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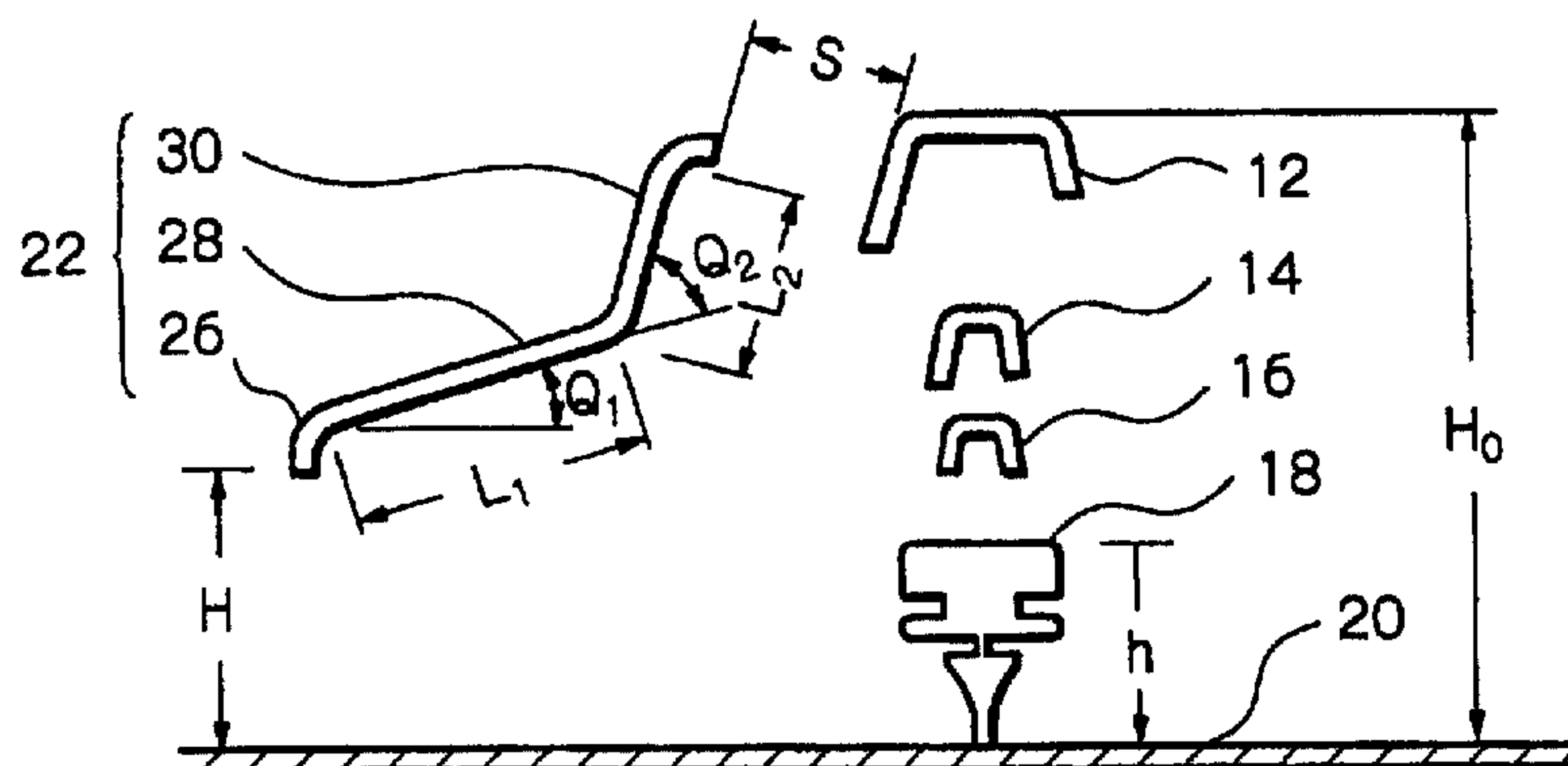
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(54) **BALAI D'ESSUIE-GLACE ET DEFLECTEUR D'AIR**

(54) **WIPER BLADE WITH WIND DEFLECTOR**



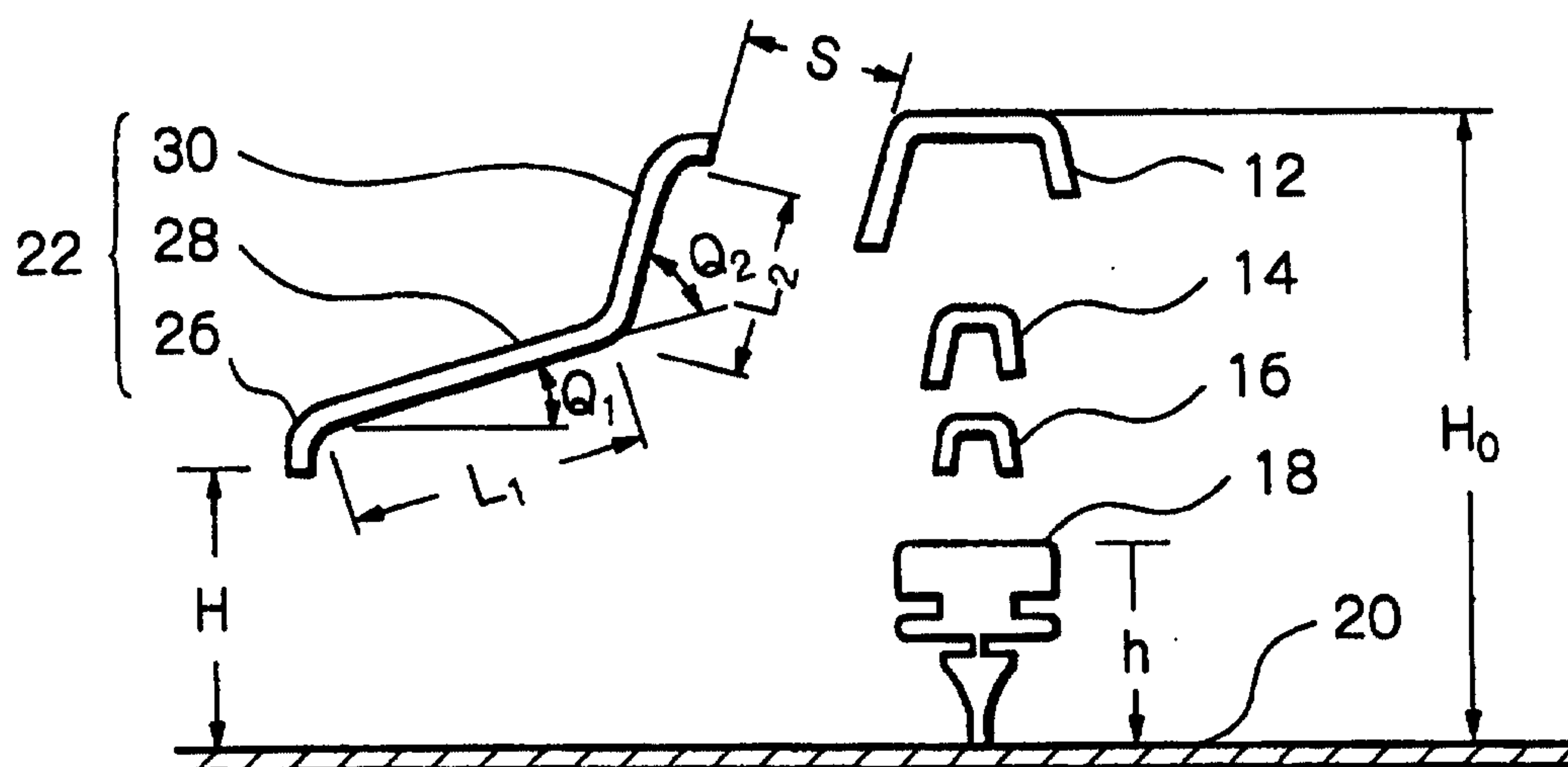
(57) L'invention concerne un balai d'essuie-glace (10) pour véhicules automobiles, qui comprend un déflecteur d'air (22) placé devant un flux d'air et maintenu en position sur une fourche principale par un support de largeur réduite. Le déflecteur en question est conçu pour que sa section transversale comprenne une surface de pression en forme de plaque (28) présentée le long du flux d'air de manière à engendrer des forces d'appui vers le bas, ainsi qu'une partie de déversement d'air (30) qui s'étend depuis l'arrière de la surface de pression susmentionnée (28) pour réduire la vitesse du flux d'air, et enfin un élément diviseur de flux d'air (26) qui s'étend vers le bas depuis l'extrémité de la surface de pression pour former un déversoir d'eau sous la surface de pression. La distance H entre le bord inférieur de cet élément diviseur de flux d'air (26) du déflecteur d'air (22) et le verre du pare-brise (20) est supérieure à la hauteur h du caoutchouc (18) du balai d'essuie-glace, sachant qu'il peut y avoir, entre cette hauteur H et une course libre S destinée à être établie entre l'extrémité supérieure de la partie de déversement d'air (30) du déflecteur d'air (22) et la fourche principale (12), une relation $1 > (S/H) > (1/5)$.

(57) A wiper blade (10) for use in motor vehicles is provided, which comprises a wind deflector (22) which is provided in front of an air stream and supported in position on a main yoke through a support of reduced width support, wherein the wiper blade comprises said wind deflector which has been formed to have such a configuration in its cross section in which it consists of a plate-like pressure-receiving surface section (28) which is provided along the air stream so as to generate downward forces, an air stream-weir section (30) which is provided to extend from the rear end of the pressure-receiving surface section so as to reduce a velocity of the air stream, and an air stream-splitting section (26) which extends downwardly from the end of the pressure-receiving surface section so as to form a water-weir section below the pressure-receiving surface section, and a distance (H) between the lower edge of said air stream-splitting section (26) of the wind deflector (22) and the shield glass (20) is greater than the height (h) of the blade rubber (18), whereas there may be such a relationship between this height (H) and a clearance (S) to be formed between the upper end of said air stream-weir (30) of the wind deflector (22) and the main yoke (12) as; $>1(S/H)>(1/5)$.

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(21) International Application Number: PCT/JP98/04278 (22) International Filing Date: 24 September 1998 (24.09.98) (30) Priority Data: 9/260203 25 September 1997 (25.09.97) JP (71) Applicant (for all designated States except US): NIPPON WIPER BLADE CO., LTD. [JP/JP]; 311, Shimotakayanagi, Kazo-shi, Saitama 347-8585 (JP). (72) Inventor; and (75) Inventor/Applicant (for US only): HARASHIMA, Mitsuo [JP/JP]; Nippon Wiper Blade Co., Ltd., 311, Shimotakayanagi, Kazo-shi, Saitama 347-8585 (JP). (74) Agent: IMAI, Shosuke; YUASA AND HARA, Section 206, New Ohtemachi Building, 2-1, Ohtemachi 2-chome, Chiyoda-ku, Tokyo 100-0004 (JP).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: WIPER BLADE WITH WIND DEFLECTOR**(57) Abstract**

A wiper blade (10) for use in motor vehicles is provided, which comprises a wind deflector (22) which is provided in front of an air stream and supported in position on a main yoke through a support of reduced width support, wherein the wiper blade comprises said wind deflector which has been formed to have such a configuration in its cross section in which it consists of a plate-like pressure-receiving surface section (28) which is provided along the air stream so as to generate downward forces, an air stream-weir section (30) which is provided to extend from the rear end of the pressure-receiving surface section so as to reduce a velocity of the air stream, and an air stream-splitting section (26) which extends downwardly from the end of the pressure-receiving surface section so as to form a water-weir section below the pressure-receiving surface section, and a distance (H) between the lower edge of said air stream-splitting section (26) of the wind deflector (22) and the shield glass (20) is greater than the height (h) of the blade rubber (18), whereas there may be such a relationship between this height (H) and a clearance (S) to be formed between the upper end of said air stream-weir (30) of the wind deflector (22) and the main yoke (12) as; $1 > (S/H) \geq (1/5)$.

DESCRIPTION

WIPER BLADE WITH WIND DEFLECTOR

5

TECHNICAL FIELD

The present invention relates to a wiper blade for use in motor vehicles, and more particularly to means for effectively suppressing a possible reduction of wiper blade performance characteristics which may otherwise occur due to
10 wind pressure etc., while a vehicle runs at a high-speed, and more particularly to means for substantially improving aerodynamic characteristics of a wiper blade.

BACKGROUND ART

Many means have been used for the purpose of
15 suppressing a possible reduction in the wiping performance of the wiper blade for motor vehicles, which may otherwise occur due to wind pressure at a high-speed. Various means may be listed for illustrative purpose as follows; a device with plate-like blades, one adapted to provide a downward
20 partial wind pressure force by forming a part of lever in a blade-like configuration, one comprising a wind deflector for shielding an air stream which strikes the blade rubber, and an article in which a distance between the undersurface of the wind deflector and the glass surface is determined to
25 be greater at the front of the air stream than at the rearward portion so as to generate a negative pressure between the undersurface of the wind deflector and the glass surface.

Such devices as those illustrated in Fig. 14 (DE.3139444), Fig. 15 (DE.3532536) and Fig. 16 (FR.262128) and the like can be cited as typical known arts, all of which may operate satisfactorily to some degree when
5 vehicles run at a speed of around 150 km/h which is a conventional speed requirement for achieving a high-speed drive, but it may be difficult for prior devices to provide a satisfactory operation when the vehicles run at the speed of around 200 km/h which is a today's common running
10 velocity.

The device in Fig. 14 is designed to deflect an air stream which strikes the blade rubber 1 by means of wind deflector 2 which is provided at a position where it may shield the blade rubber 1, but it may not shield the blade
15 rubber 1 due to a reduced area of the wind deflector 2. Besides, an air stream which has passed through a space between levers may cause a disturbance, resulting in a lack of effective urging forces, and thereby creating problems that it may not achieve a substantial improvement during
20 high-speed running.

The device shown in Fig. 15 is configured such that a lower edge 3 of the main yoke side wall extends in a spoiler design providing a particular inclined angle, but it also causes a problem that sufficient urging forces may not be
25 produced since the air stream over the upper surface of the spoiler collides against the side wall of the main yoke, and thus the flow velocity is reduced, while simultaneously the air stream flowing over the undersurface of the spoiler is

interfered with a lever etc., to prevent a smooth flow of the air stream.

The device in Fig. 16 is designed to have a configuration in which a distance between the undersurface of the wind deflector 4 and the glass surface 5 is made greater at the front of the air stream than at the back side, thereby creating a negative pressure between the undersurface of the wind deflector 4 and the glass surface 5. This approach entails, however, a problem that it may not be effective unless the wind deflector 4 is provided at a lower position, and if the wind deflector is made to be wider to provide an effective result, the wind deflector 4 may interfere with the curved glass surface or the wind frame.

DISCLOSURE OF INVENTION

In the conventional devices as above-described, provision was made for means for improving wiper blade performance while a vehicle runs at high-speed, taking aerodynamic characteristics into consideration which may occur either at the front side (upper surface in the drawing) or at a back side (lower surface in the drawing) of a wind deflector or a spoiler, based on a presumption that the air stream strikes the glass surface in a parallel manner. In contrast, the present invention is made with a presumption that an air stream is deflected upwardly as it interferes with the wiper blade, taking an air stream into consideration which acts against opposite surfaces of the wind deflector from the viewpoint of aero-dynamic behavior. As a result, a most effective aero-dynamic design has been

realized.

In summary, in the wiper blade for use in motor vehicles which is supported on the main yoke via a narrow support, a wind deflector is placed such that its side surface lying in front of the air stream may consist of an air stream-splitting section which may form a water-weir area at the rear-side of the air stream, a pressure-receiving surface section along the air stream which may create downward forces, and an air stream-weir section which may cause the air stream to flow at a reduced speed, as shown in Fig. 3. A distance H between the lower edge of the air stream-splitting section in front of the air stream and the wind shield is made to be greater than the height h of the blade rubber, and besides there may be a relation between the upper edge of the above-described air stream-weir section in the wind deflector and the distance S of the main yoke as $1 > (S/H) \geq 1/5$ or preferably $1 > (S/H) \geq (1/4)$, and there may be a relationship between the length L 1 of the pressure-receiving surface section and the length L 2 of the air-stream weir section in the cross-section of the wind deflector as; $L 1 \geq L 2$, and further, an angle $\theta 1$ to be made between the pressure-receiving surface section and the glass surface is in a range of; $0' \leq \theta 1 \leq 30'$, and a relative angle $\theta 2$ to be made between the air-stream weir section and the pressure-receiving surface section in a range of; $30' \leq \theta 2 \leq 90'$.

The air stream which flows along a wind screen is split into upper and lower flow components by means of air stream-splitting section at the tip of the wind deflector. An upper air stream component flows along the pressure-receiving surface

section, and rises upwardly while having its flow velocity reduced by means of the weir section, whereas the lower flow component partially forms a virtual blade surface at a lower portion of the pressure-receiving surface section utilizing a water-weir area 5 which is created backwardly of the air stream- splitting section. Most of the lower flow component is caused to vary its flow direction

upwardly while it flows along the virtual blade surface and the backward surface of the weir section to increase its flow velocity. The flow then passes through a space between the upper end of the weir section in the wind deflector and the side wall of the main yoke. Consequently, an increased pressure is exerted on the upper surface of the pressure-receiving surface section of the wind deflector, and an reduced surface pressure is provided to thereby generate downward forces (i.e. forces acting toward the wind screen).

10 BRIEF DESCRIPTION OF DRAWING

Now, one embodiment of the present invention will be described herein below with reference to accompanying drawings in which;

Fig. 1 is a top plan view of the wiper blade with the wind deflector of the present invention;

Fig. 2 is side plan view of the wiper blade with the wind deflector of the present invention;

Fig. 3 is a schematic cross-sectional view along line 3-3 in Fig. 1;

20 Fig. 4 is a view illustrating a comparison between the products of the present invention and a prior art product in their wind velocity and lifting forces;

Fig. 5 is a view illustrating a comparison between the products of the present invention and a prior art product in their wiping limit speeds;

Fig. 6 is a view illustrating a relationship between the distance H and lifting forces;

Fig. 7 is a view illustrating a relationship between

the ratio (S/H) of the distance S and the height H, and lifting forces in the present device;

Fig. 8 is a view view illustrating an alternative embodiment of the present invention;

5 Fig. 9 is a view illustrating an alternative embodiment, i.e., an improved modification of embodiment as shown in Fig. 8;

10 Fig. 10 is a view illustrating an alternative embodiment, i.e., a further improved modification of embodiment as shown in Fig. 8;

Fig. 11 is a view illustrating an alternative embodiment of the present invention;

15 Fig. 12 is a view illustrating an alternative embodiment, i.e., an improved modification of embodiment as shown in Fig. 11;

Fig. 13 is a view illustrating an alternative embodiment, i.e., a further improved modification of embodiment as shown in Fig. 11;

Fig. 14 is a view illustrating a known example;

20 Fig. 15 is a view illustrating an another known example; and

Fig. 16 is a view illustrating a further known example.

BEST MODE FOR CARRYING OUT THE INVENTION

25 Fig. 1 and 2 are upper plan and side views of the wiper blade with a wind deflector, illustrating a typical embodiment of the present invention. In these drawings, the wiper blade 10 with the wind deflector in accordance with

the present invention comprises a main yoke 12 which includes a coupling with the wiper arm at its central portion, a secondary lever 14 which is pivotably supported at opposite ends of the main yoke, a plurality of yokes 16, 5 each being pivotably supported on one or opposite ends of the secondary lever 14, and having a pawl by which a blade rubber 18 to be described later may be grasped, and a blade rubber 18 which is used to wipe a glass surface 20 (see Fig. 3) such as a wind shield etc. Moreover, the wiper blade 10 additionally comprises a wind deflector 22 which is provided in front of the air stream of the main yoke 12.

This wind deflector 22 may be made by a stamping operation, for example, so as to be integral with the above-described main yoke 12, and may be then connected with each 15 other by means of narrow support 24. Obviously, it is also possible to form this wind deflector 22 by a molding operation, for example, using resins or iron sheets separately from the main yoke 12, and subsequently the wind deflector 22 may be coupled with the main yoke 12 by a 20 predetermined means.

The wind deflector 22 in accordance with the present invention is made, as shown in Fig. 3 which is taken along line 3-3 in Fig. 1, so that its cross-sectional shape consists of an air stream-splitting section for allowing the 25 air stream to be split into two flow components, a pressure-receiving surface section 28 which is provided above the air stream-splitting section 26, an air stream-weir section 30 which is provided further above the pressure-receiving

surface section 28. Since it is required for the wind deflector 22 to receive an air stream flowing at an extremely high-speed, the wind deflector must be secured reliably to the main yoke 12 using as many supports 24 as possible to avoid possible breakage. At the same time, it is required to allow a great amount of air to flow out through a clearance between the wind deflector 22 and the main yoke 12, and thus supports 24 must be made in such a shape and number as not to interfere with flow-out of the air stream.

10 In the embodiment as shown in drawings, two supports 24 each of which has a substantially circular configuration is molded so as to be integral with the wind deflector 22 and the main yoke 12.

As can be seen from Fig. 3, the upper edges of the wind deflector 22 are located at a predetermined distance S from the side surface position of the main yoke 12. When a distance from the glass surface 20 is compared, the distance H to the lower edge of the air stream-splitting section 26 of the wind deflector 22 is greater than the height h of the blade rubber 18. Besides, in order to form a water-weir section of negative pressure at the lower surface side of the pressure-receiving surface section 28 of the wind deflector 22 so as to bring the wind deflector 22 closer to the glass surface 20 side, there may be a relationship

25 between the above-described distance S and the distance H of the wind deflector 22 as $1 > (S/H) \geq (1/5)$, and preferably $1 > (S/H) \geq (1/4)$. In the meantime, a symbol Ho in Fig.3 is understood to represent a height dimension to be measured

from the glass surface 20 to the upper edge portion of the main yoke 12.

The described air stream-splitting section 26 consists of a portion which extends to form substantially a right-angle relative to the glass surface 20, having a length of several millimeters. When the wiper blade 10 incorporating the window deflector of the present invention operates to wipe the glass surface 20, the air stream-splitting section may operate to split the air stream which flows along the glass surface into upper and lower flow components around the wind deflector 22. The air stream-splitting section 26 may alternatively be formed such that it may coupled in such a cross-sectional configuration that an angle of curvature is formed from the lower edge of the pressure-receiving surface section 28. Furthermore, this air stream-splitting section 26 may be made to extend toward the wiper blade side as shown in Fig. 8 ~ Fig. 13 so as to increase rigidity of the wind deflector 22, provided that its tip end may form a negative pressure water-weir area under the pressure-receiving surface section 28. The pressure-receiving surface section 28 may form an angle $\theta 1$ relative to a surface which is parallel relative to the glass surface 20 from the upper end of the air stream-splitting section 26, and extends to a length L 1. This angle $\theta 1$ should preferably be 0° through 30° . The air stream-weir section 30 may form an angle $\theta 2$ relative to the extension line of pressure-receiving surface section 28 from the upper end of pressure-receiving surface section 28, and

extends to a length L_2 . This angle θ_2 should preferably be 30° through 90° . It is also preferable for there to be a relationship between L_1 and L_2 as $L_1 \geq L_2$. In the cross-sectional shape of the window deflector 22, the pressure-receiving pressure section 28 and the air stream weir section 30 are connected with each other through a small radius curvature to prevent blockage of air stream which flows at high-speed.

In the present invention, the wind deflector 22 should preferably have a length at least one third or more that of the wiper blade, otherwise, effective urging of the wind deflector against the wiper blade itself may not be realized. In this instance, although the central portion of the wind deflector along its length should preferably coincide with the center of the length of the wiper blade, a desired effect may be provided even when the central portion of the length of the wind deflector is located in a slightly offset manner from the center of the length of wiper blade toward the tip portion side. The reason for this is that a more substantial air stream disturbance occurs in the tip portion side.

In the above arrangement, the air stream which flows along the glass surface i.e., wind screen 20 is split into upper and lower flow components by means of air stream-splitting section 26 of the wind deflector 22. The upper flow component flows along the pressure-receiving surface section 28. The flow then has its flow velocity increased by the weir section 30, and rises upwardly over the weir

section 30 while urging the pressure-receiving surface sections 28 downwardly (toward the glass surface side) to flow backwardly. On the other hand, the lower flow component of air stream acts to form a virtual blade surface below the pressure-receiving surface section 28 due to presence of a wide water-weir zone which is created at the back of air stream-splitting section 26. Most of the lower flow component has its flow velocity increased while it flows along the virtual blade surface and the back surface of the weir section 30 altering its flow direction. The lower flow component makes this weir-zone a negative pressure zone, and then exits passing through a clearance S between the upper end of the weir section 30 in the wind deflector and the side wall of the main yoke 12 at a rapid speed. Thus, an increased pressure may be exerted upon on the upper surface of the pressure-receiving surface section 28 of the wind deflector 22, whereas the lower surface is exposed to a reduced pressure. In this way, the wind deflector 22, hence the wiper blade 10 is provided with forces which may act in a downward direction (toward the glass surface).

Fig. 4 shows measurement results which have been obtained by using a small wind tunnel device for the embodiments of the present invention and for the prior art devices as shown in Fig. 14. As can be seen from this drawing, lifting forces to be effective in the device of the present invention amounts to merely 25 % of lifting forces which may be encountered in the prior device at all vehicle running speeds, which demonstrates a significant improvement

which may be achieved by the present invention in respect of urging forces to be exerted against the glass surface.

Fig. 5 shows evaluation results for a limit vehicle speed for wiping operation which have been obtained by using a wind tunnel on an actual experimental vehicle, in which comparison is made between cases of the present embodiment and prior art devices as shown in Fig. 14. The maximum vehicle speed for a wiping operation used herein represents a vehicle velocity by which the wiper blade is caused to lift off the glass surface due to wind pressures while the vehicle is running, and by which the wiper blade may no longer operate to wipe the glass surface properly, thereby preventing a vehicle driver from operating the vehicle in a normal manner and causing the driver to have a sense of danger. What can be understood from this drawing is that while the limit vehicle speed for wiping operation in the prior art device is 140 km/h, the present device could maintain sufficient wiping performance at the maximum limit vehicle speed of 180 km/h for the actual vehicle wind tunnel, which demonstrates a significant difference.

Fig. 6 is a view illustrating a relationship between the distance H to be measured from the lower edge of the wind deflector to the glass surface and lifting forces. What one can understand from this drawing is that lifting forces will be increased abruptly unless the height H is made greater than the height h of the blade rubber, whereas if it is made greater than the height H_0 , then lifting forces will be reduced.

Fig. 7 is a view illustrating a relationship between a ratio of the distance S to be measured from the upper edge of the wind deflector 22 to the side position of main yoke 12 and the distance H to be measured from the lower edge of the wind deflector to the glass surface, relative to lifting forces. What one can understand from this drawing is that while lifting forces may be increased unless the ratio (S/H) is made less than 1, they will be increased in the case that the ratio (S/H) is made smaller than (1/5).

Fig. 8 through Fig. 13 illustrate alternative embodiments of the wind deflector of the present invention. These embodiments represent a configuration in which the tip of the air stream-splitting section 26 is made to extend toward the wiper blade side. Fig. 8 illustrates an embodiment in which the air stream-splitting section 26 in Fig. 3 has an extension which is made to extend along and in parallel with the glass surface toward the wiper blade. This extension extends to a position where it may not block the flow of the air stream. Fig. 9 is a view illustrating an embodiment in Fig. 8 which has been modified to make the tip of the extension gently curved upwardly so as to ensure a smooth movement of the air stream. Fig. 10 is a view similar to Fig. 9, but illustrating a configuration in which the tip of the extension is made to curve upwardly at an obtuse angle so as not to interfere with the movement of the air stream. Fig. 11 a view illustrating an embodiment in which the extension is arranged to lie in parallel with the pressure-receiving surface section 28. Again, the tip of the

extension is located in such a position where it may not block the flow of air stream. Fig. 12 is a view similar to Fig. 11, but illustrating an embodiment in which the tip of the extension is made to curve gently upwardly to ensure a smooth movement of the air stream. Fig. 13 a view similar to Fig. 12, but illustrating an embodiment in which the tip of the extension is made to curve upwardly at an obtuse angle so as not to interfere with the movement of the air stream.

In the present invention, a weir-zone may be created below the pressure-receiving surface section, and the weir-zone may serve to form a virtual blade surface to provide a sufficient effect. As an alternative, however, a further substantial effect may be realized by making the tip of the air stream-splitting section extend in a rearward direction relative to the air stream, i.e., in the downward direction of the pressure-receiving surface section, and thereby controlling the weir-zone to have a desirable configuration.

In the meantime, in the embodiment of the present invention, the wind deflector is made as an integral molding component which has been made though a stamping operation, but alternatively the wind deflector may be made from resin materials, whereas a narrow support may be separately formed and subsequently attached to the main yoke.

INDUSTRIAL APPLICABILITY

According to the present invention, a lifting force can be reduced, by causing the air stream which strikes the wiper blade to be deflected, while simultaneously allowing a differential velocity to be created between upper and lower

pressure-receiving surfaces on the wind deflector, and
thereby producing a substantial differential pressure
between these two surfaces to generate a greater force to be
imposed in the downward direction, i.e., against the glass
5 surface. In this way, the present invention meets high-level
requirements which has been increasingly required for the
wiper blade to provide its high performance. Besides, the
wind deflector may be made in its cross-section
configuration merely from a blade material having a
10 consistently uniform thickness, and thus eliminate
additional costs.

CLAIMS

1. (amended) A wiper blade for use in motor vehicles,
 comprising a wind deflector which is provided in front of an air
 5 stream and supported in position on a main yoke through a support
 of reduced width support, wherein the wiper blade comprises said
 wind deflector which has been formed to have such a configuration
 in its cross-section in which it consists of plate-like pressure-
 receiving surface section which is provided in the direction of an
 10 air stream so as to generate downward forces, an air stream-weir
 section which is provided to extend from the rear end of the
 pressure-receiving surface section so as to reduce a velocity of
 the air stream, and an air stream-splitting section which extends
 downwardly from the end of the pressure-receiving surface section
 15 so as to form a water-weir section below the pressure-receiving
 surface section, and a distance H between the lower edge of said
 air stream-splitting section of the wind deflector and the shield
 glass is greater than the height h of the blade rubber, whereas
 there may be a such a relationship between this height H and a
 20 clearance S to be formed between the upper end of said air stream-
 weir of the wind deflector and the main yoke as: $1 > (S/H) \geq 1/4$, and
 there may be a relationship between the length L 1 of the
 pressure-receiving surface section and the length L 2 of the air-
 stream weir section in the cross-section of the wind deflector as;
 25 $L 1 \geq L 2$, and further, an angle $\theta 1$ to be made between the
 pressure-receiving surface section and the glass surface is in a
 range of; $0' \leq \theta 1 \leq 30'$, and a relative angle $\theta 2$ to be made between
 the air-stream weir section and the pressure-receiving surface

section in a range of; $30^\circ \leq \theta_2 \leq 90^\circ$.

2. (cancelled)

3. (cancelled)

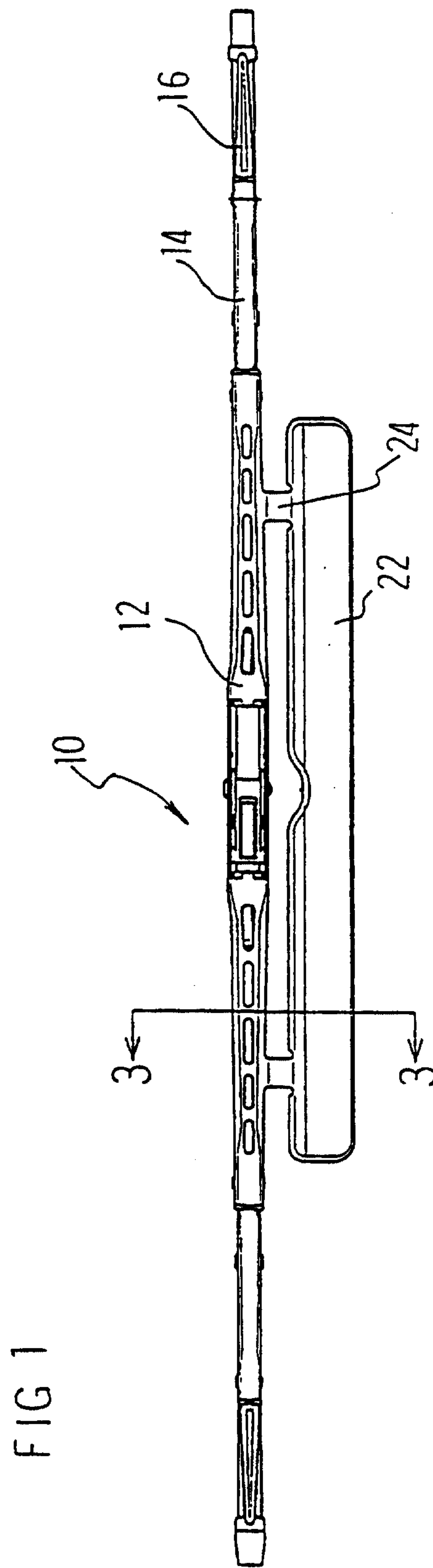
4. (cancelled)

5. (amended) The wiper blade for use in motor vehicles as set forth in Claim 1, wherein said air-stream splitting section is
5 formed in a linear or a curved configuration.

6. (amended) The wiper blade for use in motor vehicles as set forth in Claim 1, wherein said pressure-receiving surface section and said air stream-splitting section are coupled with each other through a small curve in the cross-section of the wind deflector.

10 7. (amended) The wiper blade for use in motor vehicles as set forth in Claim 1, wherein the air stream-splitting section has its tip end extended in the direction of the wiper blade side.

8. (amended) The wiper blade for use in motor vehicles as set forth in Claims 1, 5 and 6, the wind deflector has the length of



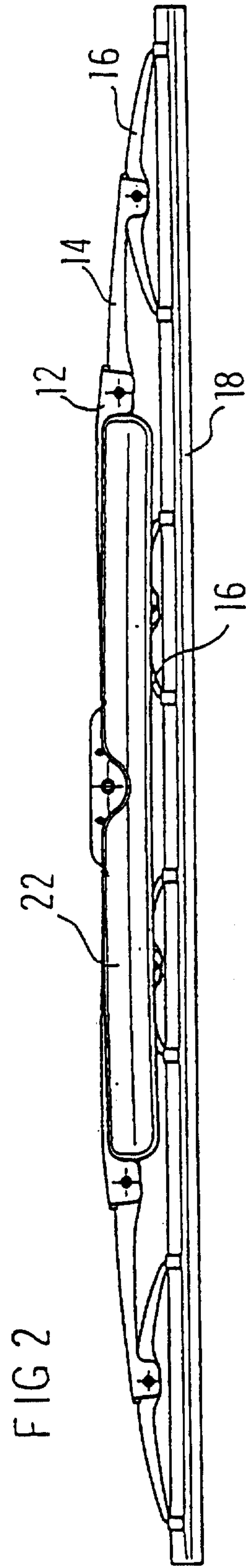


Fig. 3

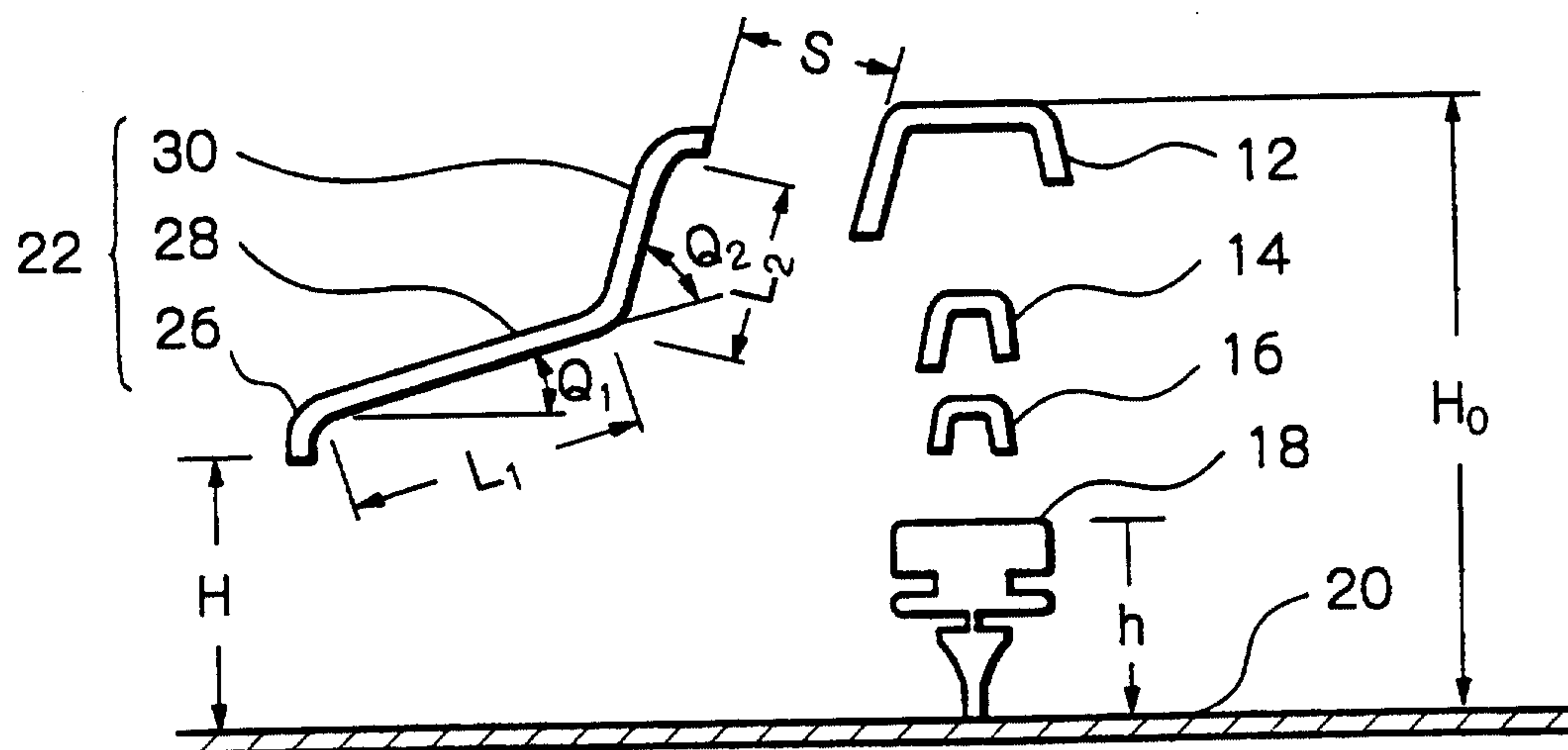


Fig. 4

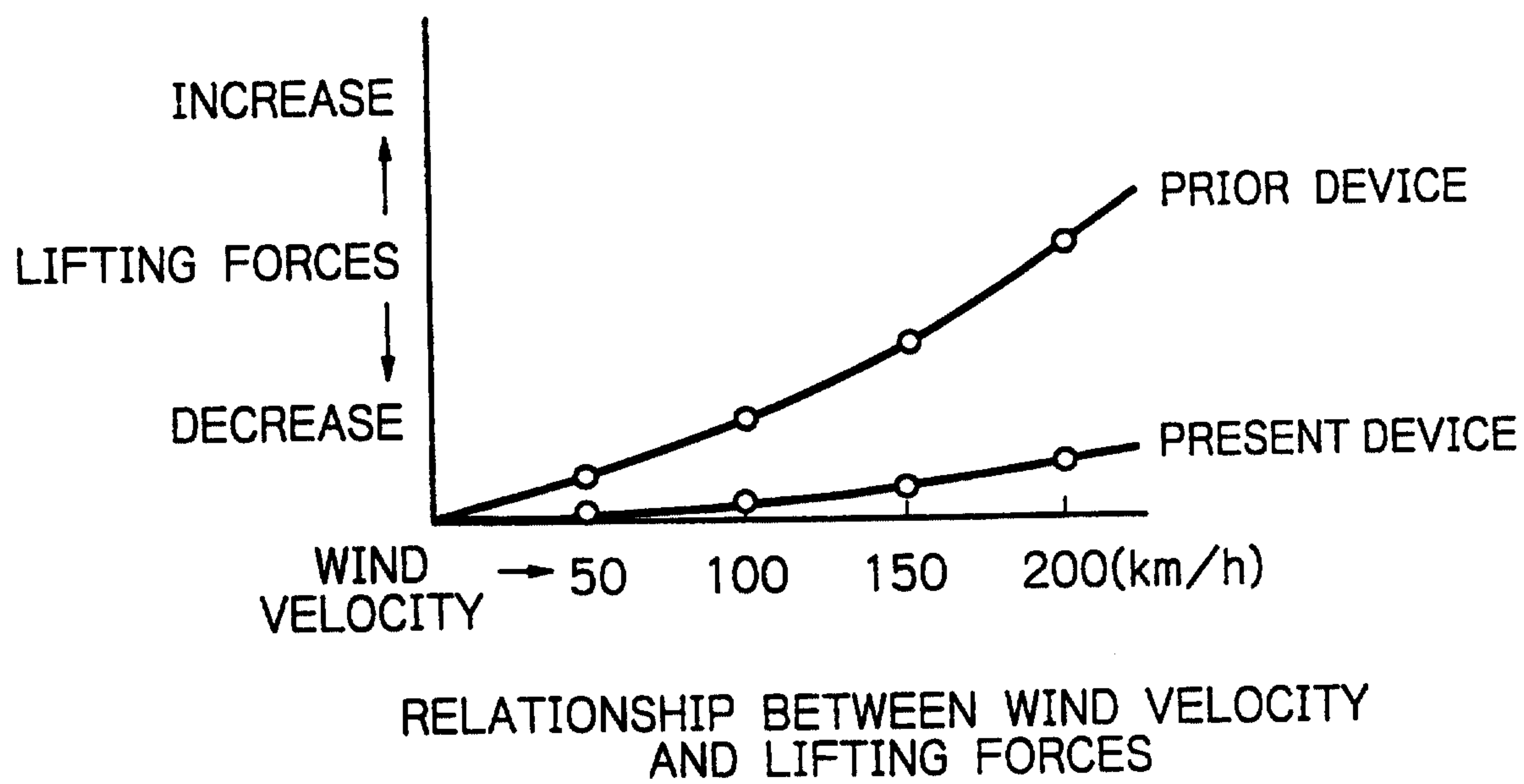
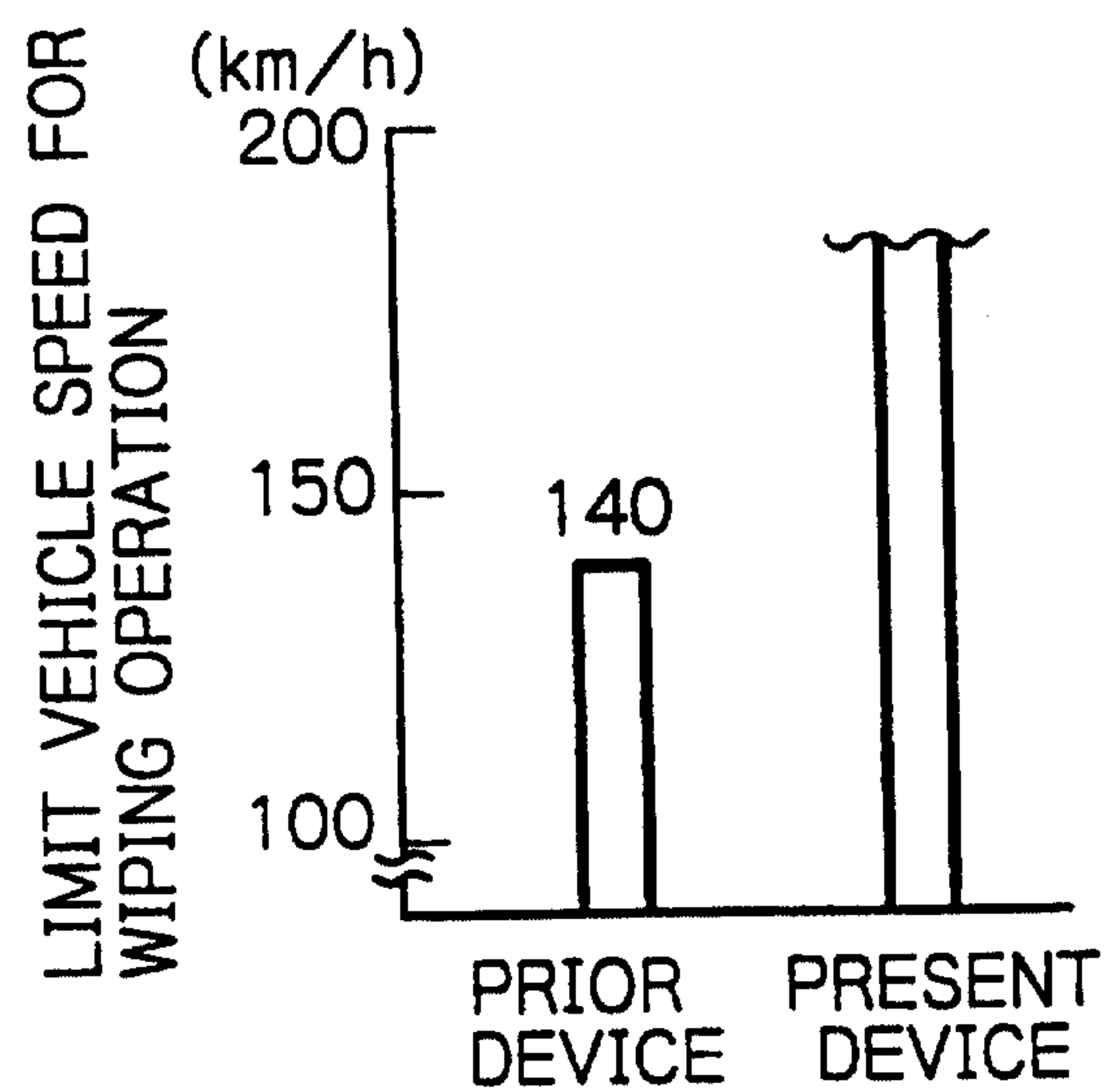


Fig. 5

TEST ON REAL VEHICLE REGARDING LIMIT
VEHICLE SPEED FOR WIPING OPERATION

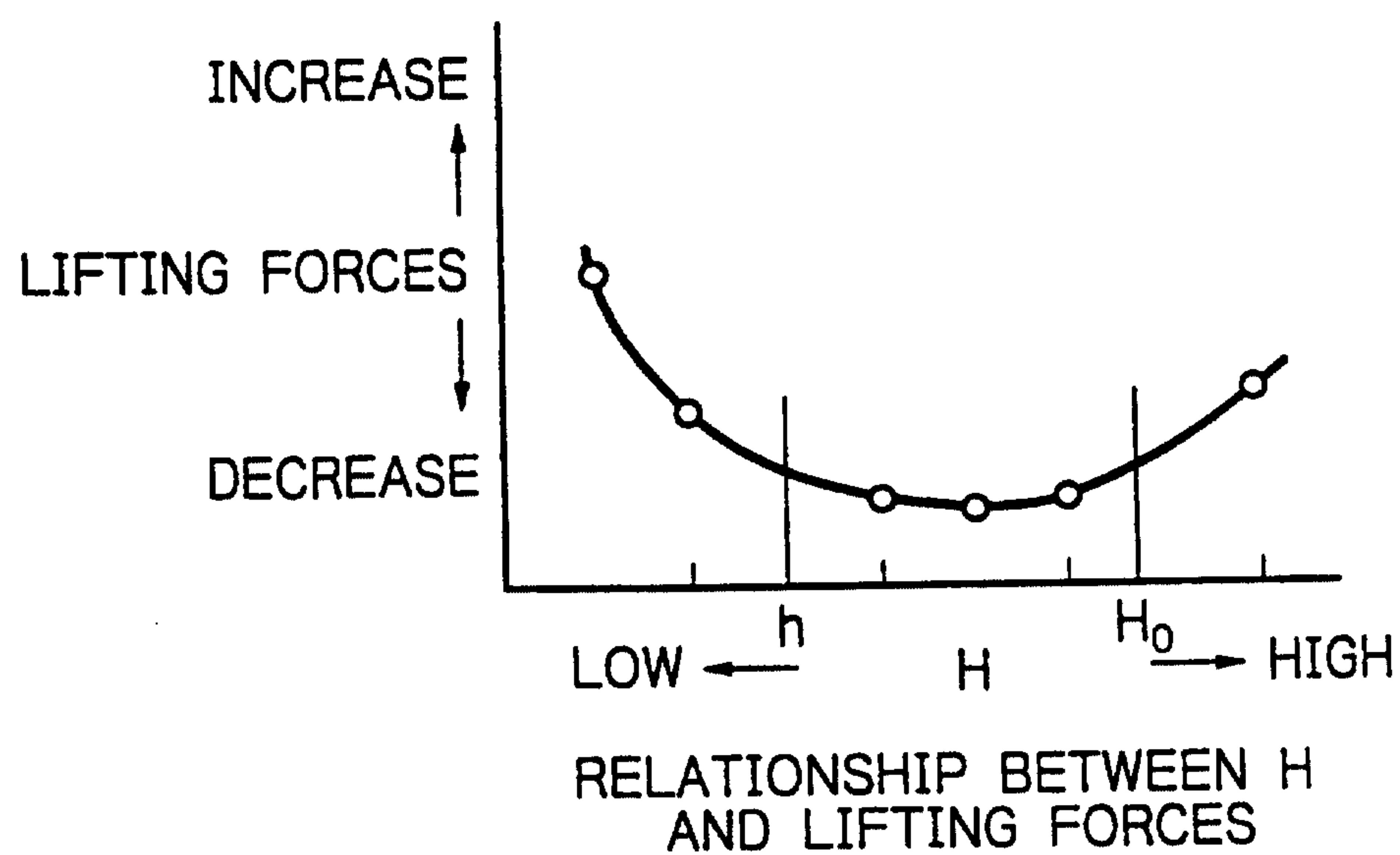
Fig. 6

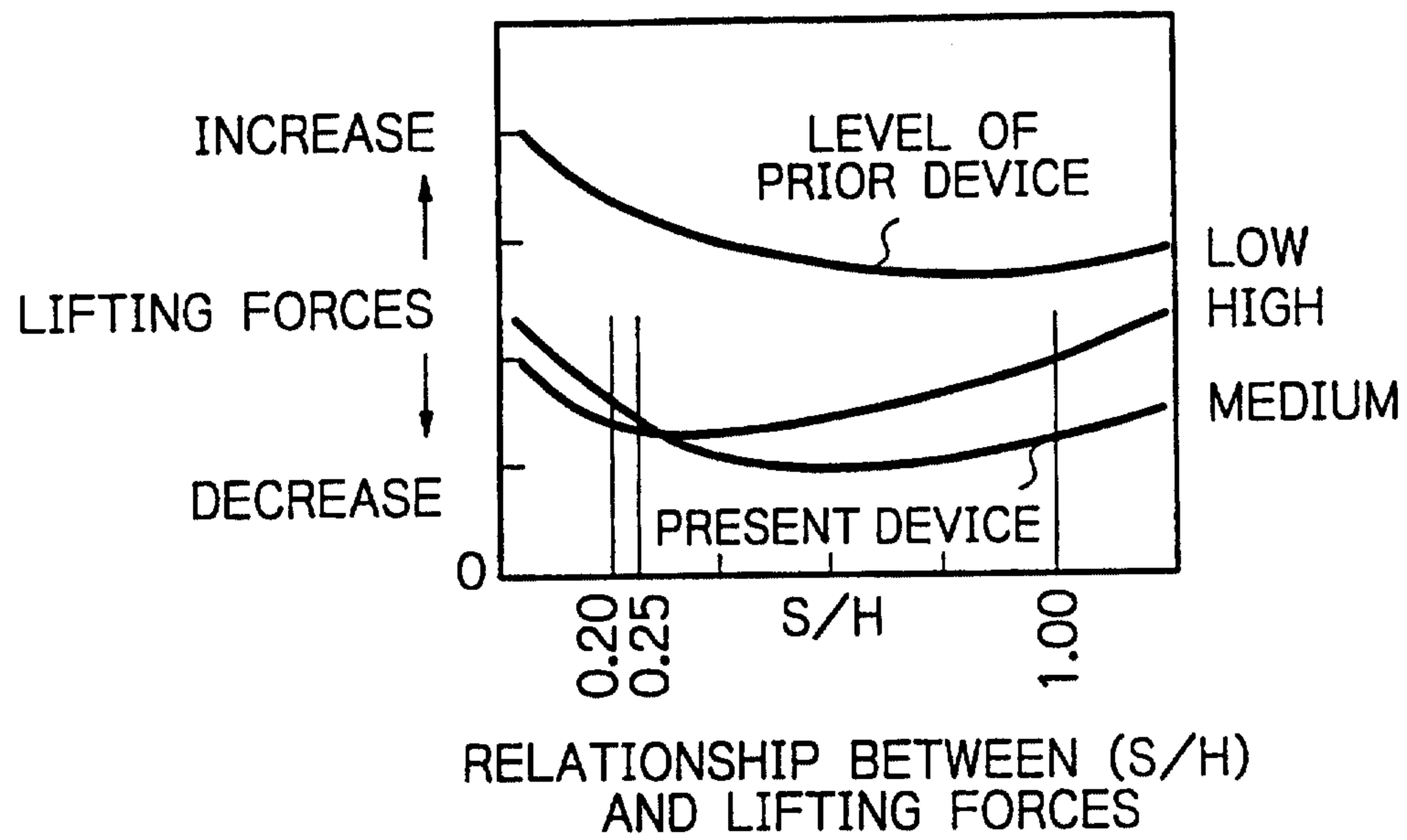
Fig. 7

FIG 8

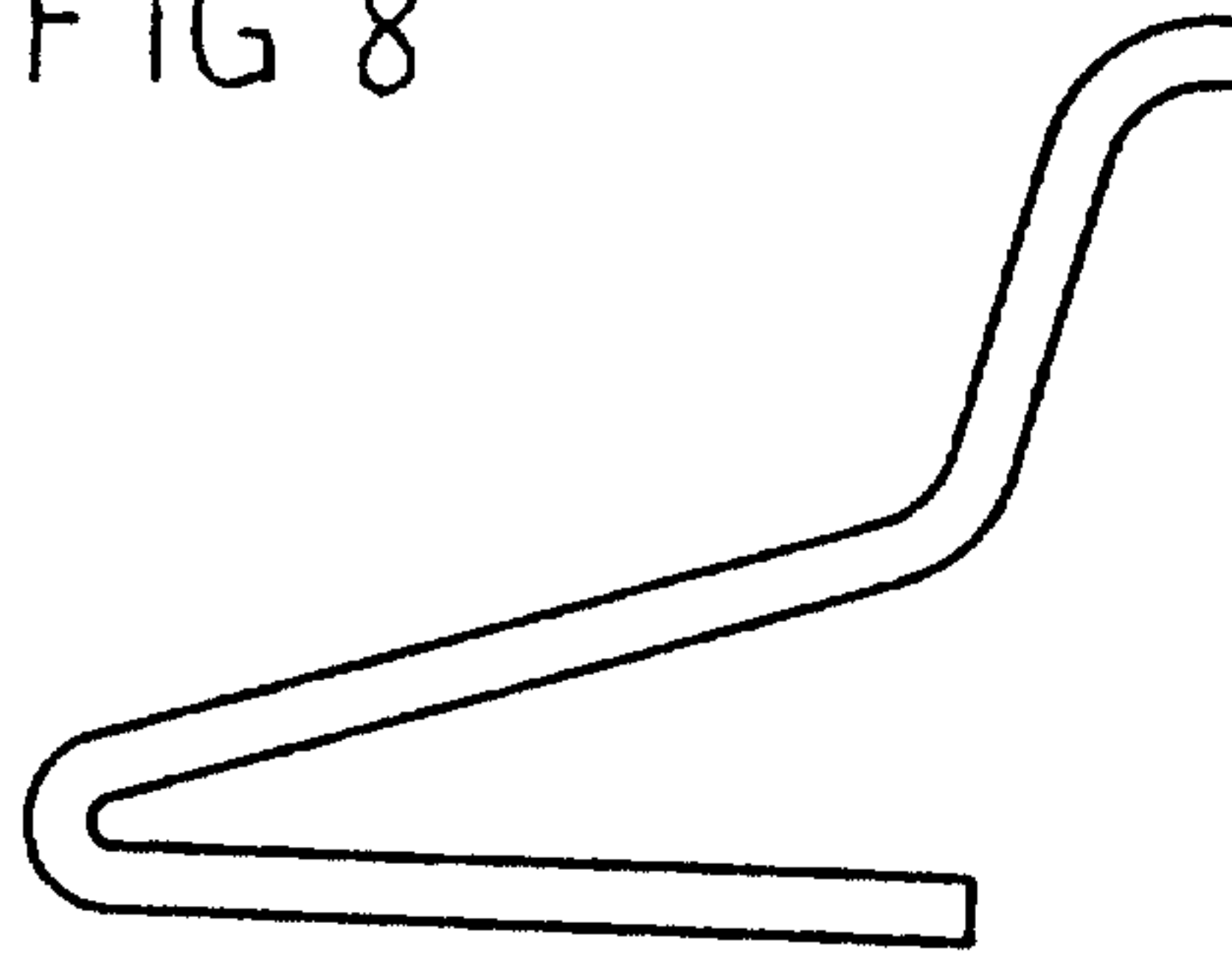


FIG 9

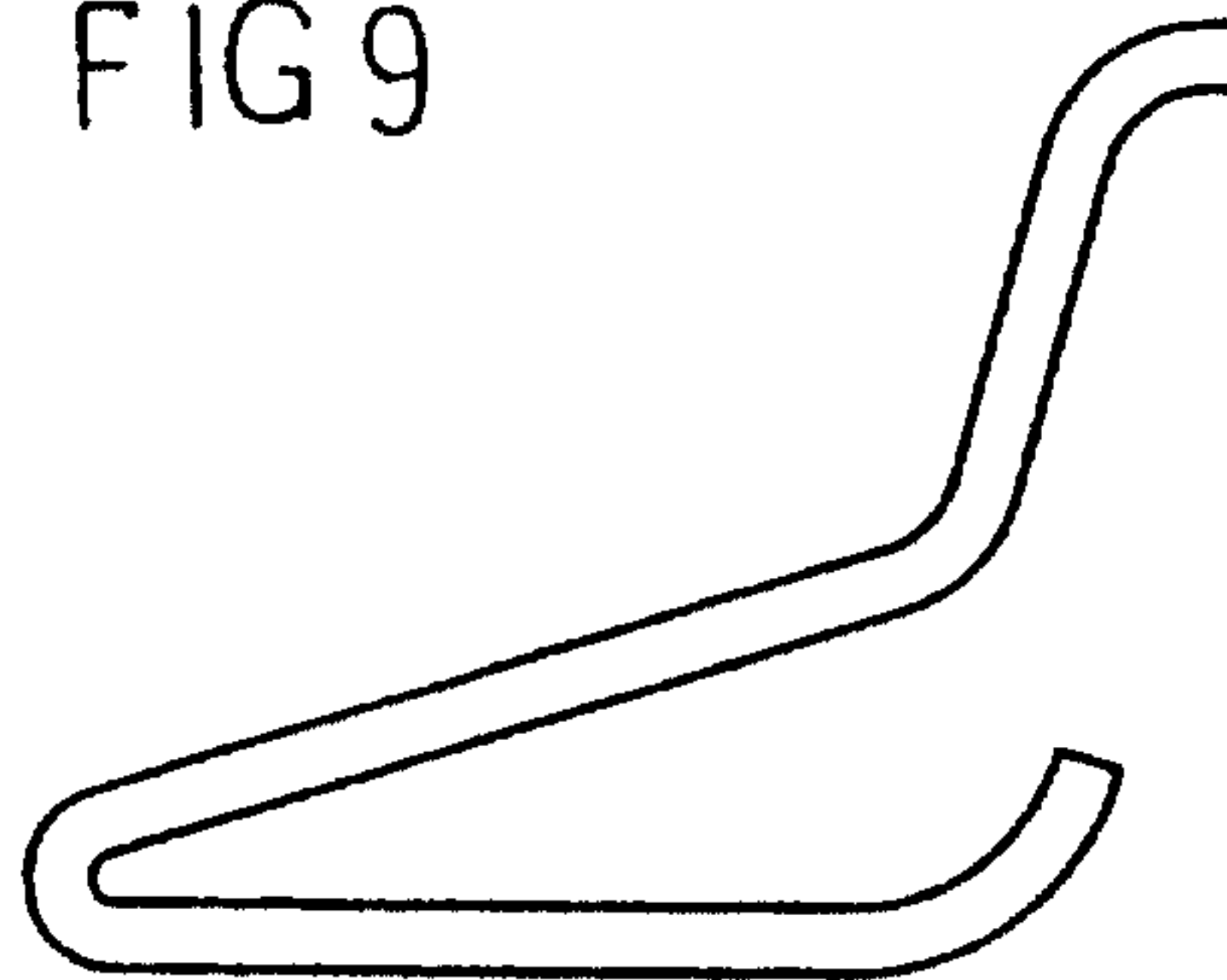


FIG 10

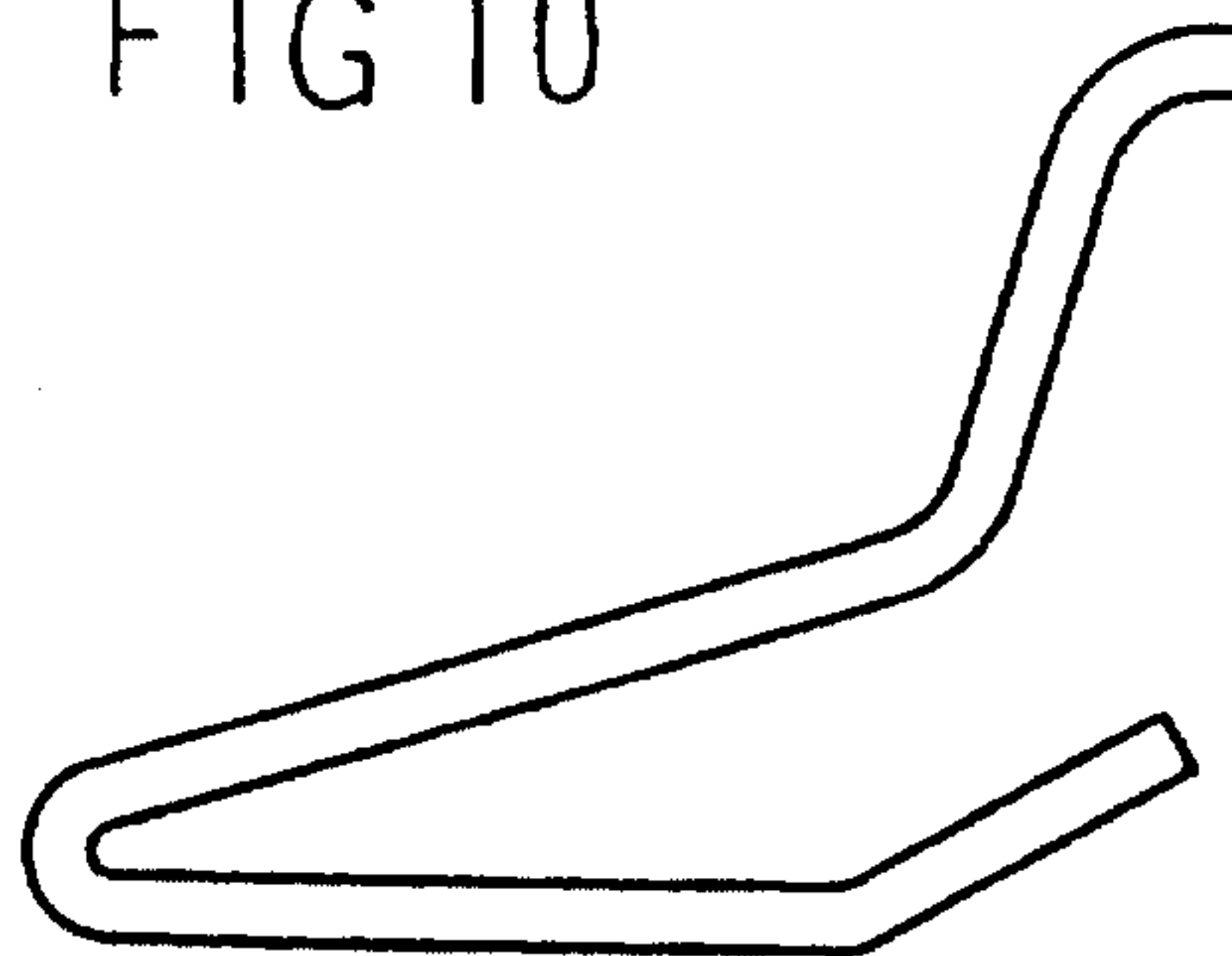


FIG 11

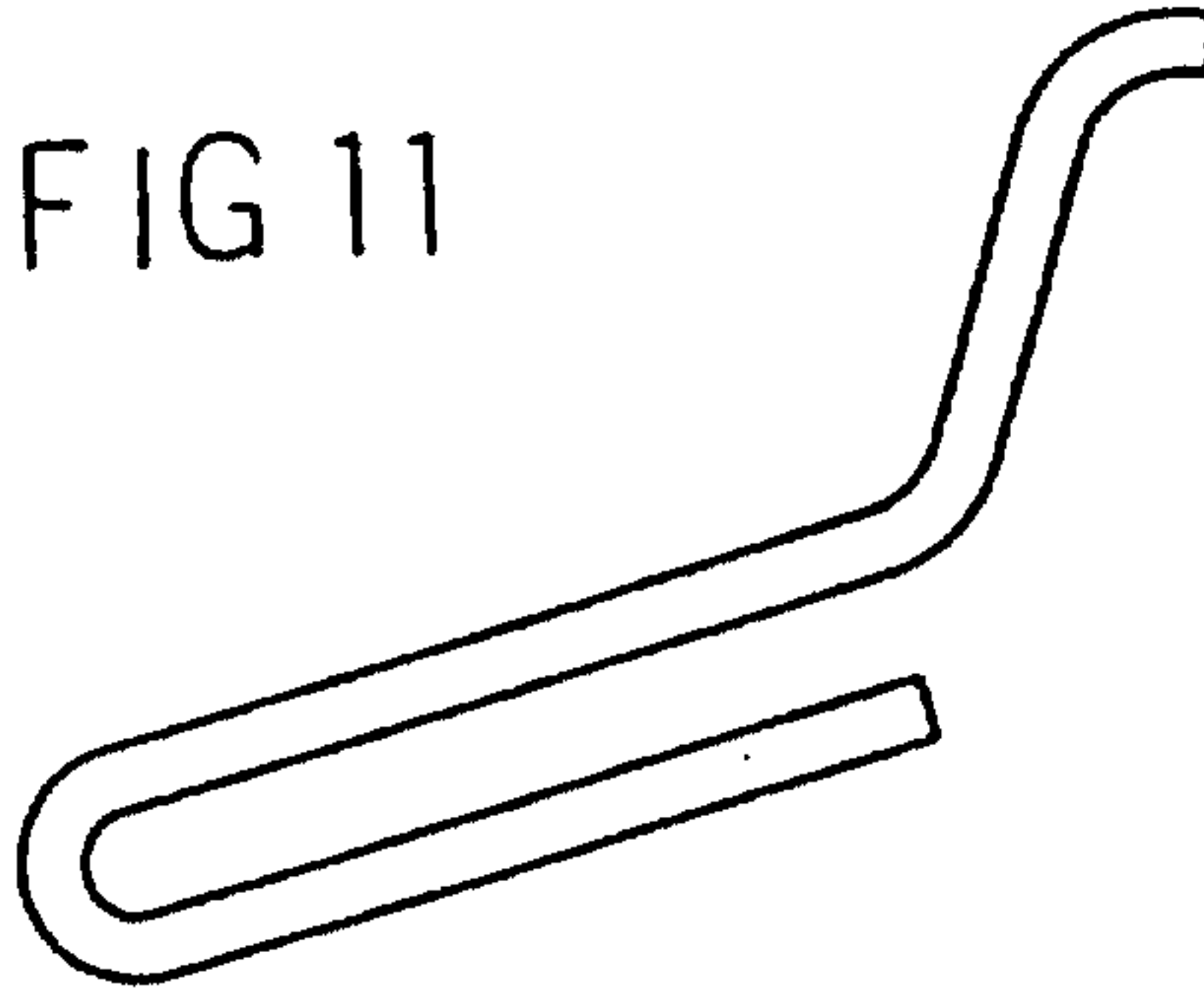


FIG 12

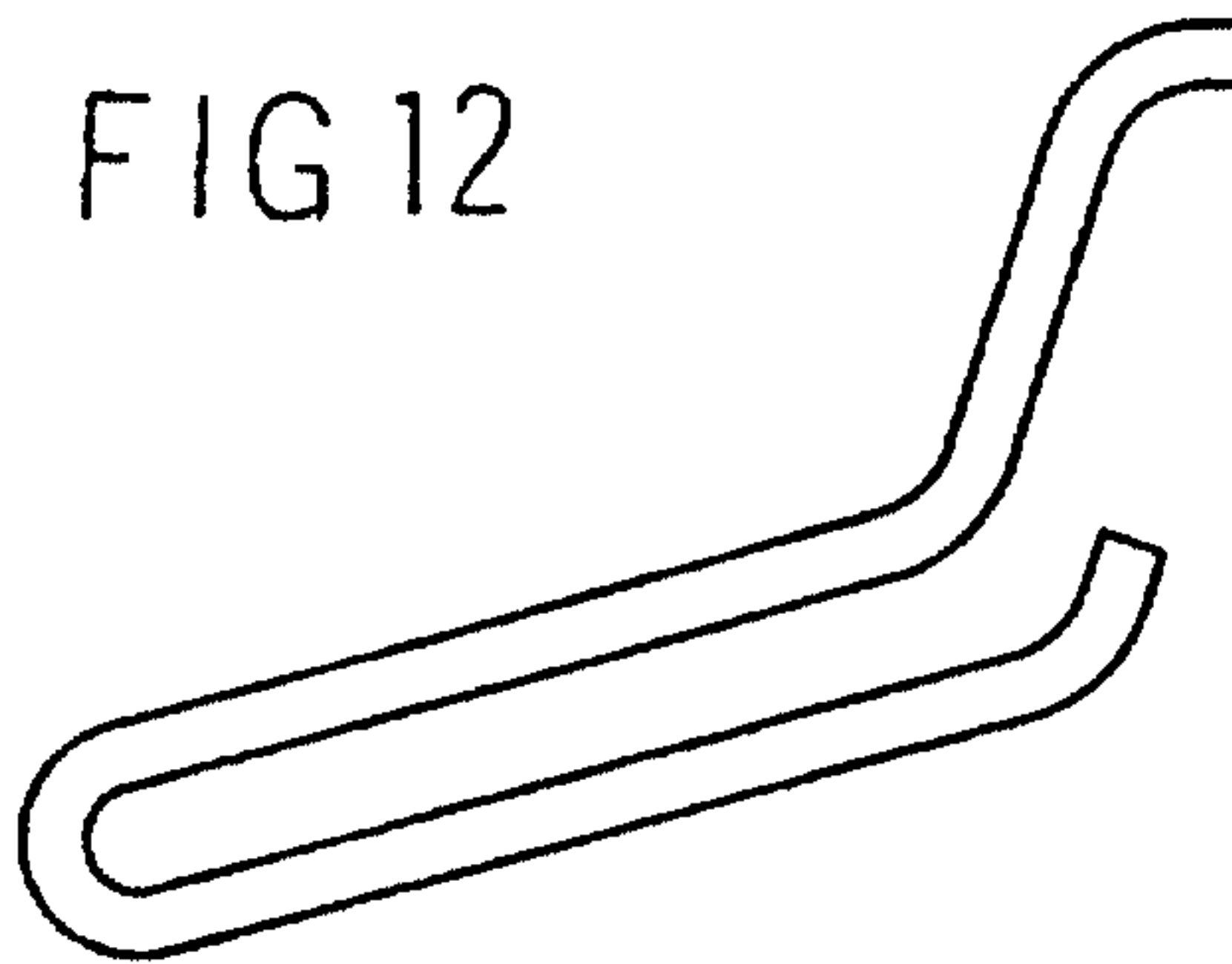


FIG 13

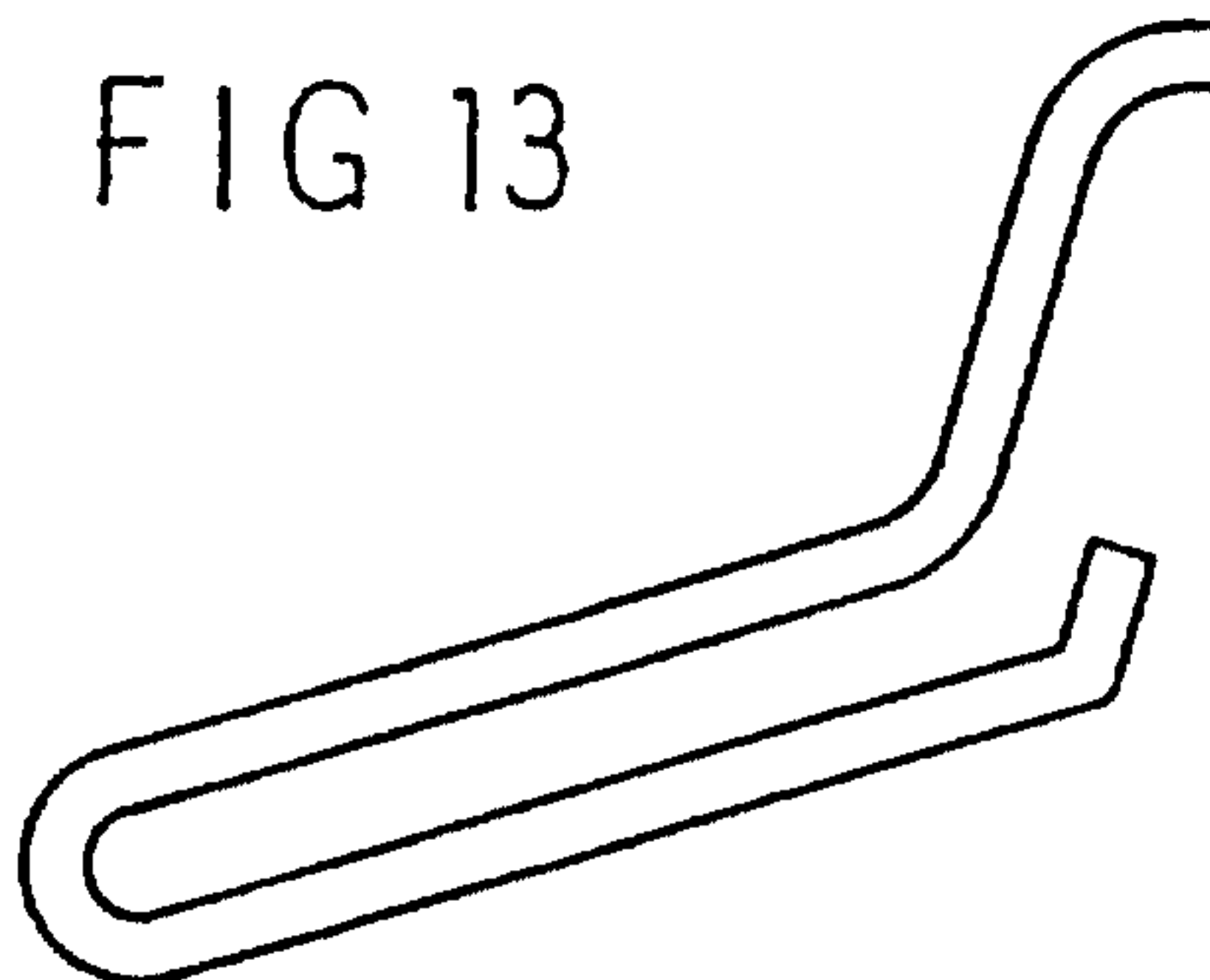


FIG 14

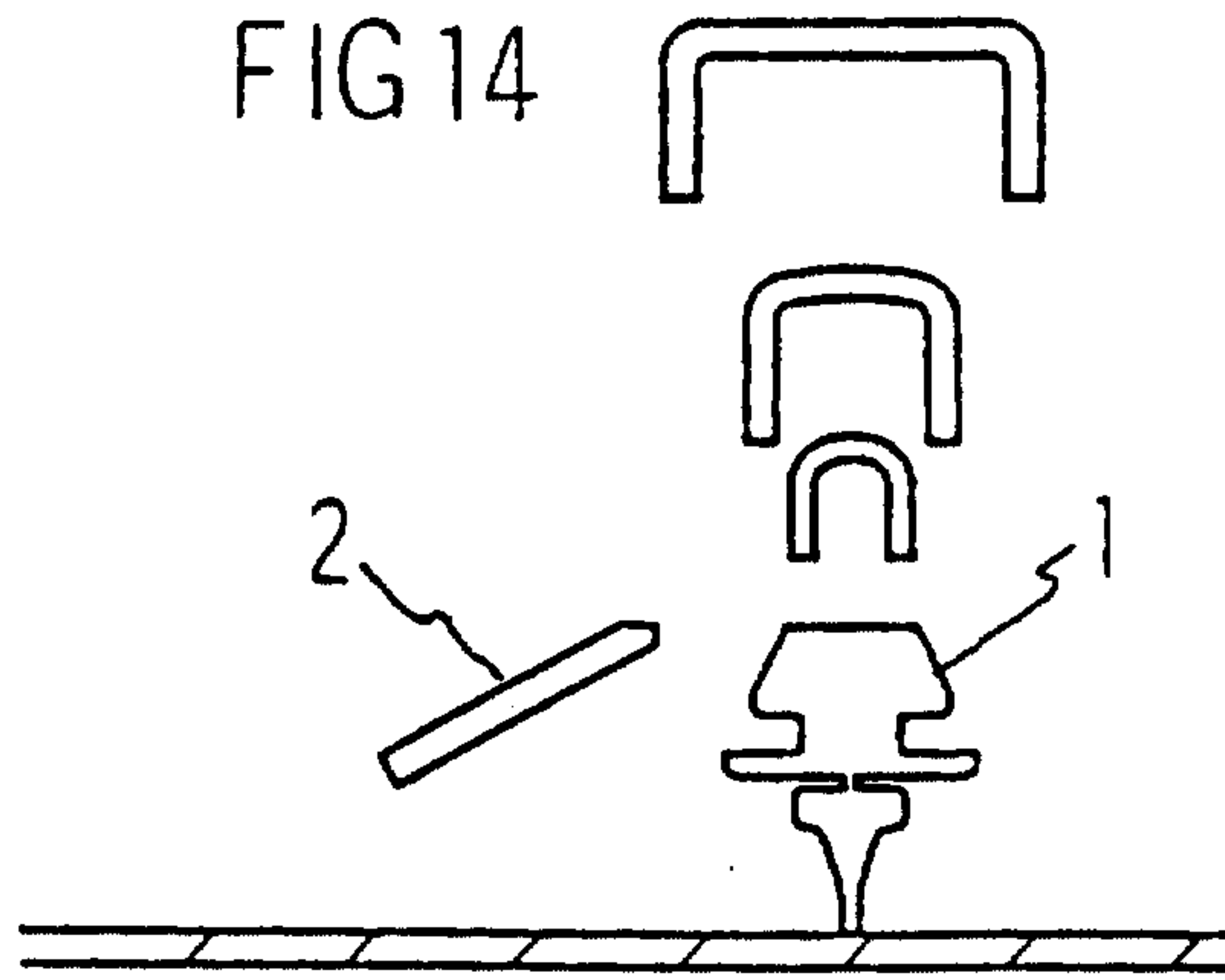


FIG 15

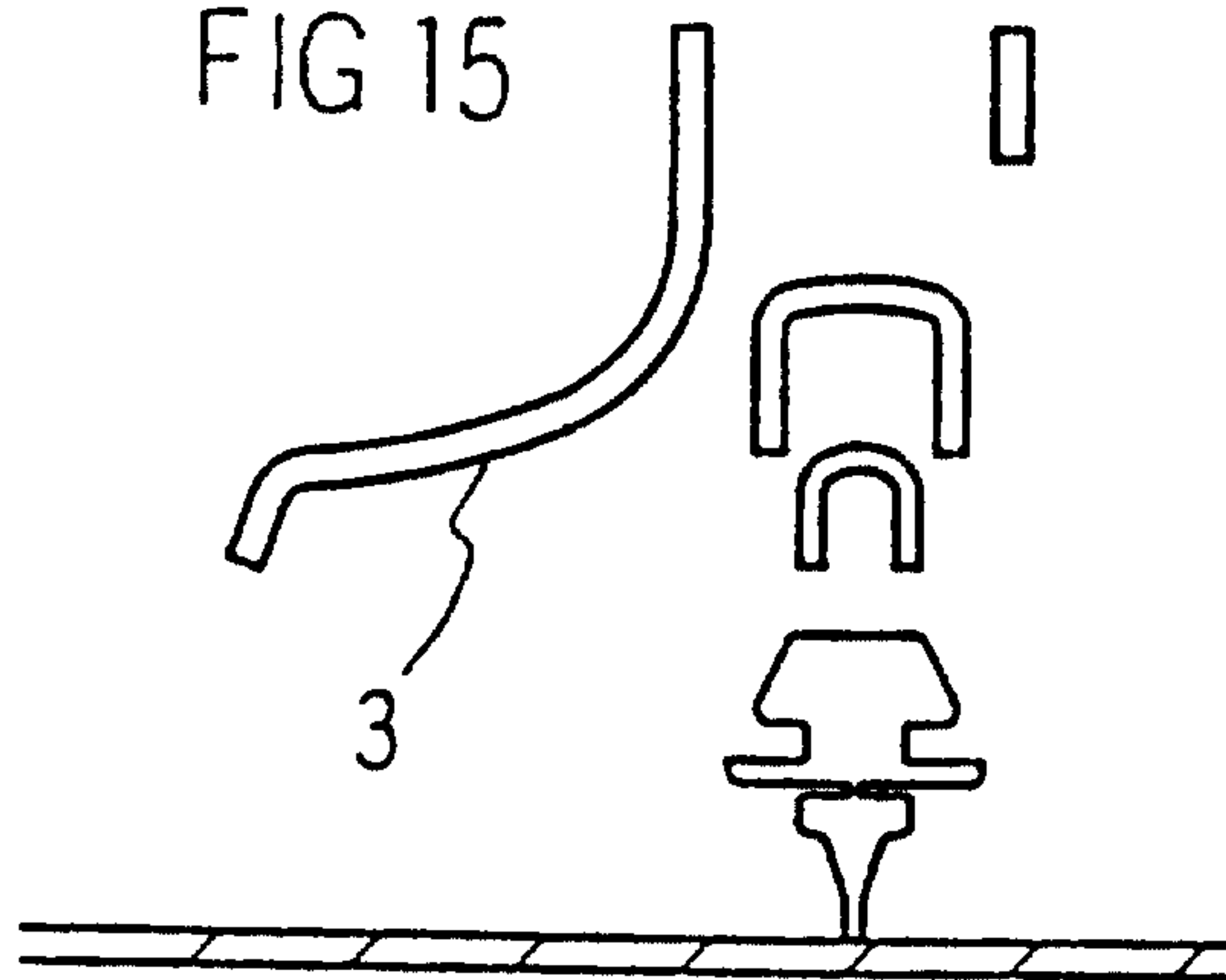


FIG 16

