along with the curvature,
- calculating the second derivative of the curvature progression K(s) of the support element according to an above relation,
- double integration yields a desired curvature progression K(s) of the support element.

37. (Previously presented) The wiper blade according to claim 25, wherein the longitudinal span is < 0.3°.

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Costco Exhibit 1002, p. 370

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UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner: Cole, L. *Art Unit:* 1744

In re:

OFFICIAL

Applicant: DE BLOCK, P.

Serial No.: 09/786,852

Filed: May 3, 2001

REQUEST FOR RECONSIDERATION

August 23, 2004

Commissioner for Patents
P. O. Box 1450
Alexandria, Virginia

Sir:

Responsive to the Office Action of May 24, 2004, please amend the application as follows:

PAGE 2/12 * RCVD AT 8/23/2004 2:34:36 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-1/1 * DNIS:8729306 * CSID:631 549 0404 * DURATION (mm-ss):02-30

CERTIFICATE OF TRANSMISSION BY FACSIMILE (37 CFR 1.8) Applicant(s): DE BLOCK, P			Docket No. 1524
Application No. 09/786,852	Filing Date 05/03/2001	Examiner COLE, L.	Group Art Unit 1744
Invention: WIPER BLADE FOR WINDSHIELDS, ESPECIALLY...			

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(Typed or Printed Name of Person Signing Certificate)

(Signature)

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Page 2

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2000

Application or Docket Number
09786852

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS		
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	7 minus 20=	* —
INDEPENDENT CLAIMS	1 minus 3 =	* —
MULTIPLE DEPENDENT CLAIM PRESENT		☐

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

SMALL ENTITY TYPE ☐ RATE	FEE	OR	OTHER THAN SMALL ENTITY RATE	FEE
BASIC FEE		OR	BASIC FEE	1000
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL		OR	TOTAL	1000

CLAIMS AS AMENDED - PART II

8.23.01

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 13	Minus	** 28	= —
Independent	* 3	Minus	*** 8	= —
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. 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 number found in the appropriate box in column 1.

FORM PTO-875
(Rev. 8/00)

Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

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PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2000

Application or Docket Number: 786852

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS		
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	7 minus 20=	* —
INDEPENDENT CLAIMS	1 minus 3 =	* —
MULTIPLE DEPENDENT CLAIM PRESENT		☐

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

SMALL ENTITY TYPE ☐ RATE	FEE	OR	OTHER THAN SMALL ENTITY RATE	FEE
BASIC FEE		OR	BASIC FEE	710.00
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL		OR	TOTAL	710.00

CLAIMS AS AMENDED - PART II

3.9.01

AMENDMENT A	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 18	Minus	** 20	= —
Independent	* 4	Minus	*** 8	= —
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	—
X40=		OR	X80=	—
+135=		OR	+270=	—
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	—

2.10.04

AMENDMENT B	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 18	Minus	** 20	= —
Independent	* 4	Minus	*** 8	= —
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	—
X40=		OR	X80=	—
+135=		OR	+270=	—
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

4.8.04

AMENDMENT C	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 16	Minus	** 20	= —
Independent	* 4	Minus	*** 8	= —
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	—
X40=		OR	X80=	—
+135=		OR	+270=	—
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. 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 number found in the appropriate box in column 1.

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09/786852

ISSUE SLIP STAPLE AREA (for additional cross references)

POSITION	INITIALS	ID NO.	DATE
FEE DETERMINATION			
O.I.P.E. CLASSIFIER			
FORMALITY REVIEW			
RESPONSE FORMALITY REVIEW			

INDEX OF CLAIMS

✓ .... Rejected
= .... Allowed
— (Through numeral)... Canceled
÷ .... Restricted
N .... Non-elected
I .... Interference
A .... Appeal
O .... Objected

Claim Final	Claim Original	Date 4-7-03	Claim Final	Claim Original	Date	Claim Final	Claim Original	Date
	1			51			101	
	2			52			102	
	3			53			103	
	4			54			104	
	5			55			105	
	6			56			106	
	7			57			107	
	8			58			108	
	9			59			109	
	10			60			110	
	11			61			111	
	12			62			112	
	13			63			113	
	14			64			114	
	15			65			115	
	16			66			116	
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	38			88			138	
	39			89			139	
	40			90			140	
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	42			92			142	
	43			93			143	
	44			94			144	
	45			95			145	
	46			96			146	
	47			97			147	
	48			98			148	
	49			99			149	
	50			100			150	

If more than 150 claims or 10 actions
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7590 09/20/2004

Striker Striker & Stenby
103 East Neck Road
Huntington, NY 11743

EXAMINER	
COLE, LAURA C	
ART UNIT	PAPER NUMBER
1744	

DATE MAILED: 09/20/2004

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/786,852	05/03/2001	Peter De Block	1524	6623

TITLE OF INVENTION: WIPER BLADE FOR WINDSHIELDS, ESPECIALLY AUTOMOBILE WINDSHIELDS, AND METHOD FOR THE PRODUCTION THEREOF

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1330	$0	$1330	12/20/2004

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PTOL-85 (Rev. 09/04) Approved for use through 04/30/2007.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

or Fax **(703) 746-4000**

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

7590 09/20/2004

Striker Striker & Stenby
103 East Neck Road
Huntington, NY 11743

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (703) 746-4000, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/786,852	05/03/2001	Peter De Block	1524	6623

TITLE OF INVENTION: WIPER BLADE FOR WINDSHIELDS, ESPECIALLY AUTOMOBILE WINDSHIELDS, AND METHOD FOR THE PRODUCTION THEREOF

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1330	$0	$1330	12/20/2004

EXAMINER	ART UNIT	CLASS-SUBCLASS
COLE, LAURA C	1744	015-250430

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 __________

2 __________

3 __________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are enclosed:

☐ Issue Fee

☐ Publication Fee (No small entity discount permitted)

☐ Advance Order - # of Copies __________

4b. Payment of Fee(s):

☐ A check in the amount of the fee(s) is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number __________ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.

☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature __________ Date __________

Typed or printed name __________ Registration No. __________

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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.

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 NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/786,852	05/03/2001	Peter De Block	1524	6623

7590 09/20/2004

Striker Striker & Stenby
103 East Neck Road
Huntington, NY 11743

EXAMINER	
COLE, LAURA C	
ART UNIT	PAPER NUMBER
1744	

DATE MAILED: 09/20/2004

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 312 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 312 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (703) 305-1383. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.

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
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/786,852	05/03/2001	Peter De Block	1524	6623

7590 09/20/2004

Striker Striker & Stenby
103 East Neck Road
Huntington, NY 11743

EXAMINER	
COLE, LAURA C	
ART UNIT	PAPER NUMBER
1744	

DATE MAILED: 09/20/2004

Notice of Fee Increase on October 1, 2004

If a reply to a "Notice of Allowance and Fee(s) Due" is filed in the Office on or after October 1, 2004, then the amount due will be higher than that set forth in the "Notice of Allowance and Fee(s) Due" because some fees will increase effective October 1, 2004. See Revision of Patent Fees for Fiscal Year 2005; Final Rule, 69 Fed. Reg. 52604, 52606 (May 10, 2004).

The current fee schedule is accessible from WEB site (http://www.uspto.gov/main/howtofees.htm).

If the fee paid is the amount shown on the "Notice of Allowance and Fee(s) Due" but not the correct amount in view of the fee increase, a "Notice of Pay Balance of Issue Fee" will be mailed to applicant. In order to avoid processing delays associated with mailing of a "Notice of Pay Balance of Issue Fee," if the response to the Notice of Allowance is to be filed on or after October 1, 2004 (or mailed with a certificate of mailing on or after October 1, 2004), the issue fee paid should be the fee that is required at the time the fee is paid. See Manual of Patent Examining Procedure (MPEP), Section 1306 (Eighth Edition, Rev. 2, May 2004). If the issue fee was previously paid, and the response to the "Notice of Allowance and Fee(s) Due" includes a request to apply a previously-paid issue fee to the issue fee now due, then the difference between the issue fee amount at the time the response is filed and the previously-paid issue fee should be paid. See MPEP Section 1308.01.

Effective October 1, 2004, 37 CFR 1.18 is amended by revising paragraphs (a) through (c) to read as set forth below.

Section 1.18 Patent post allowance (including issue) fees.

(a) Issue fee for issuing each original or reissue patent, except a design or plant patent:
- By a small entity (Sec. 1.27(a))...................... $685.00
- By other than a small entity......................... $1,370.00

(b) Issue fee for issuing a design patent:
- By a small entity (Sec. 1.27(a))...................... $245.00
- By other than a small entity............................ $490.00

(c) Issue fee for issuing a plant patent:
- By a small entity (Sec. 1.27(a))...................... $330.00
- By other than a small entity............................ $660.00

Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.

PTOL-85 (Rev. 09/04) Approved for use through 04/30/2007.

Notice of Allowability	Application No. 09/786,852	Applicant(s) DE BLOCK, PETER
	Examiner Laura C Cole	Art Unit 1744

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 23 August 2004.
2. ☒ The allowed claim(s) is/are 19,20,22,28-33,35 and 36.
3. ☒ The drawings filed on 10 February 2004 are accepted by the Examiner.
4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
6. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
7. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☒ Interview Summary (PTO-413), Paper No./Mail Date 09162004 .
7. ☒ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

EXAMINER'S AMENDMENT

An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a telephone interview with Mr. Zborovsky on 16 September 2004.

The application has been amended as follows:

In the claims:

Cancel Claims 25 and 37

The following is an examiner's statement of reasons for allowance:

None of the prior art made of record includes a wiper blade comprising a support element, wiper strip, wiper arm, the cross sectional profile in which there is a value less than 0.009 and less than 0.005, and in where the force is an actual contact force exerted on the wiper blade by the wiper arm *in condition when it is pressed against a window.* The "force" of Swanepoel is the force to straighten the support element.

Further, none of the prior art made of record includes a support element having a curvature along a coordinate which follows a span of the support element, having values such that a second derivative of the curvature as a function of this coordinate being proportional to a contact force distribution, wherein the contact force distribution *decreases toward at least one end.* Swanepoel discloses the opposite, in that the contact force distribution increases towards at least one end (Column 1 Lines 23-28). Also, none of the prior art includes that the contact force distribution is greater in a region approximately halfway between a center and an end of the wiper blade than it is at the end of the wiper blade.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Laura C Cole whose telephone number is (571) 272-1272. The examiner can normally be reached on Monday-Thursday, 7:30am - 5pm, alternating Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Robert J Warden can be reached on (571) 272-1281. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

LCC
LCC

16 September 2004

Robert J. Warden, Sr.
ROBERT J. WARDEN, SR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700

Examiner-Initiated Interview Summary	**Application No.** 09/786,852	**Applicant(s)** DE BLOCK, PETER	
	Examiner Laura C Cole	**Art Unit** 1744	

All Participants:

(1) Laura C Cole.

(2) Mr. Zborovsky.

Status of Application: Allowed

(3) _____.

(4) _____.

Date of Interview: 16 September 2004

Time: 10:45 am

Type of Interview:
☒ Telephonic
☐ Video Conference
☐ Personal (Copy given to: ☐ Applicant ☐ Applicant's representative)

Exhibit Shown or Demonstrated: ☐ Yes ☒ No
If Yes, provide a brief description: .

Part I.

Rejection(s) discussed:

Claims discussed:
25, 37

Prior art documents discussed:
Appell

Part II.

SUBSTANCE OF INTERVIEW DESCRIBING THE GENERAL NATURE OF WHAT WAS DISCUSSED:
See Examiner's Amendment

Part III.

☒ It is not necessary for applicant to provide a separate record of the substance of the interview, since the interview directly resulted in the allowance of the application. The examiner will provide a written summary of the substance of the interview in the Notice of Allowability.

☐ It is not necessary for applicant to provide a separate record of the substance of the interview, since the interview did not result in resolution of all issues. A brief summary by the examiner appears in Part II above.

LC

(Examiner/SPE Signature)

(Applicant/Applicant's Representative Signature – if appropriate)

Issue Classification	Application No.	Applicant(s)
	09/786,852	DE BLOCK, PETER
	Examiner	**Art Unit**
	Laura C Cole	1744

ISSUE CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)							
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)						
15	250.43	15	250.45 1						

INTERNATIONAL CLASSIFICATION				
A	4	7	L	1/00
B	6	0	S	1/02
				/
				/
				/

Laura C Cole
Laura C Cole 9-16-2004
(Assistant Examiner) (Date)

Harold Smith 9/17/04
(Legal Instruments Examiner) (Date)

Robert J. Warden Sr.
ROBERT J. WARDEN, SR.
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 1700
(Primary Examiner) (Date)
9/17/2004

Total Claims Allowed: 11

O.G. Print Claim(s)	O.G. Print Fig.
19	1 & 7

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1	7	31		61		91		121		151		181
	2	8	32		62		92		122		152		182
	3	9	33		63		93		123		153		183
	4		34		64		94		124		154		184
	5	10	35		65		95		125		155		185
	6	11	36		66		96		126		156		186
	7		37		67		97		127		157		187
	8		38		68		98		128		158		188
	9		39		69		99		129		159		189
	10		40		70		100		130		160		190
	11		41		71		101		131		161		191
	12		42		72		102		132		162		192
	13		43		73		103		133		163		193
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	16		46		76		106		136		166		196
	17		47		77		107		137		167		197
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	21		51		81		111		141		171		201
3	22		52		82		112		142		172		202
	23		53		83		113		143		173		203
	24		54		84		114		144		174		204
	25		55		85		115		145		175		205
	26		56		86		116		146		176		206
	27		57		87		117		147		177		207
4	28		58		88		118		148		178		208
5	29		59		89		119		149		179		209
6	30		60		90		120		150		180		210

SEARCHED			
Class	Sub.	Date	Exmr.
15	250.43	8/28/03	LCC
	250.44		LCC
	250.451		LCC
	250.48		LCC
	250.361		LCC
	250.202		LCC
	250.33		LCC
updated		5/18/04	LCC
updated		9/16/04	LCC

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	Date	Exmr.
Spoke to G. Graham Class 15	8/28/03	LCC

INTERFERENCE SEARCHED			
Class	Sub.	Date	Exmr.
same	as a base	9/16/04	LCC

(RIGHT OUTSIDE)

09/786852

ISSUE SLIP STAPLE AREA (for additional cross references)

POSITION	INITIALS	ID NO.	DATE
FEE DETERMINATION	-		
O.I.P.E. CLASSIFIER			
FORMALITY REVIEW			
RESPONSE FORMALITY REVIEW			

INDEX OF CLAIMS

✔ .... Rejected		N .... Non-elected	
= .... Allowed		I .... Interference	
— (Through numeral)... Canceled		A .... Appeal	
÷ .... Restricted		O .... Objected	

Claim Final	Claim Original	Date 4-7-03	Date 5-18-04	Date 9-16-04	Date	Date	Date	Date	Date	Date
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If more than 150 claims or 10 actions
staple additional sheet here

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (703) 746-4000

OIPE DEC 01 2004 PATENT & TRADEMARK OFFICE

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

7590 09/20/2004

Striker Striker & Stenby
103 East Neck Road
Huntington, NY 11743

12/02/2004 ZJUHAR2 00000079 194675 09786852

01 FC:1501 1370.00 DA
02 FC:1504 300.00 DA

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (703) 746-4000, on the date indicated below.

Michael J. Striker	(Depositor's name)
[signature]	(Signature)
11/29/2004	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/786,852	05/03/2001	Peter De Block	1524	6623

TITLE OF INVENTION: WIPER BLADE FOR WINDSHIELDS, ESPECIALLY AUTOMOBILE WINDSHIELDS, AND METHOD FOR THE PRODUCTION THEREOF

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	~~$1330~~ 1370	$0	~~$1330~~ 1670	12/20/2004

EXAMINER	ART UNIT	CLASS-SUBCLASS
COLE, LAURA C	1744	015-250430

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
   - ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
   - ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
   (1) the names of up to 3 registered patent attorneys or agents OR, alternatively,
   (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
   1 Michael J. Striker
   2 ______
   3 ______

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE: Robert Bosch GmbH

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Stuttgart, Germany

Please check the appropriate assignee category or categories (will not be printed on the patent): ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are enclosed:
- ☒ Issue Fee
- ☒ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies ______

4b. Payment of Fee(s):
- ☐ A check in the amount of the fee(s) is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number 19-4675 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature [signature] Date 11/29/2004

Typed or printed name Michael J. Striker Registration No. 27233

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

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.

AO 121 (6/90)

TO:	
COMMISSIONER OF PATENTS AND TRADEMARKS (USPTO) P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OF DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK

In compliance with 35 U.S.C. 290 and/or 15 U.S.C. 1116 you are hereby advised that a court action has been filed on the following patent(s)/trademark(s) in the U.S. District Court:

DOCKET NO. 12cv437	DATE FILED: 1/20/2012	UNITED STATES DISTRICT COURT, NORTHERN DISTRICT OF ILLINOIS, EASTERN DIVISION
Plaintiff(s): Robert Bosch LLC	**Defendant(s):** Trico Products Corporation	
TRADEMARK NUMBER	DATE OF TRADEMARK	HOLDER OF PATENT OR TRADEMARK
6530111	03/11/2003	Thomas Kotlarski
6553607	04/29/2003	Peter De Block
6611988	09/02/2003	Peter De Block
6675434	01/13/2004	Manfred Wilhelm
6836926	01/04/2005	Peter De Block
6973698	12/13/2005	Thomas Kotlarski

In the above-entitled case, the following trademarks(s) have been included:

DATE INCLUDED	INCLUDED BY [ ] Amendment [ ] Answer [ ] Cross Bill [ ] Other Pleading	
TRADEMARK NUMBER	DATE OF TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1.		
2.		
3.		

In the above-entitled case, the following decision has been rendered or judgment issued:

DECISION/JUDGMENT		
CLERK - MICHAEL W. DOBBINS	DEPUTY CLERK: /s/ Lorenzo Walker	DATE: 1/23/2012

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court District of Delaware on the following

☐ Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED 5/4/2012	U.S. DISTRICT COURT District of Delaware
PLAINTIFF Robert Bosch LLC		DEFENDANT Alberee Products, Inc. d/b/a Saver Automotive Products, Inc. and API Korea Co., Ltd.

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 US 6,523,218 B1	2/25/2003	Robert Bosch LLC
2 US 6,530,111 B1	3/11/2003	Robert Bosch LLC
3 US 6,553,607 B1	4/29/2003	Robert Bosch LLC
4 US 6,611,988 B1	9/2/2003	Robert Bosch LLC
5 SEE ATTACHED		

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

ADDITIONAL PATENTS

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
US 6,675,434 B1	1/13/2004	Robert Bosch LLC
US 6,836,926 B1	1/4/2005	Robert Bosch LLC
US 6,944,905 B2	9/20/2005	Robert Bosch LLC
US 6,973,698, B1	12/13/2005	Robert Bosch LLC
US 7,228,588 B2	6/12/2007	Robert Bosch LLC
US 7,293,321, B2	11/13/2007	Robert Bosch LLC
US 7,484,264 B2	2/3/2009	Robert Bosch LLC
US 7,523,520 B2	4/28/2009	Robert Bosch LLC

AO 120 (Rev. 08/10)

TO: Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	**REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK**

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court Eastern District of MIchigan on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
11-14019	9/14/2011	Eastern District of MIchigan

PLAINTIFF	DEFENDANT
Robert Bosch LLC	Corea Autoparts Producing Corporation et al

PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1 6,553,607	4/29/2003	Robert Bosch LLC
2 6,675,434	1/13/2004	Robert Bosch LLC
3 6,836,926	1/4/2005	Robert Bosch LLC
4 6,944,905	9/20/2005	Robert Bosch LLC
5 6,973,698	12/13/2005	Robert Bosch LLC

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	**DATE OF PATENT OR TRADEMARK**	**HOLDER OF PATENT OR TRADEMARK**
1 7,293,321	11/13/2007	Robert Bosch LLC
2 7,523,520	4/28/2009	Robert Bosch LLC
3 6,523,218	2/25/2003	Robert Bosch LLC
4 6,611,988	9/2/2003	Robert Bosch LLC
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT
STIPULATED ORDER DISMISSING CASE Signed by District Judge Julian Abele Cook. (Entered: 09/20/2013)

CLERK	(BY) DEPUTY CLERK	DATE
David J. Weaver	Peggy S. MIller	9/23/2013

Copy 1—Upon initiation of action, mail this copy to Director Copy 3—Upon termination of action, mail this copy to Director
Copy 2—Upon filing document adding patent(s), mail this copy to Director Copy 4—Case file copy

AO 121 (6/90)

TO:	
COMMISSIONER OF PATENTS AND TRADEMARKS (USPTO) P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OF DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK

In compliance with 35 U.S.C. 290 and/or 15 U.S.C. 1116 you are hereby advised that a court action has been filed on the following patent(s)/trademark(s) in the U.S. District Court:

DOCKET NO. 12cv437	DATE FILED: 1/20/2012	UNITED STATES DISTRICT COURT, NORTHERN DISTRICT OF ILLINOIS, EASTERN DIVISION
Plaintiff(s): Robert Bosch LLC	**Defendant(s):** Trico Products Corporation	

TRADEMARK NUMBER	DATE OF TRADEMARK	HOLDER OF PATENT OR TRADEMARK
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6675434	01/13/2004	Manfred Wilhelm
6836926	01/04/2005	Peter De Block
6973698	12/13/2005	Thomas Kotlarski

In the above-entitled case, the following trademarks(s) have been included:

DATE INCLUDED	INCLUDED BY [ ] Amendment [ ] Answer [ ] Cross Bill [ ] Other Pleading	
TRADEMARK NUMBER	DATE OF TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1.		
2.		
3.		

In the above-entitled case, the following decision has been rendered or judgment issued:

DECISION/JUDGMENT	Case closed pursuant to Stipulation of Dismissal and Order entered on 8/6/14.	
CLERK - MICHAEL W. DOBBINS	DEPUTY CLERK: /s/ M. Rivera	DATE: 8/7/2014