

1 590 778

- (21) Application No. 36369/77
- (22) Filed 31 Aug. 1977
- (31) Convention Application No. 51/104 638
- (32) Filed 1 Sept. 1976 in
- (33) Japan (JP)
- (44) Complete Specification published 10 June 1981
- (51) INT. CL.³ G03B 27/62
- (52) Index at acceptance
G2A C3 C5 C6 MG



(54) APPARATUS FOR HOLDING AN ORIGINAL AGAINST A SUPPORT SURFACE

(71) We, CANON KABUSHIKI KAISHA, a Japanese Company of 30-2, 3-chome, Shimomaruko, Ohta-ku, Tokyo, Japan do hereby declare the invention, for which we pray that a patent may be granted to us and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an apparatus for holding an original against a support surface, such as the original supporting surface of a platen in a photo-copying machine or printing machine. The invention relates particularly, but not exclusively to such an apparatus which is capable of fixedly holding down not only sheet originals but also three-dimensional originals on the original supporting surface and in which a pivotal original keep can remain stationary at any open position within a predetermined angular range so as to avoid the necessity for excessive handling of the keep during positioning of originals.

For example, electrophotographic copying machines have heretofore employed an original keep for holding originals to be copied on a transparent original supporting platen, such as a glass plate. Some known forms of original keep will now be described with reference to Figures 1 to 6 of the accompanying drawings.

Figure 1 is a perspective view showing an original keep holding apparatus 1 which is of a simple construction. A frame 2 supports a glass plate (not shown) on which an original may rest, and an original keep 3, formed of rubber or similar flexible material has a sufficient area to cover the whole surface of the glass plate. At one end, the keep 3 has its opposite side edges secured to a portion of the frame 2 by means of hinges 4. At the other end, the keep 3 is provided with a handle 5 which may be raised as indicated to permit placement of an original on the glass plate with the handle kept in the raised position. The original holding apparatus as shown in Figure 1 is very simple in construction, consists of only very few parts, and is thus economical to manufacture. However, this

apparatus exhibits certain operational disadvantages. Thus, when an original is to be placed on the glass plate, one must raise the original keep by gripping the handle with one hand while positioning the original using the other hand. Such use of both hands to effect placement of an original is inconvenient to the operator of the copying machine. Also, the keep which is made entirely of flexible material must be held down by the operator when a book or other three-dimensional original is being copied in order to ensure that the original is firmly and uniformly held against the glass platen. Thus, a keep of this construction is of poor operability. A device which was developed to overcome the problems peculiar to the original holding apparatus of Figure 1 is shown in Figures 2 to 4.

Figure 2 is a perspective view of the holding apparatus, Figure 3 is a transverse sectional view taken along the center of the Figure 2 apparatus, and Figure 4 is an enlarged, fragmentary, cross-sectional view of the mounting portion of the Figure 2 device. In apparatus 6 of Figure 2, a frame 7 supports centrally an original supporting glass plate (not shown). An original keep comprises a plate 8 which has one end thereof secured to a portion of the frame 7 by means of hinges 9 (see Figures 3 and 4), and is pivotable about the hinges 9. Supporting rods 11 extend from a block 10 integrally formed with the plate 8, and each rod 11 has one end loosely embedded in a handle 12 secured to the other side edge of the plate 8.

Reference will now be had to Figures 3 and 4 to describe the manner in which an original is urged. The plate 8 of the keep, may be raised in the direction of the full-line arrow by gripping and lifting the handle 12. When opened beyond 90°, gravity acts on the keep tending to cause it to fall rearwardly, but the back 13 of the block 10 bears against the upper surface of the frame 7 to restrict any further rotation of the keep and enables the keep to remain in that position (indicated by dot-and-dash line) even if the handle 12 is released. In

such position, the operator may use both of his hands to position an original on a glass platen 14. When having positioned the original, the operator may again grip the handle 12 to return the keep in the direction of the broken-line arrow, thus completing the original positioning operation. In this apparatus, the supporting rods 11 tend to maintain the plate 8 horizontal so that the plate 8 can uniformly hold down the original. Further, during the copying of a three-dimensional original, which may be a thick book 15 as shown in Figure 4, the urging plate 8 may bend in the form of "A" so that the book 15 can be properly held against the glass platen 14. However, although the keep will remain stationary in the raised position once that position is reached, the size of the plate 8 may make it difficult for some operators to succeed in raising the keep sufficiently for such position to be reached, so rendering the potential advantage of this apparatus unobtainable.

Another example of an original holding apparatus similar to that of Figure 2 will be considered with reference to Figures 5 and 6. Figure 5 is a perspective view of an original holding apparatus 16, and Figure 6 is an enlarged, fragmentary sectional view of the mounting portion thereof with respect to the copying machine. In Figure 5, a keep 17 formed of non-flexible material has one end thereof pivotally secured to the machine body by means of hinges 18, and is provided at its other end with a handle 19. Placement of an original with this apparatus 16 may be accomplished by gripping and raising the handle 19 of the keep 17 in the direction of the arrow, as shown in Figure 6. If the keep 17 is rotated beyond 90° , gravity tends to cause the keep to fall rearwardly away from a glass platen 20 as in the previously described holding apparatus, but the back 21 of the keep bears against a wall 22 of the machine body and the keep becomes stationary in this raised position. In such position, an original may be placed on the glass platen 20, and then the keep 17 can be returned to its initial position, whereupon the original will be urged against the glass platen by a cushion member 23 provided on the underside of the keep 17. The cushion member 23 is formed of porous material such as foamed urethane and thus, originals having slight thickness can be held on the platen by the keep, although the range of original thickness, which can be accommodated is limited. Again in the apparatus 16, the keep 17 cannot be made stationary unless it is raised beyond 90° .

Also known is an original holding apparatus disclosed in our previous U.S. Patent 3,994,582. In this apparatus, the

urging plate can be maintained open at an angle less than 90° , but this is only possible at a predetermined angle. Thus, even for thin originals, the keep must be opened to the predetermined angle and no account is taken of variation in the height of the operator.

According to the present invention there is provided apparatus for holding an original against a support surface comprising an original keep arranged to pivot about a first pivot, an elongate support member arranged to pivot about a second pivot spaced from said first pivot, an engagement member which is carried on and is displaceable along said support member and a resilient biasing element for biasing said engagement member along said support member, said engagement member being arranged to transmit to the original keep member from said resilient biasing element a pivotal bias which varies as the keep pivots, the arrangement being such that the resultant of the moments due to gravitational and biasing forces acting upon said keep enables the keep to urge an original against the support surface in a first position of the keep, and can also hold the keep stationary in a second position thereof pivotally spaced from the support surface.

The arrangement may be such that said resultant of the moments due to the gravitational force and the variable biasing force can hold the keep stationary at any said second position within an angular range. In the first position of the keep the resultant may comprise only the moment due to the gravitational force, or the combined additive effect of the moments due to both gravitational and biasing forces.

The keep may comprise a cover member and attached thereto a support element engaged by said engagement member.

The apparatus may be adapted for vertical displacement of the keep, relative to the original support surface in order to permit both thin and thick originals to be accommodated. To this end the first and second pivots may be provided by a pivot support means mounted for vertical movement relative to the original support surface.

Preferably the second position, or the angular range for the second position lies within an angle of 90° from the first position.

An embodiment of the invention will now be described by way of example with reference to Figures 7 to 15 of the accompanying drawings, in which:

Figures 1 and 2 are perspective views showing examples of the original holding devices according to the prior art;

Figures 3 and 4 are cross-sectional views of the Figure 2 apparatus;

Figure 5 is a perspective view showing another original holding device according to the prior art;

Figure 6 is a cross-sectional view of the Figure 5 apparatus;

Figure 7 is a perspective view of an original holding apparatus according to the present invention;

Figures 8 and 10 are cross-sectional views of the portion of the Figure 7 apparatus;

Figure 9 is a top plan view of that portion of apparatus shown in Figure 8;

Figures 11 and 12 graphically illustrate the relationship between the opening angle of the keep of the original holding apparatus and moments acting on the keep;

Figures 13 and 14 are fragmentary cross-sectional views of the keep or original holding apparatus according to the present invention with an original placed thereon; and

Figure 15 diagrammatically illustrates the relative position of urging pivots, spring and keep in original holding apparatus according to the present invention.

The following embodiments of the invention are described with respect to their use in a copying machine.

Figure 7 is a perspective view of an original holding apparatus of the present invention as seen from the rear thereof and showing the device as it holds down a sheet-like original. Designated by 24 is the copying machine body but this need not be described in detail herein. Designated by 25 on top of the body 24 is the original holding apparatus which includes a keep 26 comprising a cover member. Keep 26 is pivotally mounted on pivotal support means comprising a pair of mounting seats 27 by a mechanism to be described. The mounting seats 27 are secured to the upper ends of struts 28 slidably supported with respect to supporting members 29 which in turn are secured to a structure 30 in the body 24. With the above-described construction, the entire keep 26 is slidable with respect to the supporting members 29, and is thus vertically displaceable with respect to the body 24. As shown, one of the supporting members 29 may be formed with a bore large enough to receive there-through the strut 28 with some degree of freedom, thus providing an allowance for machining precision. Designated by 31 on top of the original keep 26 is an information sheet mounting portion which may comprise a recessed portion 32 formed in the keep 26 so that an information sheet 33 containing attachment directions or publicity may be placed at the bottom of the recessed portion 32, and the information sheet may be covered and fixed by a transparent film 43. With this construc-

tion, replacement of information sheet 33 may be effected by removing the transparent film 34. (For details of the construction, see Figure 13).

Operation of the device 25 will now be described. The keep 26 may be opened by raising it at the opposite side thereof from the mounting portion thereof, and this will further be described by reference to Figures 8 to 10 which illustrate the mechanism of the mounting portion.

Figure 8 is an enlarged, fragmentary sectional view of the holding apparatus as it is in its position for holding down a sheet-like original. The keep 26 of this embodiment comprises a cover member having an exterior portion formed of a non-flexible material such as metal, synthetic resin or composite material, and inwardly thereof, a cushion member 35 integrally attached to the cover member 26, the cushion member being formed by an elastomeric mat of foamed polyurethane, polystyrene, polyethylene, vinyl chloride, nitrile rubber or other foamed material. By the cushion member 35, a three-dimensional original having a predetermined thickness maybe urged against an original support surface provided by the glass platen 36 with a sufficient pressure force. Inwardly of each side of the original keep 26, a support element in the form of a plate 37 is secured by screws 38. Each plate 37 is secured to the respective mounting seat 27 by means of bearing 39 for pivotal movement about a pivot 40. In addition to the pivot 40, the mounting seat 27 is provided with a pivotable leg 42 pivotable about a pivot 41, substantially parallel to the pivot 40 and slightly above and adjacent to the glass platen 36. Depending on the set position of the pivot 41, the force of gravity acting on the keep may or may not be augmented by a downward force derived from a coil spring, to be described, in the lowered position of the keep. A support member in the form of a guide shaft 43, and a spring seat 44 are further mounted on the pivotable leg 42, and a slidable engagement member in the form of a spring seat 45 is movably fitted on the guide shaft 43 at the forward end thereof. A laterally extending pin 46 is embedded in the spring seat 45, and a resilient biasing element in the form of a compression coil spring 48 is disposed between the spring seats 44 and 45 such that the opposite ends of the pin 46 are engaged with a forward hooked portion 47 of the plate 37. Figure 8 is a cross-section taken long line 8-8 in Figure 9. With the mounting mechanism of the above-described construction, when the original keep 26 is in its lowered, or closed position as shown in Figure 8, the pivotable leg 42 has its base

leg portion 49 in abutment with the mounting seat 27, while the coil spring 48 is compressed substantially to its minimum length by and between the spring seats 44 and 45. On the other hand, the original keep 26 is subjected to a counter-clockwise moment about the pivot 40 by the force of gravity acting on the keep, thereby firmly urging an original (not shown) against the glass platen 36.

Description will now be made of the operation involved when the keep 26 is raised to place or replace an original. When the keep 26 is raised, the forward end of the guide shaft 43 is rotated in a clockwise sense as seen in Figure 8 by the forward hooked portion 47 of the plate 37 and the pin 46 of the spring seat 45 and simultaneously therewith, the pivotable leg 42 is also rotated clockwise. With the rotation of the guide shaft 43, the slidable spring seat 45 slides toward the forward end of the guide shaft 43 to thereby increase the length of the spring 48. When the opening angle between the keep 26 and the glass platen 36 reaches a predetermined angle, the clockwise moment resulting from the pivotal bias transmitted to the keep by the spring seat 45 from the coil spring 48 balances the counter-clockwise moment resulting from the force of gravity acting on the urging plate 26, so that the keep 26 can remain stationary at the raised position. The fully open position of the keep is reached when the rear end 50 of the plate 37 comes into abutment with the back 51 of the mounting seat 27. Such position is shown in Figure 10. In this position, placement or replacement of an original may take place and, since the keep 26 is stationary in the position of Figure 10, the operator can use both hands for handling the original and further, the keep is stationary at an open angle less than 90° and is accordingly readily accessible by the hand when it is to be returned to its lowered position. This means a good operability.

The balanced open position of the keep is determined by selecting the strength of the coil spring 48 in relation to the weight of the keep 26 and thereby balancing the clockwise and the counter-clockwise moment with each other. The balanced position of the keep 26 may be within a predetermined range of angle less than a maximum opening angle of 90° which facilitates the handling of the keep. This could be ascertained empirically and will further be described by reference to Figures 11 and 12. Figure 11 is a graph illustrating the relationship between the opening angle Θ of the original keep and the moments. Curve M_c represents the moment acting on the original keep by gravity, and

appears as a function of $\cos. \Theta$. Curve M_o represents the moment from the spring force which tends to raise the keep and depicts a curve similar to a parabolic curve in the graph. In the graph, it is seen that within an angular range defined by the points a and b the moments M_o and M_c are approximately equal, so that the spring force balances the gravitational force acting on the keep. In other words, the keep can remain stationary at any point within the angular range defined by the two points a and b in the graph.

Figure 12 is a graph illustrating the relationship between the resultant of the two moments and the opening angle. As shown, the curve $M_o - M_c$ has a substantially flat range at the top thereof and, by designing the spring such that in this range $M_o - M_c = 0$, it will be possible to make the urging plate become stationary at any point within the opening angle of the urging plate which pertains to such range. It is possible to increase or reduce the angular range of stationary position as desired, by suitably altering the value of the friction moment $\pm M_f$ resulting from the friction in mounting mechanism of Figure 8. In Figure 12, since the frictional moment $+M_f$ resisting opening of the keep exceeds the positive value of $M_o - M_c$ at its flat peak the keep is held stationary.

In the mechanism having the values as shown in Figures 11 and 12, the keep can be held stationary at any angle within the range of about 40° up to the maximum opening angle 90° .

Reference is now made to Figures 13 and 14 to describe the condition in which an original is actually held down by the original holding apparatus described above. First, hold-down of a sheet-like original will be discussed with reference to Figure 13 which is a fragmentary cross-sectional view of the original holding portion of the keep 26. Designated by 52 is a relatively thin sheet-like original which, in this case, is well urged against the glass plate 36 by the cushion member 35 of the keep 26. Next, hold-down of a three-dimensional original will be described with reference to Figure 14. Designated by 53 is an example of a three-dimensional original which is shown there as a book. In this case, where the original is relatively thick, the hold by the cushion member 35 alone is limited and the entire holding apparatus 25 may displace upwardly to urge the original in the manner as shown. The floating mechanism for the device 25 has already been described in connection with Figure 7 and by that mechanism, the device 25 may be returned to its position of Figure 10 with the keep 26 remaining open. If the floating mechanism is designated as shown in Fig-

ure 7 and the entire urging device 25 is removable from the apparatus body, then the copying of voluminous three-dimensional originals will become easy as well as the use of accessories for overlays or the like. Further, the entire area of the original supporting surface can be used without being interfered with by the holding apparatus and this is effective for the copying of widely dimensioned originals, as well.

The above-described embodiment of the present invention is diagrammatically depicted in Figure 15, where point A corresponds to the pivot 40 of the original keep, point B corresponds to the point of engagement between the pin 46 and the hooked portion 47 of the plate 37, and point C corresponds to the pivot 41. The straight line passing through the points A and B represents the plate 37, namely, corresponds to the original keep 26; the member D pivotable about the point C corresponds to the pivotable leg 42; and the spring E between the member D and the point B corresponds to the coil spring 48. In the arrangement described above, the point A may be either fixed on the apparatus body or provided with some degree of vertical freedom as in the shown embodiment to thereby increase the range of application of three-dimensional originals. In the embodiment illustrated above, an urging plate comprising a combination of an original keep 26 and a cushion member 35 has been shown by way of example, whereas a similar effect may be achieved by combining the keep supporting mechanism with a keep comprising a plate of flexible material and a rigid support means for supporting the plate.

The present invention, as hitherto described, enables the keep to become stationary within a predetermined range which facilitates the handling of the keep. Thus, the open position of the keep may be selected to be at a convenient angle. In other words, it is not essential to raise the keep to an excess angle; this enhances the operability. Also, it can be arranged that when an original is to be held down, it can be urged against the original supporting surface not only by the action of gravity on the keep but also by a resilient force acting on the surface of the original which results from displacement of a shaft to which one end of a resilient member is secured. Thus, the original can be brought into uniformly intimate contact with the original support surface.

The original holding apparatus disclosed herein is of course applicable to both the apparatus of the movable original supporting platen type and the apparatus of the stationary original supporting platen type, and is applicable to any form of photo-

copier, and to various forms of printing and recording machines adapted to receive an original.

WHAT WE CLAIM IS:—

70

1. Apparatus for holding an original against a support surface comprising an original keep arranged to pivot about a first pivot, an elongate support member arranged to pivot about a second pivot spaced from said first pivot, an engagement member which is carried on and is displaceable along said support member and a resilient biasing element for biasing said engagement member along said support member, said engagement member being arranged to transmit to the original keep member from said resilient biasing element a pivotal bias which varies as the keep pivots, the arrangement being such that the resultant of the moments due to gravitational and biasing forces acting upon said keep enables the keep to urge an original against the support surface in a first position of the keep, and can also hold the keep stationary in a second position thereof pivotally spaced from the support surface.

2. An original holding apparatus according to claim 1, wherein the arrangement is such that said resultant of the moments due to the gravitational force and the variable biasing force can hold the keep stationary at any said second position within an angular range.

3. An original holding apparatus according to claim 1 or claim 2, wherein the arrangement is such that in said first position of the keep said moments due to both the gravitational and biasing forces each contribute to said resultant and each act in a sense to urge the keep toward the support surface.

4. An original holding apparatus according to claim 1 or claim 2, wherein the arrangement is such that in said first position of the keep, of the gravitational and biasing forces, only the former contributes to said resultant and acts in a sense to urge the keep toward the support surface.

5. An original holding apparatus according to any preceding claim wherein said keep comprises a cover member and attached thereto a support element engaged by said engagement member.

6. An original holding apparatus according to any preceding claim wherein said first and second pivots are provided by pivot support means mounted for vertical movement relative to the original support surface whereby the keep is vertically displaceable.

7. An original holding apparatus ac-

130

- ording to claim 6, wherein the said pivot support means is adapted to permit the apparatus to be removably mounted with respect to the original support surface.
- 5 8. An original holding apparatus according to any preceding claim wherein said second position or said angular range therefor lies within an angle of 90° from the said first position.
- 10 9. An original holding apparatus according to any preceding claim wherein said resilient biasing element comprises a coil spring.
- 15 10. An original holding apparatus according to claim 9 wherein said coil spring is coaxially carried on said elongate support member and is compressively stressed between said displaceable engagement member and a spring seat which is fixed to said elongate support member. 20
11. An original holding apparatus substantially as herein described with reference to Figures 7 to 15 of the accompanying drawings.

R. G. C. JENKINS & CO,
Chartered Patent Agents,
Chancery House,
53/64 Chancery Lane,
London WC2A 1AY.
Agents for the Applicants

1590778

COMPLETE SPECIFICATION

8 SHEETS

This drawing is a reproduction of the Original on a reduced scale

Sheet 1

FIG. 1

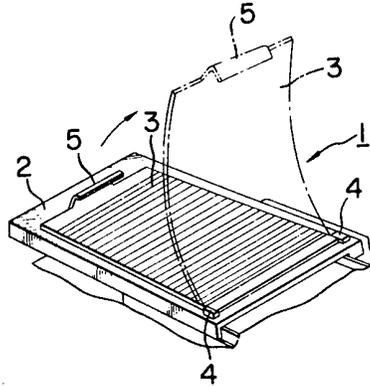


FIG. 2

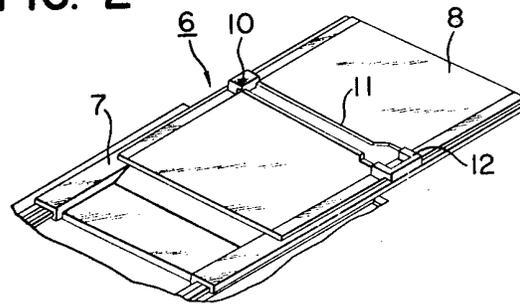
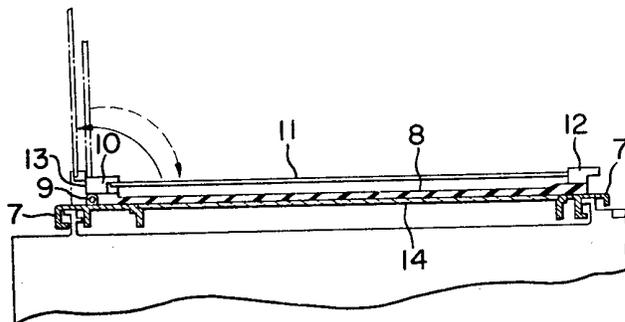


FIG. 3



1590778

COMPLETE SPECIFICATION

8 SHEETS

*This drawing is a reproduction of
the Original on a reduced scale*

Sheet 2

FIG. 4

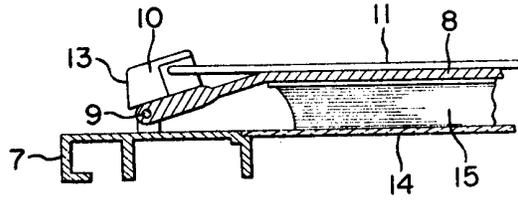


FIG. 5

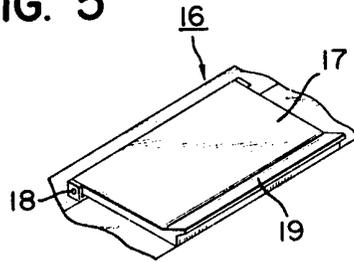
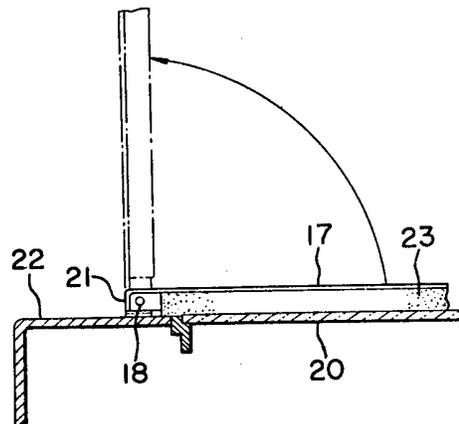


FIG. 6



1590778

COMPLETE SPECIFICATION

8 SHEETS

*This drawing is a reproduction of
the Original on a reduced scale
Sheet 3*

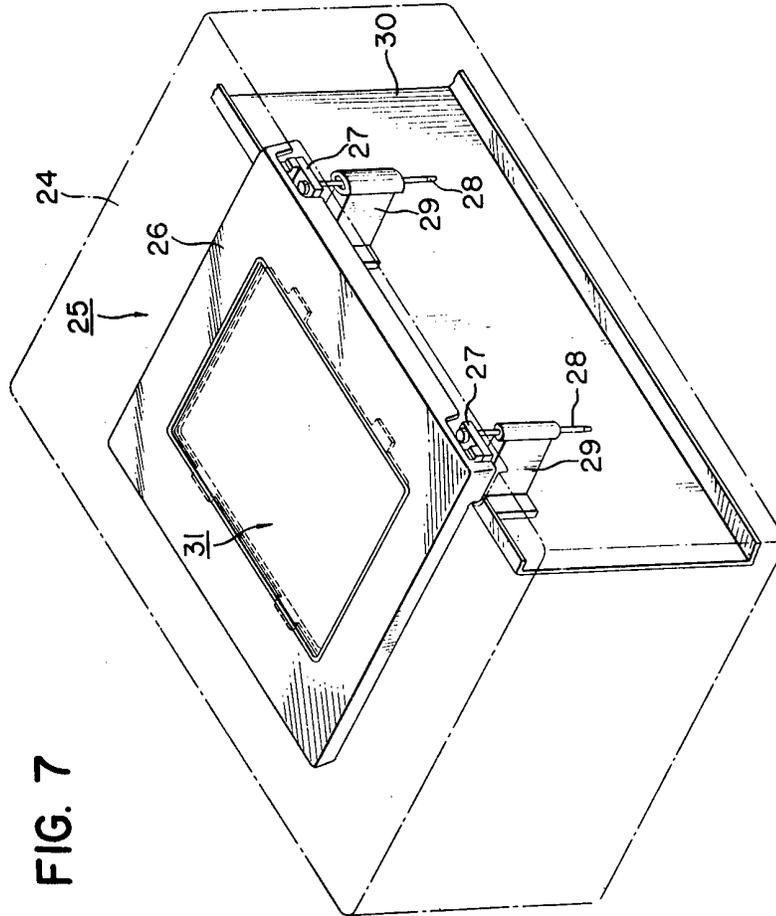


FIG. 7

FIG. 8

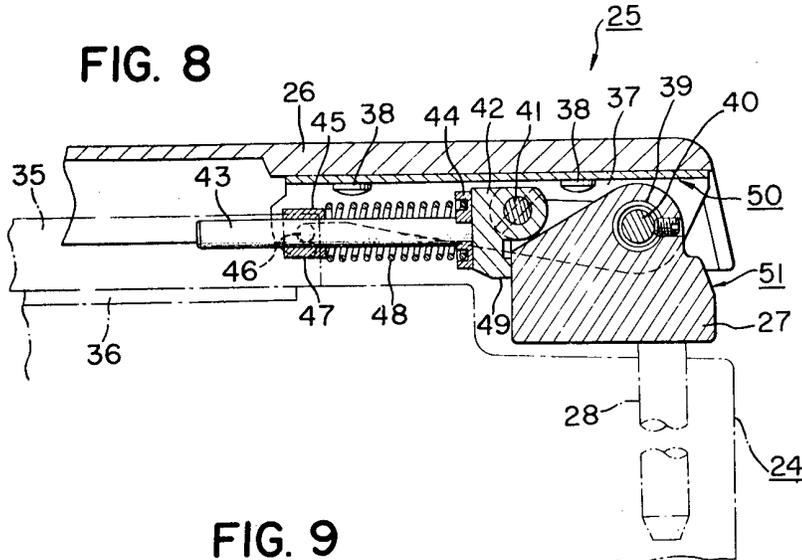


FIG. 9

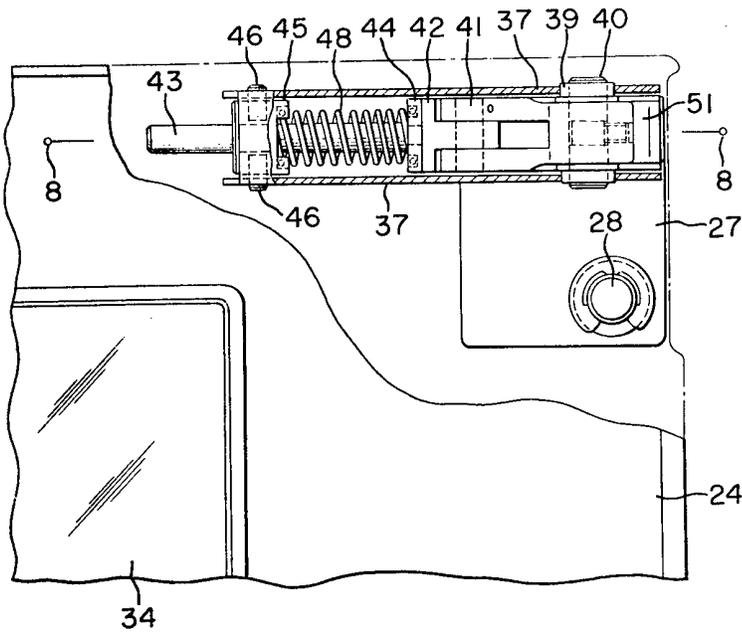


FIG. 10

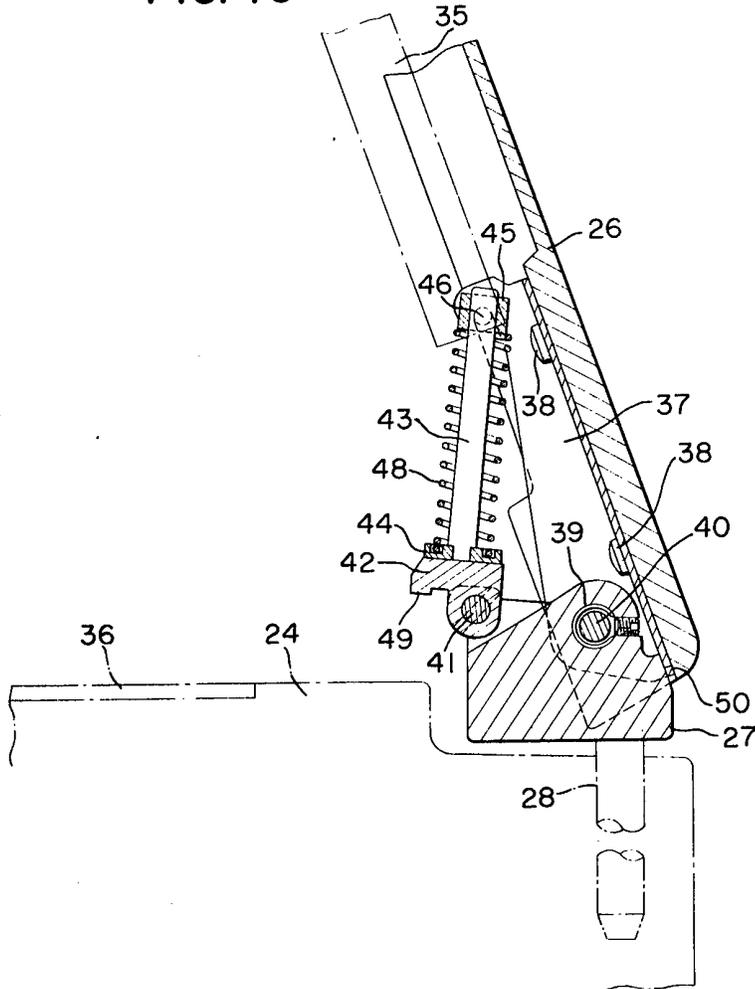


FIG. 11

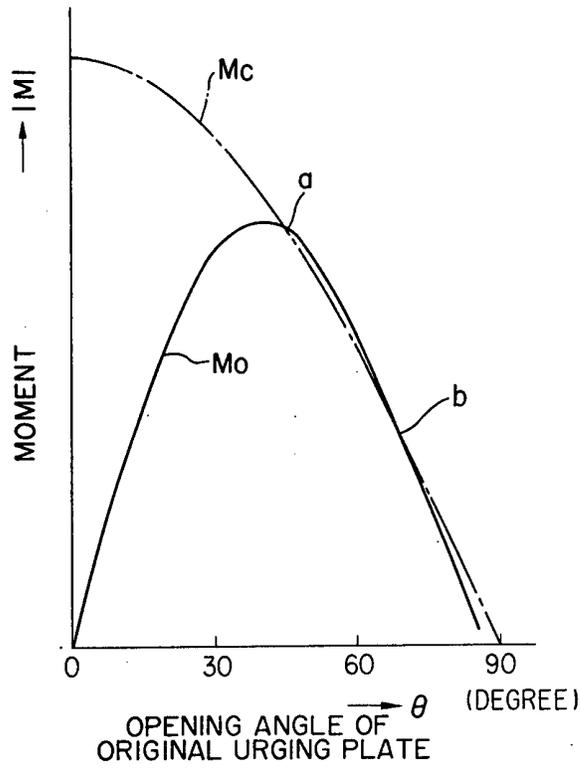


FIG. 12

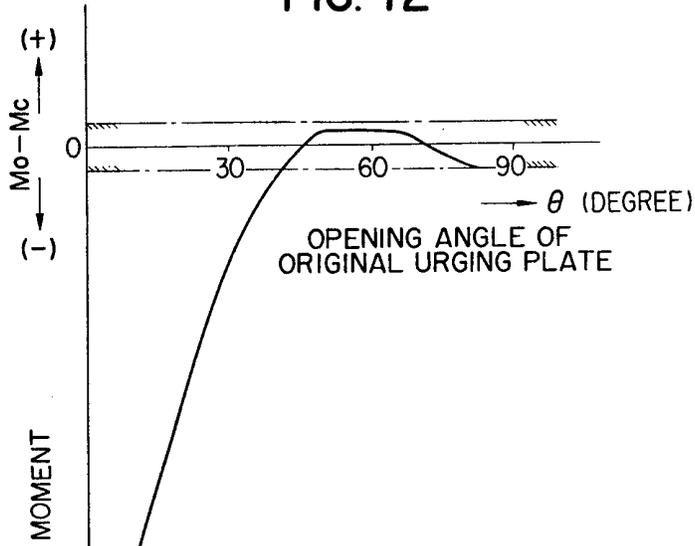


FIG. 15

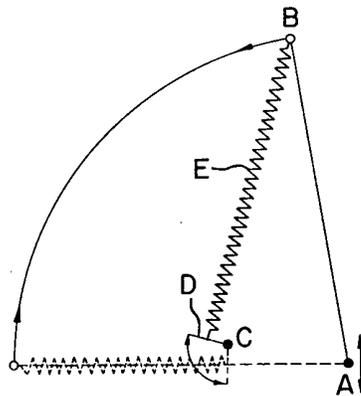


FIG. 13

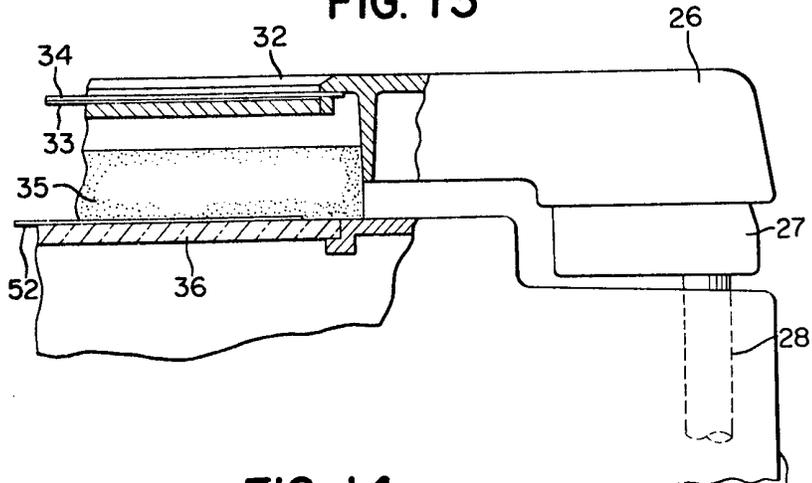


FIG. 14

