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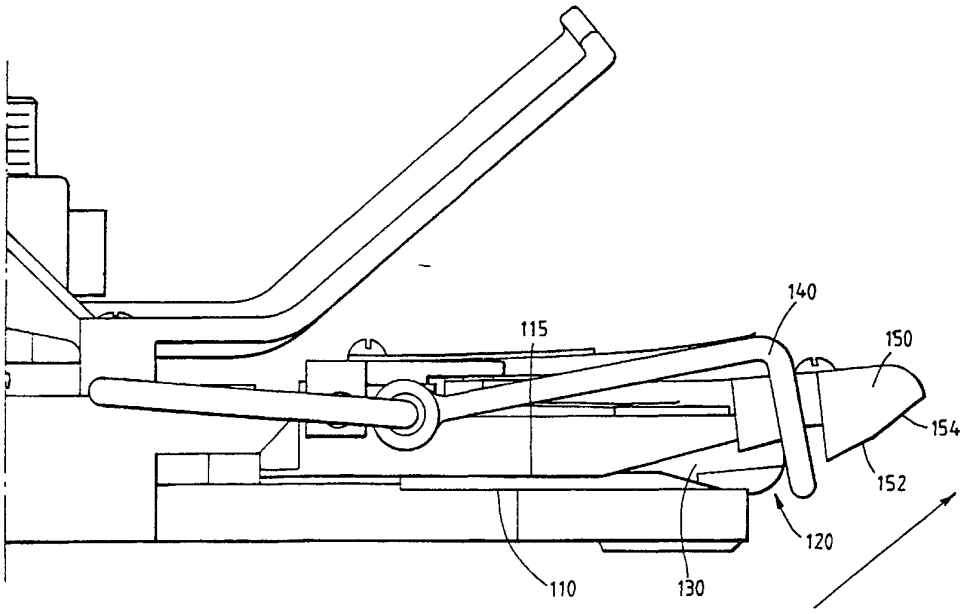
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(54) **Title:** CAPPING APPARATUS



(57) **Abstract**

A capping apparatus having a bridge bar (140) for pressing the trailing edge of a PT cap down on a jar and a magnetic slide block (150) which pulls the leading edge of the cap up away from the jar so that the cap sits squarely on the jar. A hold down (130) at the outlet of a chute (110) and the bridge bar both extend across the width of the chute and cap therein, thus applying even pressure to the cap and preventing twisting within the chute.

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CAPPING APPARATUS

This invention relates to a capping apparatus and method of capping. In particular, it relates to an apparatus for applying press-on, twist off (PT) caps to containers such as glass jars. Generally, such capping apparatus is fitted above and at an angle to a horizontal conveyor, along which containers pass during the capping process.

Such a capping apparatus, or capper, is known in which caps pass down a chute to a cap pick-up point at which they are collected one-by-one by containers passing beneath the end of the chute. At the cap pick-up point, the leading cap is engaged by stops just ahead of its transverse diameter which prevent the cap from falling out of the chute. A hold-down device presses on the top of the cap to ensure that the cap cannot inadvertently twist over the stops and then out of the chute. This is aggravated by further caps behind the leading cap which push on the leading cap and may cause a cascade of caps onto the jars on the conveyor below.

Capping processes are high speed operations, generally applying caps at a rate of 400 to 500 caps/min. It is therefore critical that no cascade of caps occurs since the capping process would have to be halted in order to clear the caps from the bottle conveyor.

Conversely, retention forces applied to the cap firstly by the chute and then by the hold down and stops must not be so great that caps are not released and bottles missed in the capping process. Careful control of chute dimensions is therefore of paramount importance in conventional equipment.

Generally, the sides of the chute are moved to a width just greater than the cap width and a plate or block above the chute is lowered to limit the head space above

caps in the chute. Generally the sides and top plate of the chute are set to a minimum clearance for clear passage of the caps. This prevents lateral movement or undue twisting of the caps in the chute but the dimensions must not be reduced to such an extent that the caps stick within the chute itself.

In conventional machines, the hold down is spring loaded so that as a jar approaches the leading cap, it lifts the cap over the stops against the biasing action of the hold down. At this point the cap is at about 26° to the top of the jar. At pick-up, a slide block and so-called "duckbill" assembly, which are also spring-loaded, bias the cap towards the jar, preventing the cap from rising up away from the jar.

The duckbill of the prior art is a two-piece assembly, each piece being individually sprung. The first part is disposed parallel to the plane of the chute and extends around the hold down and slide block behind it. The second part of the duckbill is at an oblique angle to the first part and is disposed more or less horizontally and parallel to the plane of the top of the jars. It can therefore be seen that the cap has to pass from a position in which it is at an angle to the jar top to a final horizontal position in which it sits squarely on the jar.

Conventionally, caps for applying to glass jars include a plastisol compound. Prior to capping, the caps are pre-heated with steam to about 105°C so that the compound becomes pliable. At the cap pick-up point, glass thread on the jar engages with the pliable compound and forms an impression in the compound, making the cap difficult to move. It is therefore important that the cap be applied level in the first instance.

A particular problem of known cappers is that the caps tend not to translate fully to the position in which

they sit squarely, forming a secure package. During sterilising, compound within a PT cap on a glass jar is heated to about 120°C and can therefore flow freely so that the cap can move and adjust itself to seat squarely as the compound slowly forms itself about the glass thread and sealing surface. In a pasteurisation process, however, little or no extra heat is used, so that little or no flow of the compound arises and any cap which is not already seated squarely remains tilted and therefore both insecure and unsightly. Furthermore, if pressure is applied to a tilted PT cap at low temperatures, tearing of the compound may arise since it is not free to flow.

It is therefore an object of the present invention to provide a capping apparatus and method of capping in which PT caps are applied so as to sit squarely on the jars. It is a further object of the present invention to provide an improved method of cap control.

According to the invention, there is provided a machine for capping a container, comprising: a chute having an outlet; one or more stops for preventing a cap from falling out of the chute outlet; means for holding the cap on the chute at the chute outlet; and means for biasing the cap downwardly towards the container; in which the capping machine further comprises means for attracting the leading edge of the cap upwardly away from the container as the biasing means biases the trailing edge of the cap downwardly towards the container.

Preferably, the attraction means comprises one or more magnets. There may be two sets of one or more magnets, poles of the two sets being at an oblique angle to each other. Preferably, the attraction means are located in a slide member, which may comprise first and second portions, at an oblique angle to each other. Thus, for example, the attraction means may comprse a pair of

magnets at a first angle to the chute and a third magnet at a second angle to the chute, the third magnet being substantially horizontal.

Alternatively, the attraction means may comprise a pneumatic suction device, for example. Whilst other attraction means may be used, it is preferred that these be disposed that so as to prevent the cap from diving and to guide the cap to a level position where it can sit squarely on the container.

Preferably, the biasing means comprises a bar. This bar may extend across the whole width of a cap so as to prevent the cap from twisting laterally on a container. The bar may also extend upwardly, away from the cap so that there is room for the holding means, or hold down. The hold down may then also be wide since it has space to extend across the width of the cap and thus prevent twisting of the cap within the chute.

The use of a wide hold down gives better control than in prior art cappers since tolerances can be much greater than for prior art cappers which require a narrow chute for control of the cap within the chute.

The hold-down preferably comprises a bevelled surface which enables caps to move fast and freely along the chute to the outlet. The hold down may also include a convex surface which guides the cap towards its desired horizontal position. The hold down preferably does not contact the cap prior to pick up of the cap by a container.

According to a further aspect of the present invention, there is provided a method of capping a container, comprising the steps of: passing a cap along a chute to a chute outlet; retaining the cap at the chute outlet prior to pick-up of the cap by the container; and, subsequent to pick-up, biasing the trailing edge of the

cap towards the container and simultaneously attracting the leading edge of the cap away from the container.

A preferred embodiment of capping apparatus will now be described, by way of example only, with reference to the drawings, in which:

Figure 1 is a side view of part of a prior art capping apparatus;

Figure 2 is a side view of part of the capping apparatus of the present invention;

Figure 3 is a side view of a hold down of the apparatus of figure 2;

Figure 4 is an underside view of a slide block of the apparatus of figure 2; and

Figure 5 is a side view of the slide block of figure 4.

Figure 1 shows a known capping apparatus comprising a chute 10 at 40° to the horizontal, along which caps will pass to a pick-up point 20. At the pick-up point 20, two stops (not shown) are provided, one either side of the chute outlet in order to hold the leading cap in position. A hold-down 30 having a small clearance from the chute at the pick-up point is provided to hold the leading cap on the chute as the cap sits against the stops. Beyond the pick-up point 20, the capper comprises a slide block 40 and a two-part "duckbill" assembly 50, 60, so called because of its shape. The hold-down 30, slide block 40 and duckbill assembly 50, 60 (shown at rest in figure 1) are all spring loaded so that these components press down on a cap and are free to be deflected individually by the cap as it moves along the capping apparatus.

A container such as a bottle or jar passes along a horizontal conveyor under the capper in the direction shown by the arrow in figure 1. As the leading edge of the jar impinges on a cap held at the pick-up point 20,

it lifts the cap over the stops, against the force of the hold-down 30. Once the cap has exited the chute 10, it relies on the forward motion of the jar, together with downward pressure exerted in turn by the slide block 40 and duckbill 50, 60, to guide it into position on the jar.

Beyond the capper shown in figure 1 is a sealing belt which forces any cap which is not sitting squarely on the jar into the correct position but which will tend to tear compound with the PT cap in so doing. It is therefore necessary for the capping apparatus itself to extend almost as far as this belt, in an attempt to square up the cap prior to sealing. It can be seen that the duckbill assembly, in particular, extends a long way beyond the body of the capper, over the jar conveyor.

As the cap passes beyond each of the components of the capper, each component will spring back into its rest position prior to the passage of the next cap. Since the components are long, this results in a large movement in the form of deflection and springing back as each cap passes in turn. It can therefore be seen that each component will suffer a large degree of fatigue, particularly of their springs due to this continuous large movement. It will be apparent from figure 1 that in order to locate the cap on the jar, it is necessary for the cap to rotate from a first position approximately parallel to duckbill member 50 to a horizontal position parallel to the conveyor. This does not always occur, particularly in cases where the cap is 40mm in diameter.

Furthermore, in this prior art capper, the hold down 30 does not extend across the width of the cap and is U-shaped in transverse section, so that it only contacts the cap at two points which are approximately 10mm apart, fairly centrally on the cap. In addition, the slide block 40 acts only on a central 10mm portion of the cap. This

allows the cap freedom to twist over the stops if forced forward by impetus of caps behind it in the chute.

Figure 2 shows a preferred capping apparatus of the present invention, having a hold down 130 which extends across the width of a chute 110 and is bevelled from rear to front so that a cap is guided towards the chute outlet freely and easily and prevented from twisting within the chute 110. A bridge bar 140 having a cross-sectional diameter of approximately 5mm and extending over about 60mm across the apparatus and then perpendicularly upwards is provided beyond the pick-up point. The use of this bridge bar 140 thus provides space for a full-width hold-down 130.

A one-piece contoured slide block 150 extends beyond the bridge bar. The slide block has a first surface 152 at an acute angle to the horizontal and a second surface 154 which is substantially horizontal and parallel to the top of jars which pass along in the direction indicated by the arrow.

The hold down 130, bridge bar 140 and slide block 150 are all spring loaded. A comparison of the apparatus of figure 2 with the apparatus of figure 1 clearly shows that the use of a bridge bar has enabled the overall length of the apparatus of figure 2 to be reduced considerably in comparison with that of figure 1, thus reducing the deflection of individual components and the resultant fatigue. Furthermore, the distance travelled by the capped jars can be reduced by moving the sealing belt nearer to the capper.

A side view of the hold down 130 is shown in figure 3. From this figure, it can be seen that the hold down comprises a first surface 132 which is bevelled at an acute angle of approximately 16 degrees and a second curved surface 134.

Figures 4 and 5 show underneath and side views respectively of the slide block 150. Within the slide block are a pair of magnets 160 positioned symmetrically about the longitudinal axis, parallel to the lower surface 152 and set back 2mm from that surface, and a single third magnet 165 positioned centrally, parallel to the second lower surface 154 and set back 1mm from that surface. It can be seen that the magnet 165 is also set back from the front of the slide block so that it overlies the junction between surfaces 152 and 154. It will be appreciated that the magnets do not need to be set back from the lower surfaces of the block but that this is preferred in order to avoid damage to a cap passing underneath the block 150.

In use, caps pass along the chute 110 to stops (not shown) at the chute outlet and pick-up point 120. The hold down 130 will not normally contact the leading cap until it is raised over the stops by the action of a bottle or jar passing under the capper as indicated by the arrow in figure 2. However, the bevelled surface of the hold down (figure 3) both prevents twisting of caps within the chute and acts as a guide towards the pick-up point 120. The fact that the hold down is full width also removes the need for the chute width to be adjusted to within a close tolerance of the cap width to prevent caps from cascading out of the chute onto the jars. Furthermore, plate or block 115 (figure 2) above the chute need not be lowered close to the caps for the same reason. Thus the use of a wide hold down avoids time-consuming adjustment of the chute 110 and plate 115 to within a critical tolerance. It will also accommodate distorted caps which could normally jam in the chute.

As a jar contacts a cap held at the pick-up point 120, the cap will be lifted over the stops against the action of the hold down 130. The hold down 130 and

bridge bar 140 then press the cap onto the jar. The curved front surface 134 of the hold down (figure 3) enables the hold down to cooperate with the bridge bar, whilst the bevelled surface 132 prevents the next cap from falling out of the chute.

The cap is carried in the direction of the arrow by the movement of the jar and so passes to a point at which the bridge bar alone is pressing on the cap. At this point, the bridge bar 140 is acting on the rear half of the cap only and the magnets 160 attract the leading edge of the cap towards the slide block, thus rotating the cap towards the horizontal.

As the cap moves further, the bridge bar 10 pushes down the trailing edge of the cap and the third magnet 165 pulls the front edge around the contour in slide block 150 to a horizontal position where it will sit squarely on the jar. Generally, the slide block 150 will not be contacted by the cap but it is possible that due to manufacturing tolerances of compound thickness, glass thread diameters and jar height, some caps will sit higher relative to the conveyor and will contact the block. In this case, the positioning of the third magnet 165 pulls the leading edge of the cap around the contour between surfaces 152 and 154 in the same way as in non-contacting caps, and the slide block 150 then presses down on the cap due to being spring-loaded. However, even when the slide block is pushed up by the cap and jar, it never moves to the extent required by the duckbill assembly 50, 60 of figure 1. The springs of the capper of figures 2 to 5 thus do not suffer from fatigue as quickly as do the springs of the apparatus of figure 1.

It will be appreciated that the invention has been described above by way of example only and that changes may be made without departing from the scope of the invention.

C L A I M S:-

1. A machine for capping a container, comprising:

a chute having an outlet;

one or more stops for preventing a cap from falling out of the chute outlet;

means for holding the cap on the chute at the chute outlet; and

means for biasing the cap downwardly towards the container;

in which the capping machine further comprises means for attracting the leading edge of the cap upwardly away from the container as the biasing means biases the trailing edge of the cap downwardly towards the container.

2. A capping machine according to claim 1, in which the attraction means comprises one or more magnets.

3. A capping machine according to claim 1 or claim 2, in which there are two sets of one or more magnets, poles of the two sets being at an oblique angle to each other.

4. A capping machine according to any one of claims 1 to 3, in which the attraction means are located in a slide member.

5. A capping machine according to claim 4, in which the slide member comprises first and second portions, at an oblique angle to each other.

6. A capping machine according to any one of claims 1 to 5, in which the biasing means comprises a bar.

7. A capping machine according to any one of claims 1 to 6 in which the holding means and the biasing means are substantially the same width as the chute.

8. A method of capping a container, comprising the steps of:

passing a cap along a chute to a chute outlet;

retaining the cap at the chute outlet prior to pick-up of the cap by the container; and, subsequent to pick-up,

biasing the trailing edge of the cap towards the container and simultaneously attracting the leading edge of the cap away from the container.

9. An apparatus substantially as hereinbefore described, with reference to figures 2 to 5 of the drawings.

10. A method substantially as hereinbefore described, with reference to figures 2 to 5 of the drawings.

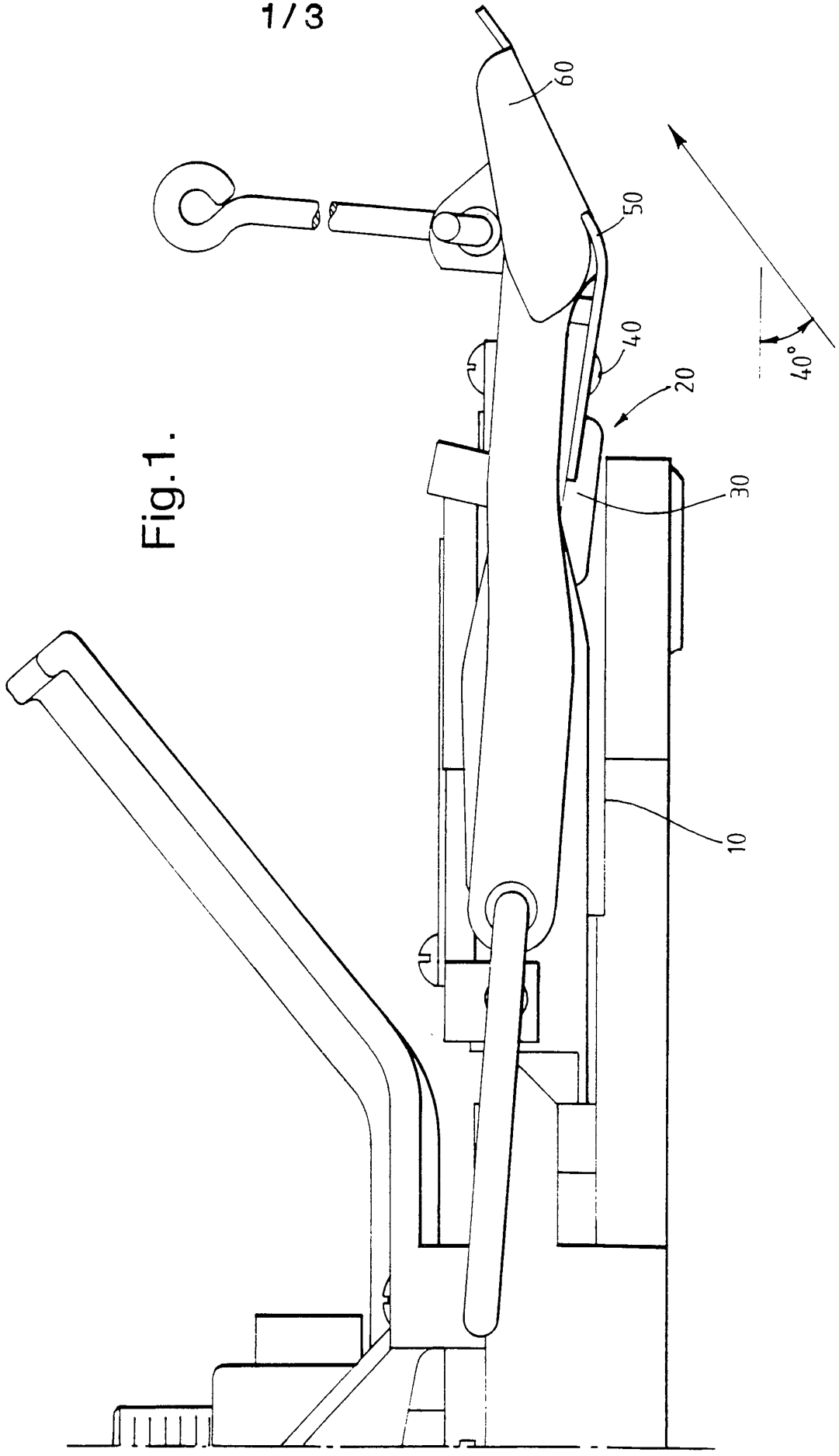
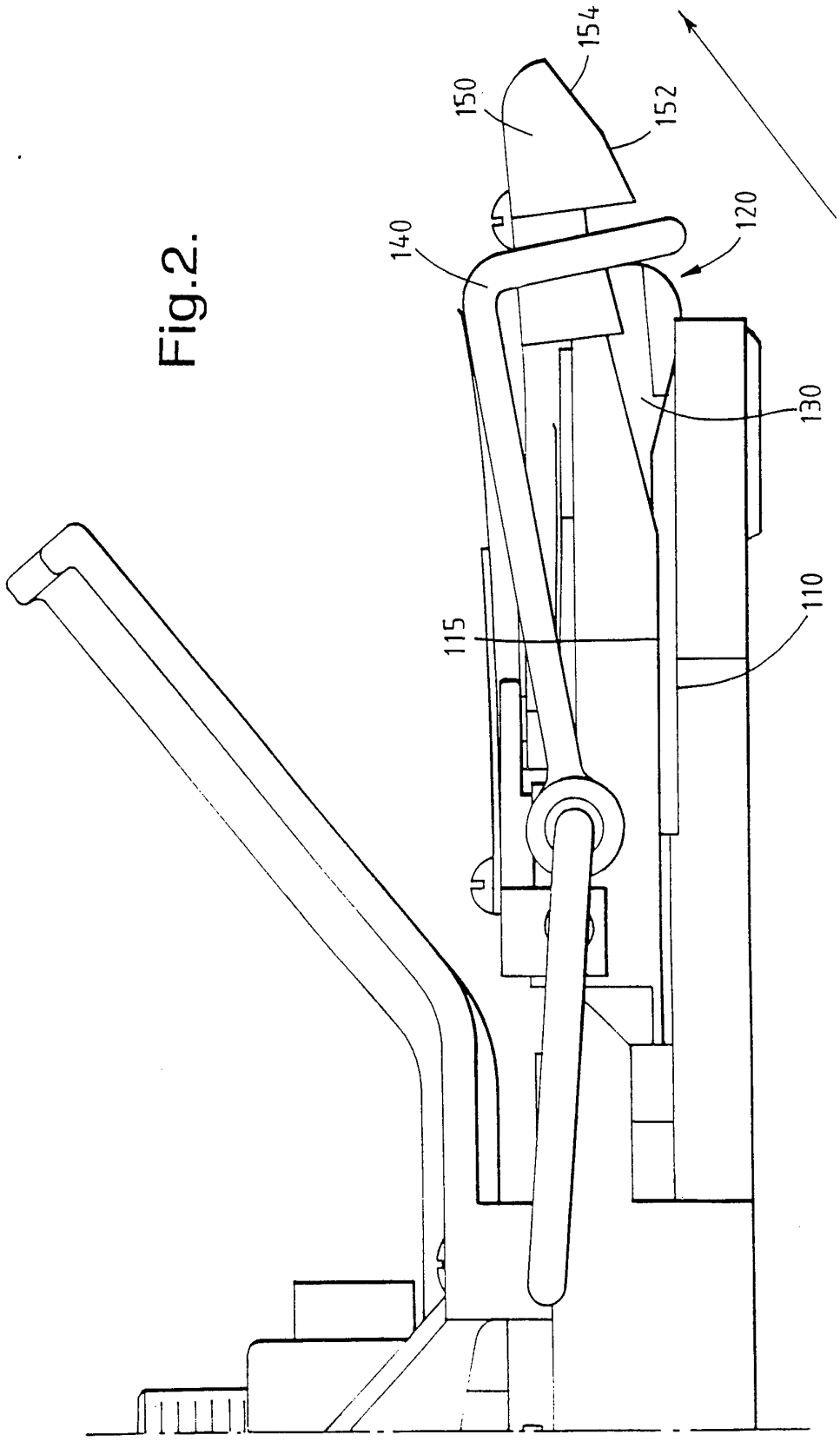


Fig.1.

Fig.2.



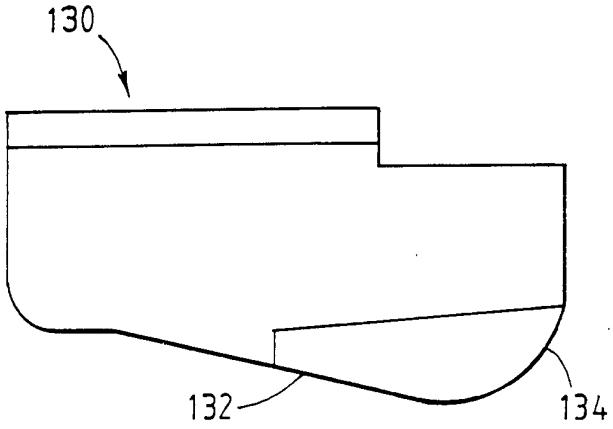


Fig.3.

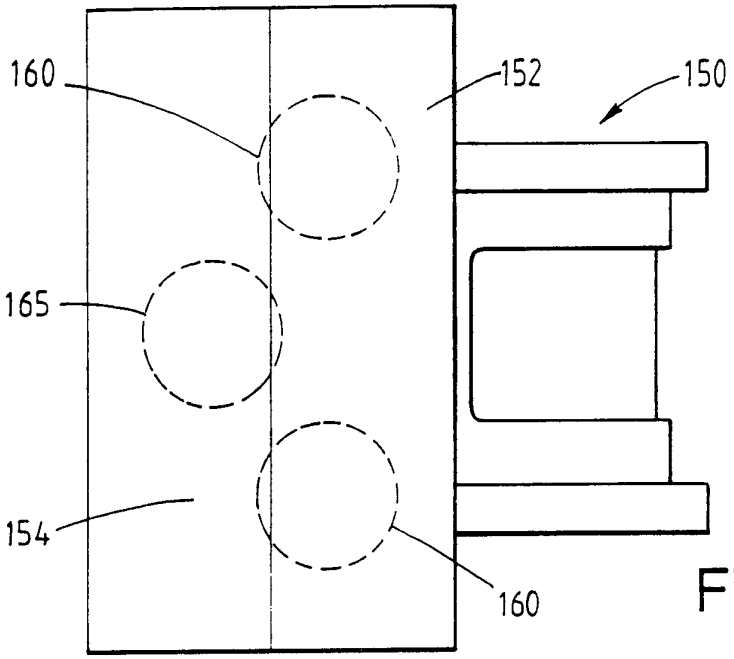


Fig.4.

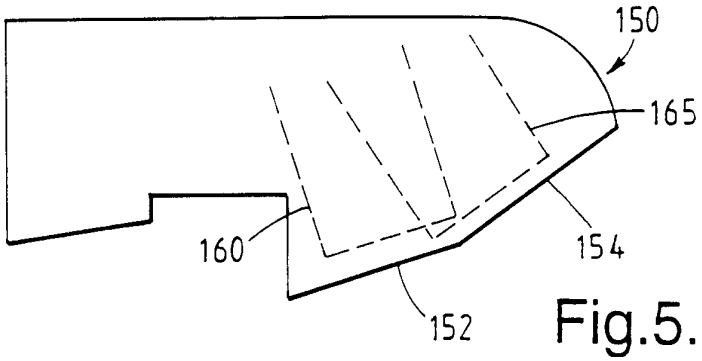


Fig.5.

INTERNATIONAL SEARCH REPORT

Inter nal Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 5 B67B3/22

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 5 B67B

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.
A	EP,A,0 170 627 (ITALCAPS SPA.) 5 February 1986 see abstract; figures	1,8
A	US,A,4 835 943 (MUELLER) 6 June 1989 see abstract; figures	1,8
A	BE,A,658 780 (ANCHOR HOCKING GLASS CORP.) 17 May 1965 see page 5, last paragraph - page 6, paragraph 3; figures	1,8
A	EP,A,0 018 461 (ITALCAPS SPA.) 12 November 1980 see abstract; figures	1,8
A	US,A,3 214 887 (WELLER) 2 November 1965 see column 2, paragraph 2; figures 4-6	1,8

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☒ Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
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Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)		Publication date
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US-A-4835943	06-06-89	NONE		
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US-A-3214887		NONE		