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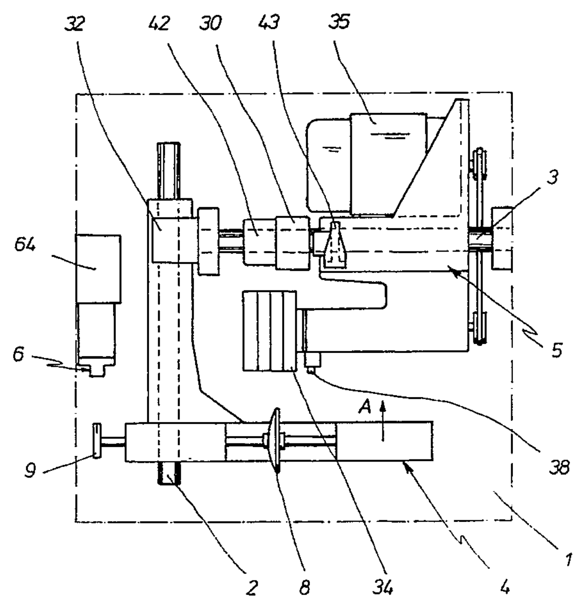
(54) Lens bevelling machine.

(57) The machine coordinates the movement of a carriage (5) supporting a shaft (33) for the rotation of grind wheels (34) and a movement perpendicularly to the former movement of a carriage (4) supporting a shaft (12) on which a lense (8) may rotate. The wheel holder shaft (5) is provided with a driving member (30) fixedly attached to a rotating cam (43) of variable width and a driven member (31) having a cam guide (44) which locks with the wider portion of the cam (43), there being only in this case a position of absolute locking between the driving member (30) and the driven member (31); an encoder (85) detects the successive popsitions and movements of the driven member (31) and a feeler (38) is adapted to detect positions of the lens (8) relative to the grind wheels (34).

FIG. 1



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LENS BEVELLING MACHINE

The invention relates to a lens bevelling machine, comprising: a first guide bar; a lens holder carriage moveable along the first guide bar between a first rest position and a second work position; actuatable means for retaining the lens holder carriage in the first position thereof; resilient means urging the lens holder carriage to the second position thereof on being released from said retaining means; a rod on said lens holder carriage, disposed at rightangles to said first guide bar and adapted to support a template; a longitudinally moveable rack mounted on the lens holder carriage in alignment with the rod and adapted, together with the rod to hold the lens; a motor and transmission means for causing the rod and the rack to rotate; a second guide bar parallel to said rod and rack; a wheel holder carriage longitudinally moveable along the second guide bar and comprising a shaft parallel to the second guide bar; grind wheels mounted on said shaft; means for causing the grind wheels to rotate; drive and motion transmission means; detection and signal emitting means; a microprocessor for receiving said signals and for controlling said drive means.

The generally known machines of the type described do not allow the contour or periphery of the lenses for mounting a corresponding frame to be satisfactorily performed.

It is an object of the invention to provide some fully automated means for providing a perfectly finished bevel, faster operation and minimum use of manual labour in the process.

This object is achieved by a machine of the type described at the beginning characterized in that said wheel holder carriage comprises a driving member, directly associated with a stepper motor capable of causing said longitudinal movement, and a driven member, associated with the former by means of a locking device comprising, on the one hand, a rotating cam driven by a motor fixedly attached to the driven member and provided on the periphery thereof with portions of variable width from a portion of maximum width to a portion of minimum width and, on the other hand, a cam guide fixedly attached to the driven member and inside which there moves a cam which may fit snugly in the cam guide when the maximum width portion thereof engages in the guide, there being formed a position of fixed attachment between the driving and driven members, while when a portion of narrower width engages the cam guide, said position of fixed attachment between the driven member and the driving member ceases to exist; and in that between said detection means there is an encoder for detecting the successive positions of said driven member and a feeler, located in the proximity of the grind wheels, for detecting the lens positions.

Further advantages and features of the invention will be appreciated from the following description, in which a preferred embodiment of the invention is disclosed without any limiting nature and with reference to the accompanying drawings in which.

Figure 1 is a schematic plan view of the overall machine.

Figure 2 is a schematic elevation view of the lens holder carriage, comprising a template and a lens.

Figure 3 is a schematic view, partly in section, of the lens holder carriage retaining system.

Figure 4 is a schematic view of the lens holder carriage, the grind wheels being shown in phantom.

Figure 5 is a schematic cross section view of the locking device between the driving and driven members of the wheel holder carriage.

Figure 6 is a schematic view of the lens holder carriage tensioning means.

Figure 7 is a schematic view in cross section of the device in support of the reproducing unit, the periphery of the grind wheels being shown in part in phantom.

Figure 8 is a schematic perspective view of one embodiment of the lens holder carriage movement measuring device.

Figure 9 is a part schematic view of the lens in contact with a grind wheel.

Figure 10 is a schematic perspective view of another embodiment of the lens holder carriage movement measuring device.

Figure 11 is a part schematic view in cross section of the device of Figure 10.

Figure 12 is a schematic perspective view of the wheel holder carriage movement measuring device.

Figure 13 is a schematic cross section view of the feeler; and

Figure 14 is a diagram of peripheral blocks of the machine.

The machine of the invention, as may be seen in Figure 1, comprises basically a platform 1 on which there is mounted a first guide bar 2 and a second guide bar 3 disposed at rightangles and in different planes. A lens holder carriage 4 may move along the first guide bar 2 between a first rest position (illustrated in Figure 1) and a second operative position (shown in part in Figure 9). A wheel holder carriage 5, to be referred to hereinafter, is mounted on the second guide bar 3.

In Figure 2 there is illustrated in greater detail, albeit also schematically, the lens holder carriage 4. There is to be seen a rod 7, parallel to the second guide bar 3 and, therefore, disposed at rightangles to the first guide bar 2. This rod is adapted to support a template 9 which is associated, as will be described hereinafter, with the reproducing unit 6. Also mounted on the carriage 4 is a rack 15 which may be moved lengthwise by a pinion 16 driven by a motor 17. The rack 15 is aligned with the rod 7 and these two members are adapted to hold a lens 8 therebetween. The rod 7 and the rack 15 and, therewith the lens 8 and the template 9 are caused to rotate by a stepper motor 10 and corresponding transmission means comprising a gear train 11, a shaft 12, pulleys 13 and belts 14. The carriage 4 runs on bearings 18 along a rail 19 fixedly attach to the platform 1.

Figure 3 shows means for retaining the lens holder carriage 4 in the said first rest position. Said retaining means comprises a lever 20 which pivots about a shaft 21 and has a hook shaped end portion 22 which may engaged a fixed pin 23. The other end of the lever 20 is engaged by a spring 25 ur ging the lever to the retained position thereof. An electromagnet surrounds a pusher 24 and when the former is energised the pusher 24 engages the lever and urges it out of the retained position thereof. There is also an end-of-stroke sensor 26.

Figure 4 schematically shows the wheel holder carriage which may move lengthwise along the second guide bar 3. Said carriage 5 comprises a driving member 30 and a driven member 31. A stepper motor 32 causes the driving member to moved along the guide bar 3 by way of a spindle 45′ (Figure 5). The driven member 31 comprises a shaft 33 on which there are mounted the grind wheels 34. Said shaft is driven by a motor 35 and a belt 36 and pulleys 37 transmission. In the proximity of the grind wheels 34 there is a feeler 38 for detecting the positions of the lens 8. Said feeler is described more fully hereinafter.

The driving and driven members 30, 31 are mutually associated by a locking device 40 (Figures 4 and 5). The driving member 30 is fixedly attached to a rotating cam 43, caused to rotated by a motor 42. The cam 43 is provided on the periphery thereof with portions of different which, comprised between that of a maximum width portion (the cam portion closest to the guide bar 3 in Figure 5) and that of a minimum width portion (the cam portion farthest removed from the guide bar 3 in Figure 5).

The driven member 31 is fixedly attached, in turn, to a cam guide 44 defining a gap in which the cam moves while rotating. The width of the gap is substantially the same as the width of the widest portion, where by the cam 43 is adapted to fit snugly in the cam guide 44 when the maximum width portion of the cam is positioned in the cam guide 44. At this time the driven member 30 is unmovably attached to the driven member 31, such that both members move jointly over the whole length of the second guide bar 3.

On the contrary, when another portion of the cam 43, of necessity of smaller diameter, is in the guide 44, there will be some degree of play between the driving member 30 and driven member 31 during the said longitudinal movements. The cam 43 rotates under the control of a light sensitive detec tor 45. An encoder shown in Figure 12 is adapted to detect the successive positions of the driven member 31 and store them in the memory of a computer and a microprocessor adapted to receive signals from the encoder or from other detectors, sas well as to control the various drive means.

Figure 6 shows resilient means urging the lens holder carriage 4 towards the second operative position thereof from the time when said carriage 4 is released from said retaining means. The resilient means comprises a spring 51 attached at one end thereof to the carriage 4 and drawing the carriage, urging the lens 8 against one of the grind wheels 34. There are tensioning means 47 comprising cables 52 and 53 and pulleys 54 and 55 associating the other end of the spring 51 with a nut screwed on a spindle 49, mounted in a support 50. A stepper motor 48 causes the spindle to rotate and therefore movement of the nut, adjusting the tension of the spring 51. There is a light sensitive detector 56.

The machine of the invention is provided with a reproducing unit 6 comprising a circular sector 57 the radius of which is substantially the same as that of the grind wheels 34. The sector extends from a member 58 on which there are two contacts 59 and 60 held apart by a spring 61.

The circular sector 57 is mounted on a shaft 62 driven by a spindle 63 from a stepper motor 64, with a coupling 65 and having a bearing 66. This mechanisms allow the sector 57 to be moved parallel to the first guide bar 2 between a first retracted position and a second contact position. In the first position the rod 7 is substantially equidistant from the surface of sector 57 and the surface of the grind wheels 34 or, in other words, the perimeter of the sector 57 is substantially a right projection of part of the perimeter of the grind wheels 34 where by when the sector 57 and the grind wheels 34 are viewed from the side they are apparently super-imposed.

Nevertheless, the machine is provided with means to moved the first retracted position of the sector 57 slightly forward or backward. As discussed hereinafter, this allows lenses to be ground to a perimeter which is slightly larger or slightly smaller than the perimeter of the template 9.

In the second position of the sector 57 this contacts the template 9 (or other object) when the latter is in the position corresponding to the first position of the lens carriage 4. With said contacts the force of the spring 61 is overcome allowing the contacts 59, 60 to closed a circuit and output a signal. Among the various detection means the machine has, there is an end-of-stroke sensor 26 (Figure 3) signalling that the sector 57 of the reproducing unit 6 has reached the second position whereby the pusher 24 is caused to descend and the lens holder carriage 4 is released.

The lens holder carriage 4 is provided with a movement measuring device 67 (Figure 8) formed by a bracket 68, a square 69 and which comprises a toothed belt 70 driving an encoder 71.

Figures 10 and 11 show another embodiment of a movement measuring device 75 for the lens holder carriage 4 along the first guide bar 2. The device 75 comprises a wheel 66 having a peripheral rubber ring 77. The wheel is coaxial with an encoder 78 and the two are drivingly connected together whereby they rotate simultaneously. These members are attached to a bar 79 which pivots about a pin attached to a fork on the machine platform 1.

The wheel bears against a square 80 attached to the lens holder carriage 4 and movement of the square causes the wheel 76 and, therefore, the encoder 78 to rotated. To ensure correct support of the wheel 76 there is a counterweight 81 beside the encoder 78.

There is preferably a plurality of grind wheels 34 which are for rough grinding of mineral or glass lenses, for rough grinding lenses made from plastics or organic material, for smooth grinding self centering bevels, for smooth grinding guided bevels, etc. For self centering bevels, the grind wheel is providing with a off-center V-shaped groove. From the groove to the nearest side wall of the grind wheel the slope of the V is steeper and here the grind wheel is harder, whereby it cuts less. Reciprocally, from the groove to the more distant side wall of the grind wheel, the slope of the V is gentler (i.e. the surface differs less from a cylindrical surface) and the grind wheel is softer, i.e. it cuts more.

As is known, the bevelling of a lens is preceded by a rough grinding operation.

When it decided to effect this operation with a template, the following procedure is adopted: the appropriate template 9 is mounted in the corresponding place on the lens holder carriage 4. The lens 8 which it is desired to rough grind (and subsequently bevel) is trapped between the rod 7 and the rack 15, the pressure being adjusted depending on the characteristics of the lens, which are also indicative of the tension which is it desired to apply to the spring 51 by way of the tensioning means 47. It is also determined in advance whether the rough grinding is to be effected by repeated short reversals of the rotation of the rod 7 (and therefore of the lens 8) or by a continuous slow rotation of the said rod.

These possibilities are provided by the machine's computer and microprocessor, and the type of rough grinding wheel is also selective, i.e. for mineral or organic lens.

When the machine is set running, the reproducing unit 6 moved forward, whereby the sector 57 leaves the first retracted position thereof to reach the second position thereof in which it releases the lens holder carriage 4.

Figure 12 shows a device 82 similar to the previous device 75, although in this case it is for measuring the movement of the driven member of the of the wheel holder carriage along the second guide bar 3.

Said device 82 comprises a wheel 83 provided with a peripheral ring 84. The wheel is coaxial with an encoder 85 and the two are drivingly connected together such that they rotate simultaneously. These members are attached to a bar 86 which rocks around a pin attached to a fork of the machine platform 1. The wheel 83 bears against a plate 87 attached to the wheel holder carriage 5 and a movement of the plate 87 causes the wheel 83 and, therefore, the encoder 85 to rotate. To ensure an effective engagement of the wheel 83, avoiding sliding, there is a counterweight 88 beside the encoder 85.

Figure 13 shows certain details relating to the feeler 38. As stated above, this is located adjacent the grind wheels 34 and is designed to engage the the lens 8. The feeler 38 comprises a base 89 to which there is adhered a conductive sheet 90, preferably of silver. Between the sheet 90 and the base 89 there is an insulating film 91 which in the position shown is in connection in turn with a first contact 92 and a second contact 93. Independently of the strip 90, both contacts 92, 93 are insulated from each other. The said contacts 92, 93 are also preferably of silver and have cables 94 connecting them to the machine processing systems (computer and microprocessor).

From the base 89 there extends a stem 95 which passes through an elongate hole 96 of a support member 97 made from stainless steel attached to another support member 98 of insulating material which is fixed to the wheel holder carriage 5, with an O-ring between them. The free end of the stem is covered by a resilient sheath 99, associated with a rubber shield 100, sealingly attached to the support member 97. A spring 101 urges the assembly to a centered position such as shown.

The feeler is also adapted to occupy a first position of oscillation in a first direction (to the left in the figure) in which the conductive sheet 90 only connects with the first contact 92, being spaced apart from the second contact 93. Furthermore, there is a second position of oscillation in the second direction (to the right in the figure) opposite to said first direction. In the second position, connection is maintained with the second contact 93, being spaced apart from the first contact 92. These positions are transmitted over the cables 94 to the processing systems, where they are associated with the lens position.

Therefore, the carriage 4 comes under the action of the thrust force A of the spring 51 whereby the carriage 4 leaves the first rest position thereof and moves towards the second working position thereof. Therefore, the template 9 keeps in contact with the sector 57 during the return of the latter to the first position thereof. This contact is maintained until the lens 8 makes contact with the corresponding rough grinding wheel 34, which stops the lens holder carriage 4 while the reproducing unit 6 and the sector 57 return to the first retracted position, with the template 9 separating from the sector 57. The rough grinding action of the grind wheel 34 on the lens 8 to be rough ground causes the lens holder carriage 4 to feed further forward.

This further forward feed produces a further contact between the template 9 and the sector 57, with the consequent closure of the contacts 59 and 60, causing the rod 7 and the lens 8 to rotated slightly. This slight rotation brings an unground portion of the lens 8 face to face with the grind wheel 34 whereby the carriage 4 recedes and the sector 57 and template 9 moves apart again, with the rough grinding (alternating or continuous) of the lens and the successive repetition of the cycle being continued, i.e. forward feed of the carriage until further contact between the template 9 and the sector 57, further rotation of the rod 7 and lens 8, further separation of the template 9 and further rough grinding, until the said rough grinding is finished all around the periphery of the lens 8, to conclude with a light smooth grind provided by the same rough grinding wheel.

When the rough grinding is finished, a self centering bevel grind may be obtain also with template by proceeding as follows. With the corresponding program connected, at the end of the rough grind, the reproducing unit 6 slightly pushes the template 9 while the driving member 30 and the driven member 31 remain fixedly attached to each other, since the maximum width portion of the rotating cam 43 is inserted in the cam guide 44. The motor 32 drives the wheel holder carriage 5 until the feeler 38 engages the convex surface of the lens 8 (Figure 4), whereupon the feeler sends a signal corresponding to the position of the lens 8 to the encoder 85 for movement of the carriage 5. Once the lens position is known, the lens holder carriage 4 withdraws and the wheel holder carriage 5 is located in such a way that the V-shaped groove of the corresponding self centering bevel grinding wheel becomes aligned with the lens 8, after which a movement of the reproducing unit 6 locates the lens holder carriage 4 in such a way that the lens 8 enters the said V-shaped groove, without any risk of sliding along one of the surfaces of the V, preventing the grind wheel from engaging a front surfaces of the lens, which would cause marks on such sur face.

In the meantime, the cam 43 has rotated so that the maximum width portion thereof is removed from the guide 44, whereby the driven member 31 becomes free to move independently to a certain extent relative to the driving member 30.

After the rough grinding the lens 8 usually has a curved surface since it reproduces the shape of the inside of the rim of spectacle frames. While the lens rotates, the periphery thereof (now within the V groove) suitably moves the grind wheel. During rotation a series of contacts occur between the template 9 and the sector 57, whereby the lens holder carriage 4 moves backwards and forwards over a short distance.

During the first revolution of the bevelling operation, the encoder 85 of movement of the driven member 31 outputs signals relating to the movement of member 31. At the end of the first revolution, a further rotation of the cam 43 locks the driving member 30 and driven member 31 together again, so that in the subsequent bevelling revolutions, it is the motor 32 which controls the movements of the wheel holder carriage 5, thereby avoiding the possibility of deforming the bevel already made. At the end of the last revolution of the bevelling operation, the reproducing unit 6 pushes the template 9, returning the lens holder carriage 4 to the first rest position thereof, where it is retained by the retaining means, i.e. the lever 20 engaged with the fixed pin 23. Reference will be made hereinafter to further bevelling operations.

As stated above, the pertinent forward or backward movements of the reproducing unit 6 are controlled by the microprocessor program. The lens holder carriage 4 is subjected to a thrust A and accompanies the reproducing unit 6 through the template 9. The following functions may be carried out among others: controlled feed towards the rough grinding wheel, stopping on reaching the rough grind dimension, recoil for changing from rough to smooth grinding, feed towards the bevelling wheel, stopping on reaching the smooth grinding dimension, forward and reverse feed to reproduce a form programmed in the microprocessor, forward and reverse feed to reproduce a particular template size or shape, recoil to the rest position.

It should be understood that many work programs may be developed by way of the microprocessor and the stepper motors. The thrust A may be adjusted at will, depending on the thickness and characteristics of the lens and may be modified while working. The thrust A should be held constant while working independently of the shape and size of the lens, to which end there is a powered mechanism which, moving at the same speed as the powered support, maintains the traction constant by way of the spring thereof.

The spring 51 draws the lens holder carriage 4 towards the grind wheels 34, while the spindle 49 pulls on the spring 51 at the same rate as the unit 6 withdraws, thereby maintaining a constant tension across the ends of the spring. By way of the photosensitive sensor 56, this mechanism may allow the rest position or stepped positions according to conventional pressure increments, such as fractions of 1/2 or 1 kg.

To program the exact position of the bevel, it is necessary to know the situation of the external contour of the convex surface of the lens, so that in theory, it should be sufficient to know the curve of said convex surface and the size or shape to be worked, but in practice, owing to flattening and flexing of the holding means, the lens may be slightly deformed, whereby it is absolutely necessary to have a means capable of detecting the exact position of the lens once it has been held and trimmed by the rough grinding wheel.

As stated above, the feeler 38 acts in such a way that once the lens 8 has been rough ground, the carriage 4 withdraws and separates the lens from the grind wheel 34 and thereafter the wheel holder carriage 5 moves to located the feeler alongside the convex surface of the lens, the carriage feeding forward again until the lens reaches the measuring height and finally the wheel holder carriage moves the feeler in the opposite direction in engagement with the lens periphery. This detecting operation may be performed at one or more points around the periphery coinciding with the points of inflection determining the shape of the spectacles, or at particular positions, e.g. every 90°, as also on the other side of the lens, i.e. the concave side. At the end of the detection stage, the position of each of the sides of the lens and the thicknesses of the contour are accurately known. These details are necessary for the automatic preparation of any type of bevel. Once a single point of the lens periphery is known, it is sufficient for the grind wheels to move and locate themselves accurately in place.

The reproducing unit 6 performs a horizontal movement increasing or reducing the size of the lens 8 relative to the template 9, according to how the position of the circular sector 57 is modified relative to the periphery of the grind wheels 34. When a template 9 having the shape of the frame is placed in the lens holder carriage 4, the machine will reproduce it on the lens 8, with the size depending on the position of said sector. This same device may reproduce frame shapes if these data are stored in a computer, whereby the template 9 must be completely circular and have a preset diameter. The motors 10 and 64 and member 58 act synchronously throughout the work program. This unit performs the following operations among others: increase or reduction of the lens size relative to the template, electronic reproduction of a shape and feeding the lens towards the grind wheel or withdrawing it therefrom.

This automatic lens grinding machine is capable of making a direct copy from the template having a shape of the rim of a spectacle frame, or an electronic copy through a computer in which a large number of spectacle frame shapes and sizes are stored. When a particular shape is required from the memory, it may be reproduced on the lens by way of the powered support 6.

The shape of a spectacle frame shape may be entered in the memory in at least three different ways: a) by program from diskette or tape; b) by direct copy of the frame using an apparatus capable of tracing the silhouette of a rim and converting the values of the mechanical movement into electronic equivalents; c) by direct measurement from the bevelling machine itself through a template mounted on the lens holder carriage bearing against the powered sector, which is fixed and coincides with the grind wheel periphery.

As the template rotates, it causes the lens holder carriage to move and these movements are measured by the encoder which converts the linear movement of the carriage into rotary movements, whereby the distance between the grind wheel periphery and the center of the template is known at all times.

The wheels grind the lens within the machine and the latter is provided with a casing to dampen the noise produced therein. The upper lid of the casing is provided with an automatic opening and closing device. An inner trough collects the coolant and glass remains and leads them to an external tank.

The present automatic bevelling machine incorporates a hi-tech microprocessor control and is prepared to reproduce shapes from a conventional template, or by electronic copying, through a peripheral system, directly from a frame, template or lens, which peripheral system combines the functions of reading, centering, blocking, storing and sending commands to the bevelling machine, and both the bevelling machine and the peripheral unit are provided with a keyboard and monitors for interfacing with the operator in the chosen language, i.e. Spanish, English, French, Italian or any other. Thus, the electronic template may be required from the diskette store or read directly from a frame, template or lens, through the automatic device.

The purpose of the said peripheral system is to send the bevelling machine a package of data corresponding to the contour of an off-center lens, according to optical parameters, over a communications bus, for subsequent grinding of an ophthalmic lens having the shape of said contour, where a button has been adhered to said lens to allow it to be mounted in the grinding machine.

Said peripheral system, as shown in Figure 14, is formed by three optional independent modules, i.e. a contour reader ML, a contour store MA and a lens blocking and centering device MC, which are controlled by a computerized electronic system SEC, which interfaces with the user through a monitor M and a keyboard.

The function of the read module ML, driven by a motor MG, is to pick up the inner shape of a frame rim or the external contour of a template or bevelled lens, said contour being determining by a list of points in polar coordinates with a center inscribed in the pick up contour.

The store module MA allows the contour pick up by the reading module ML to be stored in the two diskettes D of the system, classifying with the name of the frame or with any other reference through the alphanumeric keyboard.

The purpose of the blocking and centering module MC is to superimpose the analogue image of the projection of a lens on a semi transparent screen on the monitor M, after picking it up by a video camera CV. The placement of a lens on a support under a projections screen, in accordance with reference marks, and the decentering data entered by a the keyboard corresponding to the optical parameters of the user of the frame the form of which is to be ground, form a perfectly aligned superimposition on the monitor, it being possible to slide the digital image of the template contour over the screen, using the keyboard, for a subjective adjustment of the contour to be ground, with details relating to centering such as minimum lens diameter or prismatic dioptres of decentering also appearing on the screen. Finally, the lens is blocked with an automatic mechanism MB, with the form to be ground being stored in a buffer memory of the SEC, for retrieval by the bevelling machine when required.

In Figure 14, the SEC starts out from a control unit UC to which the monitor M with an image processor PI and a control panel PM with a keyboard interface IT revert. The association with the peripheral modules is as follows: between it and the read module there is interposed a driver motor DM and a movement transducer interface ITD, it is associated with the file module MA with a diskette driver DD and it is associated with the centering module MC with a camera interface IC, a lens illuminating camera CIL, connected to a light point FL and a driver motor blocker DMB.

Access is Obtained through the machine sensitive keyboard to: retrieval of work or prescription to be performed, working with or without physical template, selection of most appropriate type of rough grinding, selection of suitable operating pressure, selection of bevelling programme, variation of parameters, opening or closing of clamps holding the lenses, selection of most appropriate holding pressure and raising or lowering the protective cover.

The selected data and displayed during the process with LEDs. Operative and maintenance messages are received through the bevelling screen, such as: print-out of pending jobs, chosen job, number of lenses worked, cooling circuit cleaning warnings, etc.

The work pressure may be programmed at will although, as a safety measure, the lens always makes a first contact with the grind wheel with a minimum pressure which is progressively increased up to the programmed pressure.

Likewise, the holding pressure is selective, with the lens being taken hold of at a low pressure, with the programmed pressure being applied at the onset of the work cycle.

Claims

1.- A lens bevelling machine, comprising: a first guide bar (2); a lens holder carriage (4) moveable along the first guide bar (2) between a first rest position and a second work position; actuatable means for retaining the lens holder carriage (4) in the first position thereof; resilient means urging the lens holder carriage (4) to the second position thereof on being released from said retaining means; a rod (7) on said lens holder carriage (4), disposed at rightangles to said first guide bar (2) and adapted to support a template (9); a longitudinally moveable rack (15) mounted on the lens holder carriage (4) in alignment with the rod (7) and adapted, together with the rod (7) to hold the lens (8); a motor (10) and transmission means (11, 12, 13, 14) for causing the rod (7) and the rack (15) to rotate; a second guide bar (3) parallel to said rod (7) and rack (15); a wheel holder carriage (5) longitudinally moveable along the second guide bar (3) and comprising a shaft (33) parallel to the second guide bar (3); grind wheels (34) mounted on said shaft (33); means (35) for causing the grind wheels (34) to rotate; drive and motion transmission means; detection and signal emitting means; a microprocessor for receiving said signals and for controlling said drive means, characterized in that said wheel holder carriage (5) comprises a driving member (30) directly associated with a stepper motor (32) capable of causing said longitudinal movement, and a driven member (31), associated with the former by means of a locking device (40) comprising, on the one hand, a rotating cam (43) driven by a motor (42), fixedly attached to the driving member (30) and provided on the periphery thereof with portions of variable width from a portion of maximum width to a portion of minimum width and, on the other hand, a cam guide (44) fixedly attached to the driven member (31) and inside which there moves a cam which may fit snugly in the cam guide (44) when the maximum width portion thereof engages in the guide, there being formed a position of fixed attachment between the driving and driven members (30, 31), while when a portion of narrower width engages the cam guide (44), said position of fixed attachment between the driven member (31) and the driving member (30) ceases to exist; and in that between said detection means there is an encoder for detecting the successive positions of said driven member (31) and a feeler (38), located in the proximity of the grind wheels (34), for detecting the lens (8) positions.

2.- The machine of claim 1, characterised in that said feeler (38) is oscillating and is adapted to occupy a centered position in which it is urged to remain by spring means, a first oscillation position in a first direction and a second oscillation position in a second direction opposite to said first direction, the feeler being fixedly attached to a conductive sheet (90), there being a first (92) and a second (93) mutually insulated contacts, such that in the centered position the conductive sheet (90) is connected with both contacts (92, 93), in the first oscillation position it is connected with the first contact (92) only and in the second oscillation position it is connected with the second contact (93) only.

3.- The machine of claim 2, characterised in that the feeler (38) comprises a base (89) to which said conductive sheet (90) is adhered by way of an insulating film (91); and a stem (95) passing through an elongate orifice (96) of a support (97) and the end of which is covered by a resilient sheath (99), the feeler (38) being hermetically sealed from the outside.

4.- The machine of claim 1, characterised in that it is provided with a reproducing unit (6) comprising a circular sector (57) having a radius generally equal to that of the grind wheels (34) and adapted to move in parallel with said first guide bar (2), between a first retracted position in which the rod (7) is generally equidistant from the surface of the circular sector (57) and the surface of the grind wheels (34), and a second position in which the sector (57) is in contact with the template (9), the latter being in a position corresponding to the first position of the lens holder carriage (4), said circular sector (57) comprising two contacts (59, 60) normally held apart by a spring (61), said spring being overcome when the circular sector (57) with the template (9) or with another object.

5.- The machine of claim 3, characterised in that it is provided with means for slightly advancing or retarding said first retracted position of the circular sector (57) of the reproducing unit (6), allowing lenses which are slightly uniformly larger or smaller relative to the template (9).

6.- The machine of any one of claims 1 to 5, characterised in that said actuatable retaining means for the lens holder carriage (4) comprise a rocking lever (20) having a hook-shaped end (22) adapted to engage a fixed pin (23), there being a spring (25) urging the lever to the retaining position and a pusher (24) capable of overcoming said spring (25), releasing the lever, said pusher being controlled by an electromagnet acting when the reproducing unit (6) reaches said second contact position.

7.- The machine of claim 6, characterised in that said detection means comprise an end-of-stroke sensor (26) signalling that the sector (57) of the reproducing unit (6) has reached said second position.

8.- The machine of claim 1, characterised in that the lens holder carriage (4) is provided with a device (67) measuring the movement thereof along the first guide bar (2) and said device comprises a square (69) associated with a toothed belt (70) adapted to drive an encoder (71).

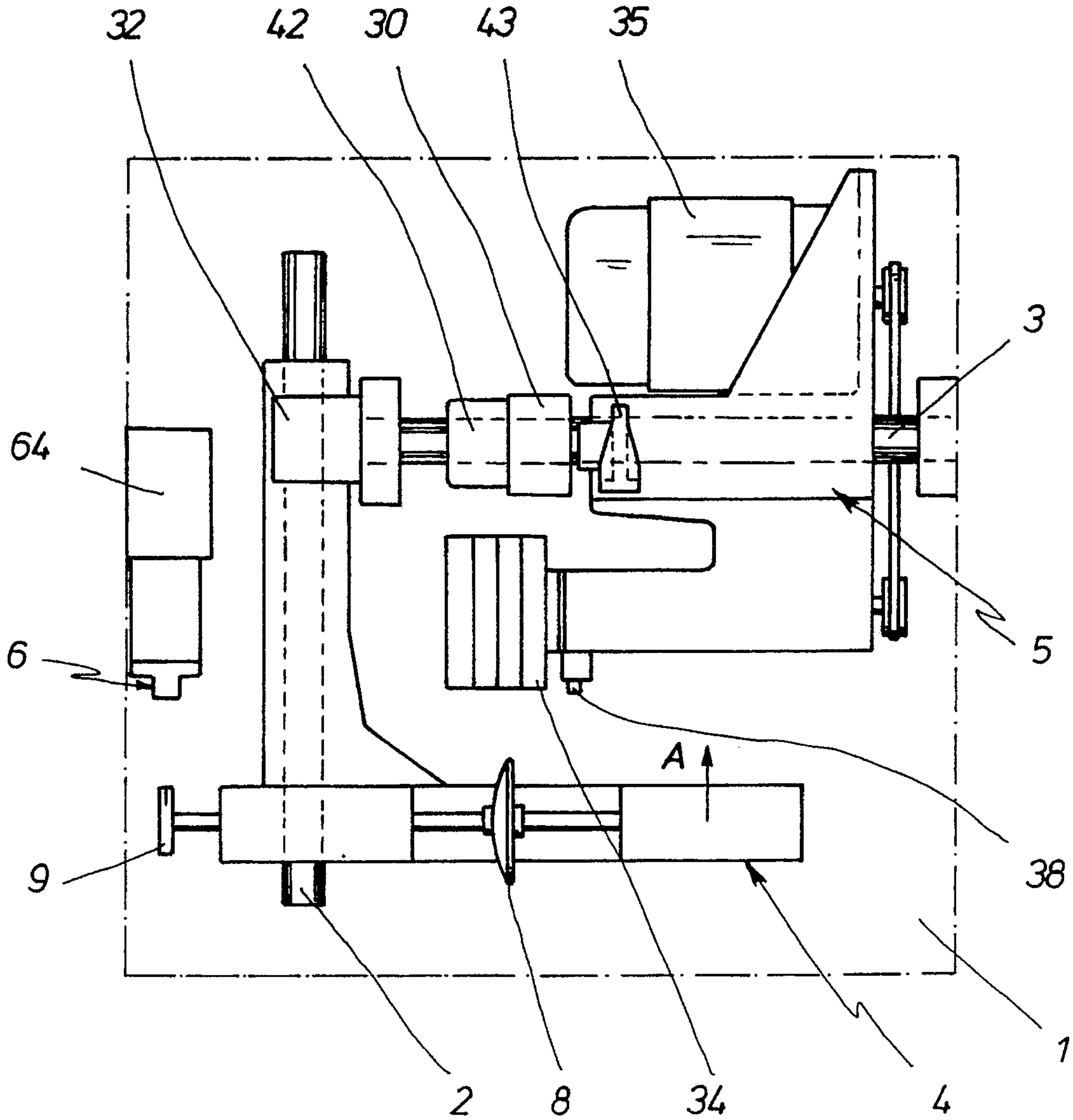
9. The machine of claim 1, characterised in that it is provided with a device (75) measuring the movement of the lens holder carriage (4) along the first guide bar (2) and the device (75) comprises, on the one hand, a wheel (76) and an encoder (78) attached to the the machine platform (1) coaxially and adapted to rotate simultaneously and, on the other hand, a square (80) attached to the lens holder carriage (4) on which said wheel (76) bears, the movement thereof causing rotation of the wheel (76).

10.- The machine of claim 1, characterised in that said resilient means (47) urging said lens holder carriage (4) to the second position thereof comprise a spring (51), having one of the ends thereof drawingly associated with the lens holder carriage (4), there being tensioning means (47) for varying the tension of said spring.

11.- The machine of claim 7, characterised in that said tensioning means are constituted by a nut, cables (52, 53) and pulleys (54, 55) associating the nut with the spring (51), a spindle (49) on which the nut is threaded and a stepper motor (48) for rotating the spindle (49) and causing the nut to move.

12.- The machine of claim 1, characterised in that it is provided with a device (82) measuring the movement of the driven member (31) of the wheel holder carriage (5) along the second guide bar (3), the device (82) comprising, on the one hand, a wheel (83) and an encoder (85) attached to the machine platform (1), coaxially and adapted to rotate simultaneously and, on the other hand, a plate (87) attached to the wheel holder carriage (5) on which said wheel (83) bears and whose movement causes the wheel (83) to rotate.

FIG. 1



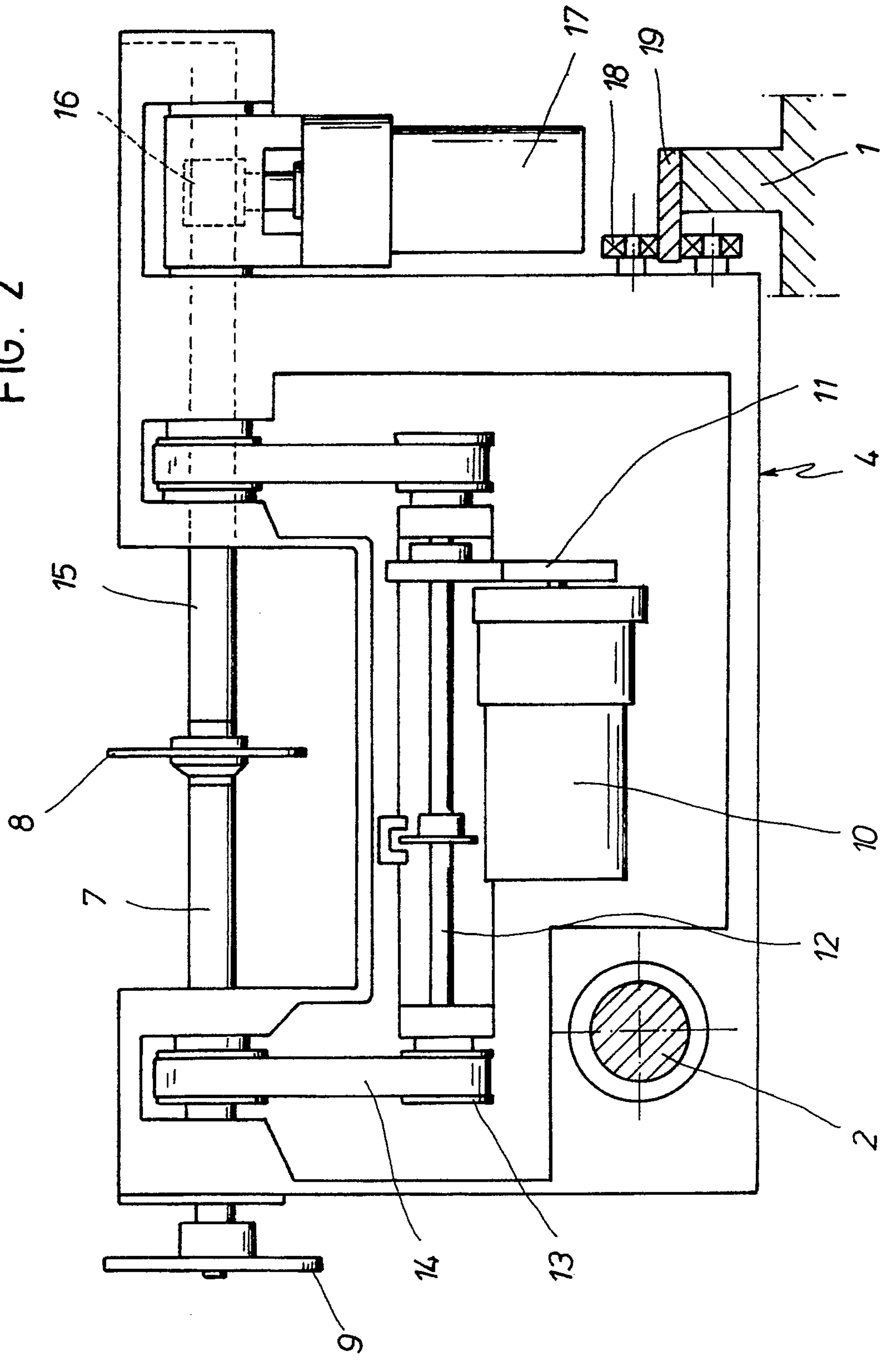


FIG. 2

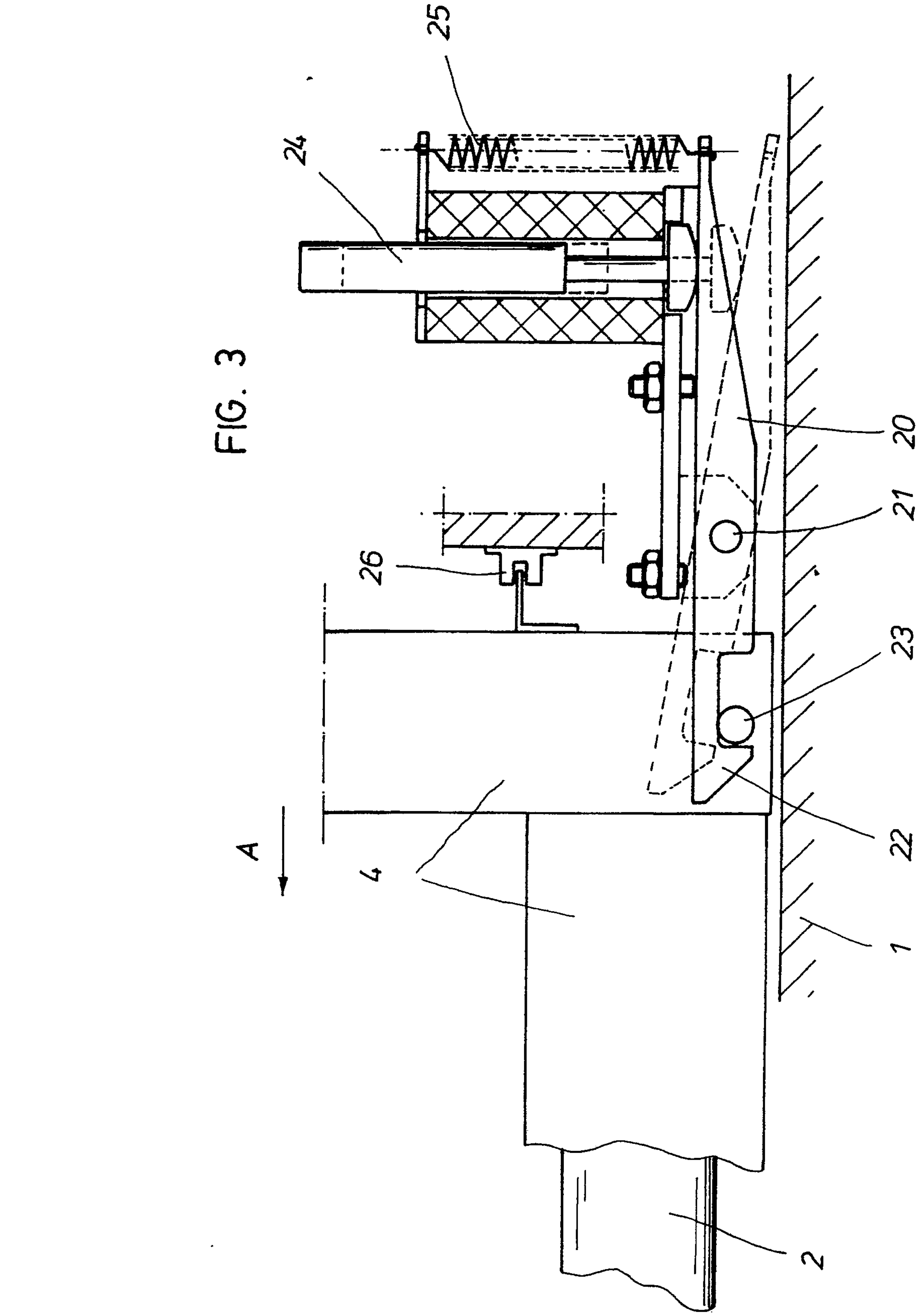


FIG. 3

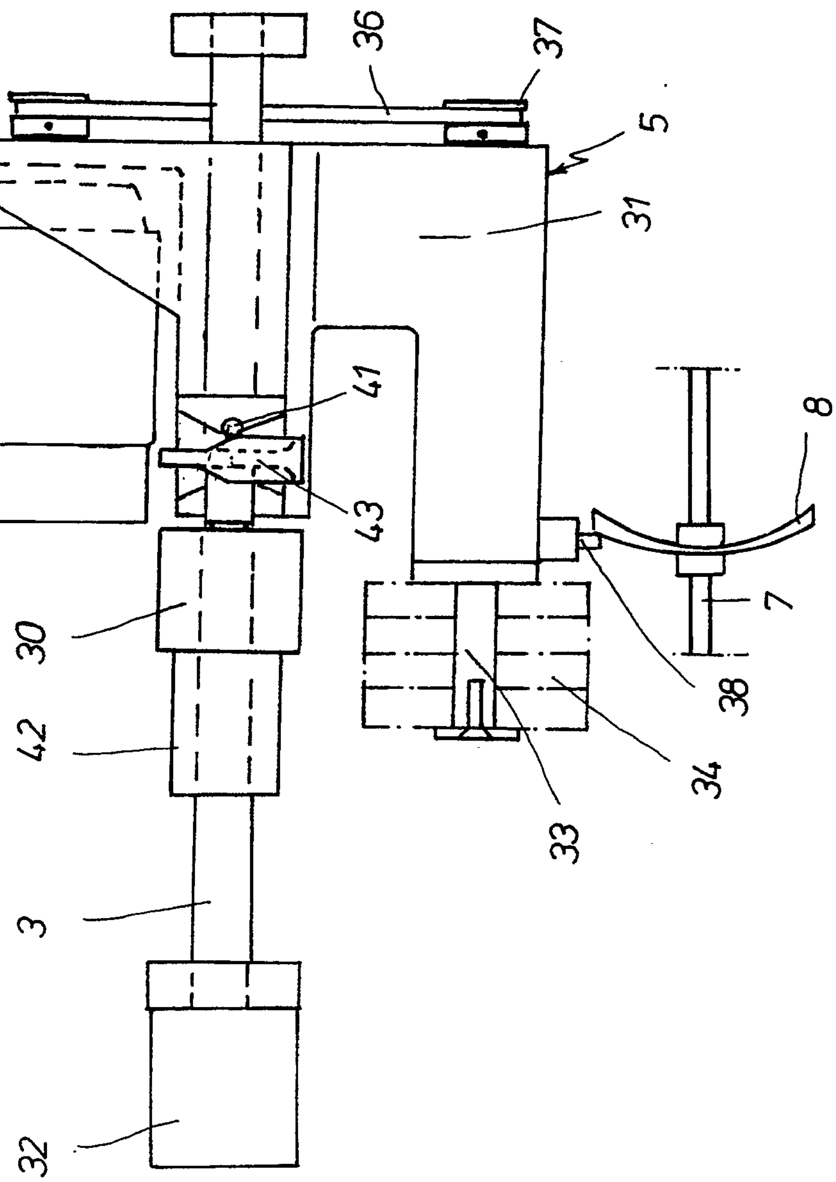
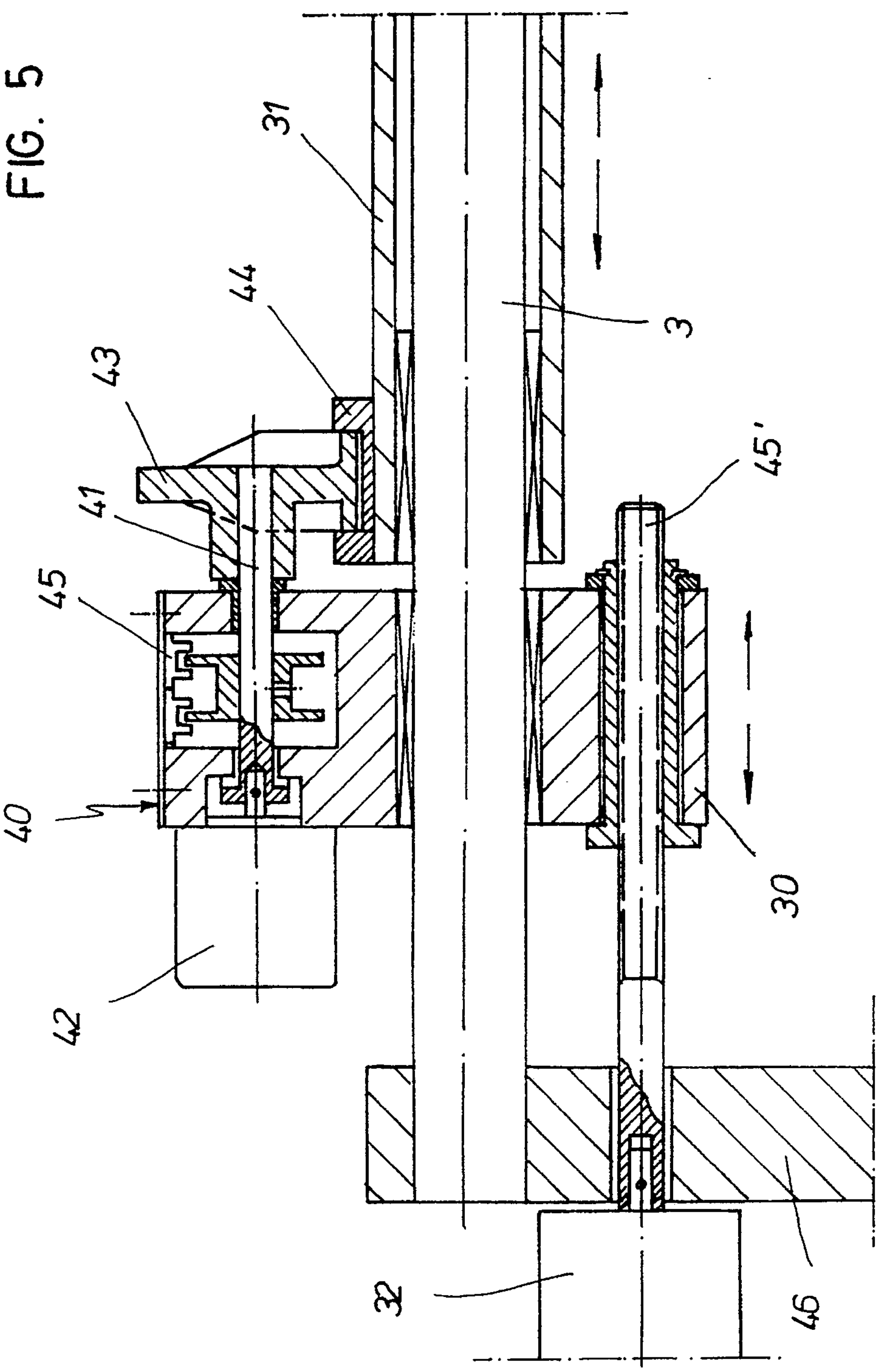


FIG. 4

FIG. 5



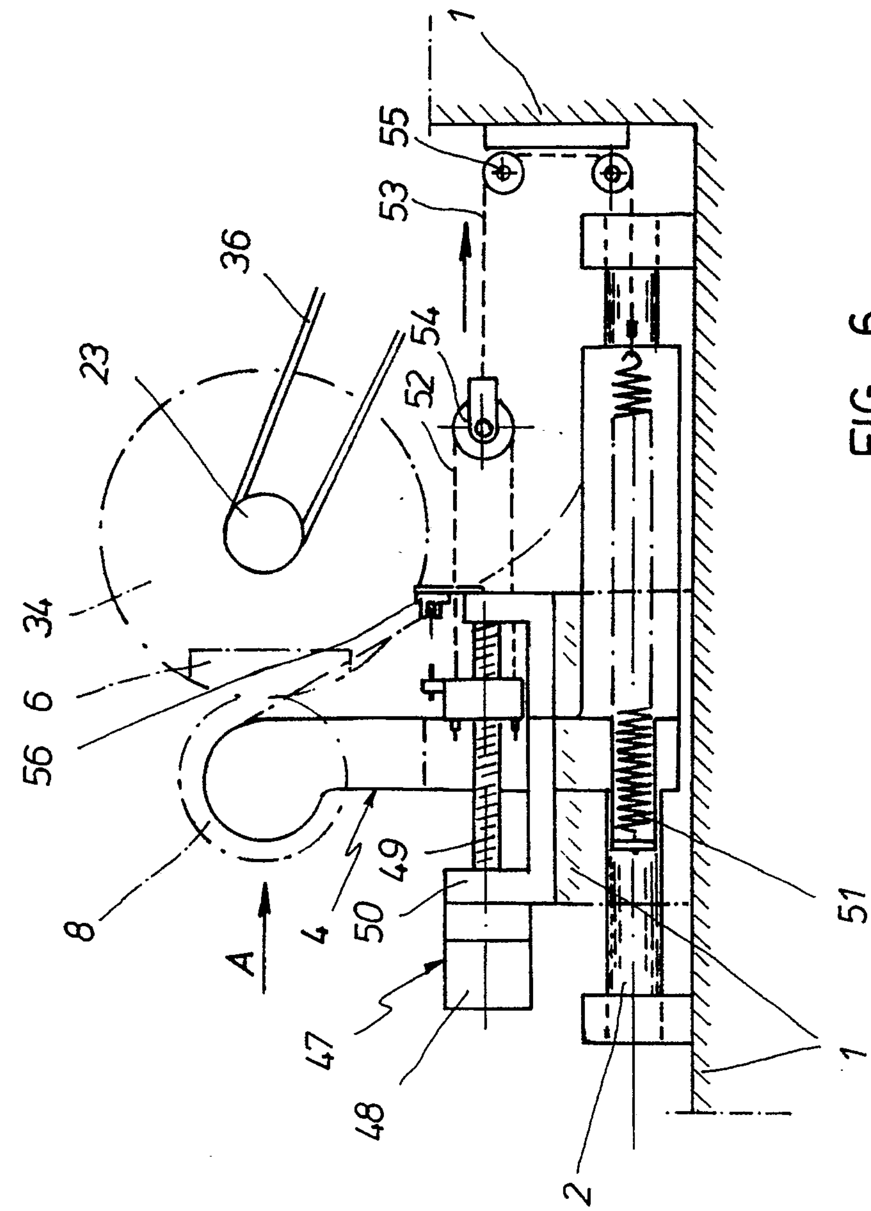
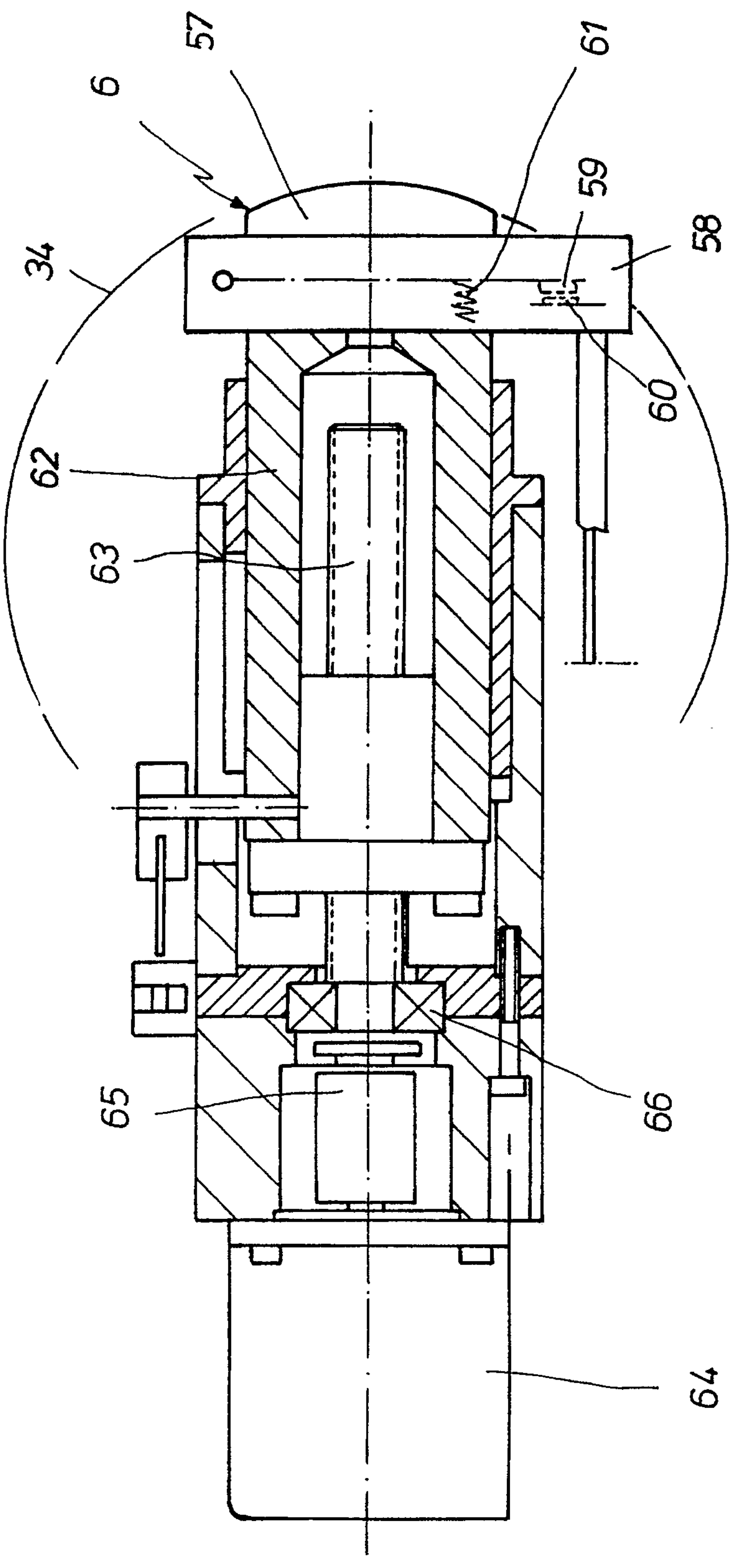


FIG. 6

FIG. 7



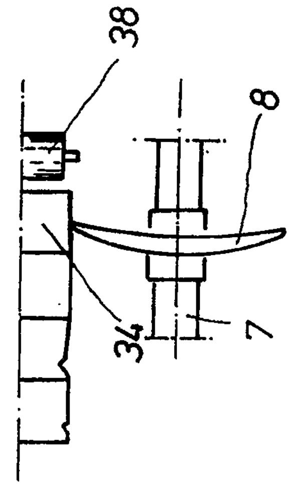


FIG. 9

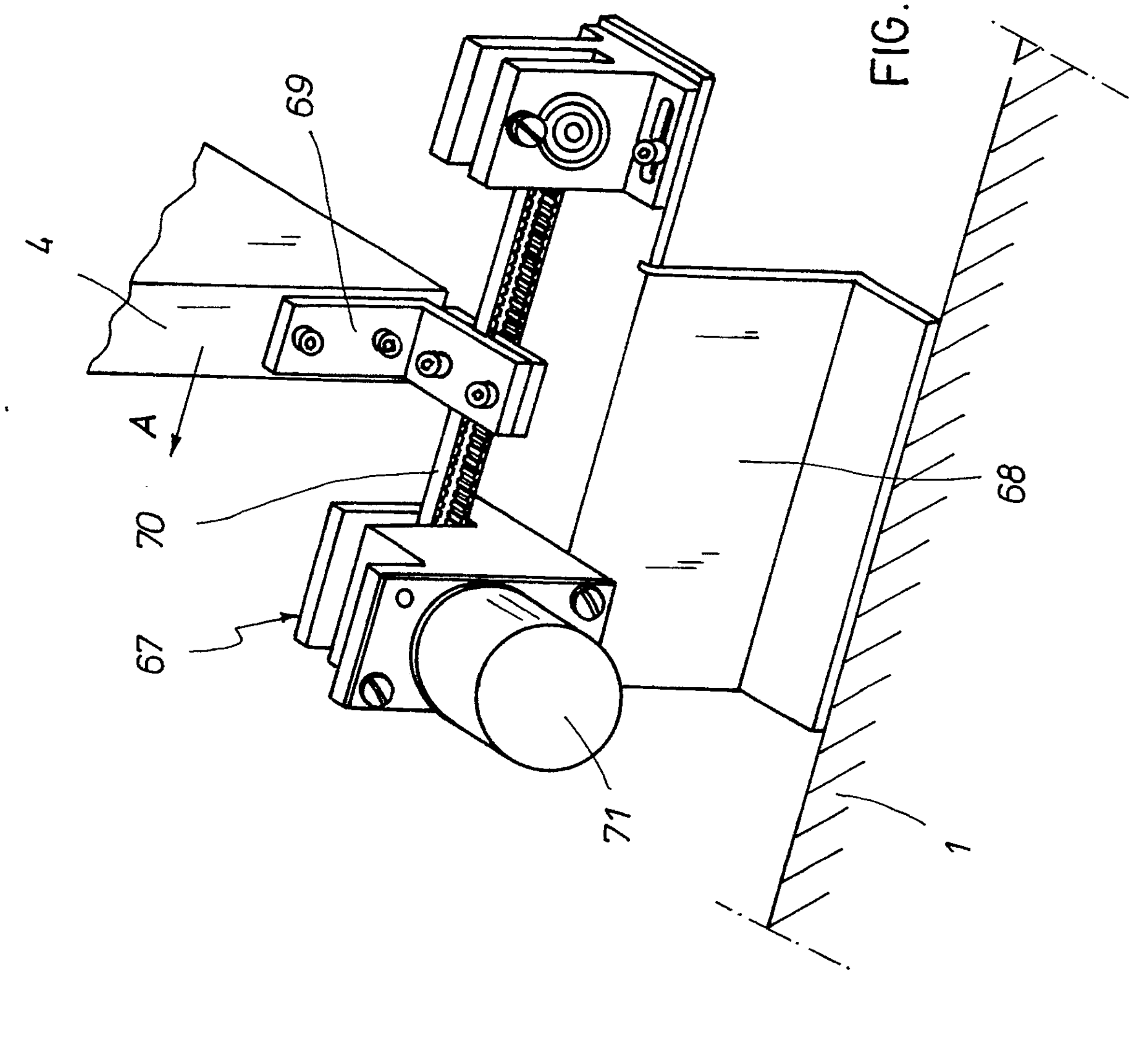


FIG. 8

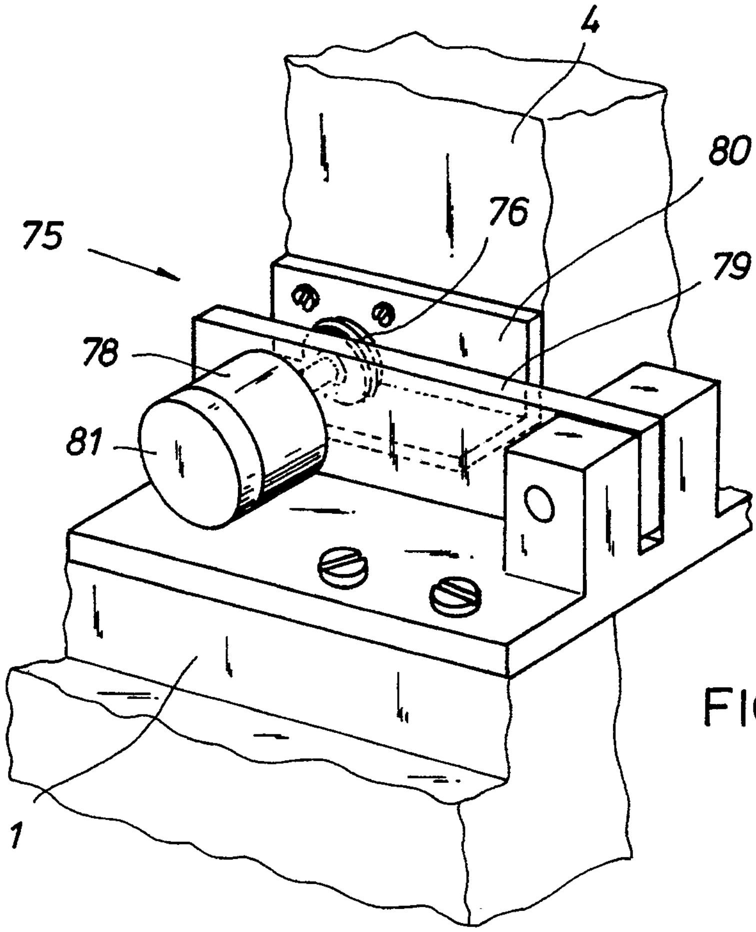
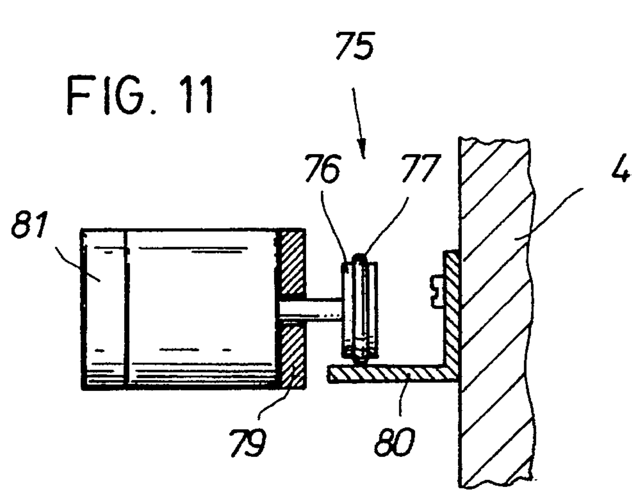


FIG. 10

FIG. 11



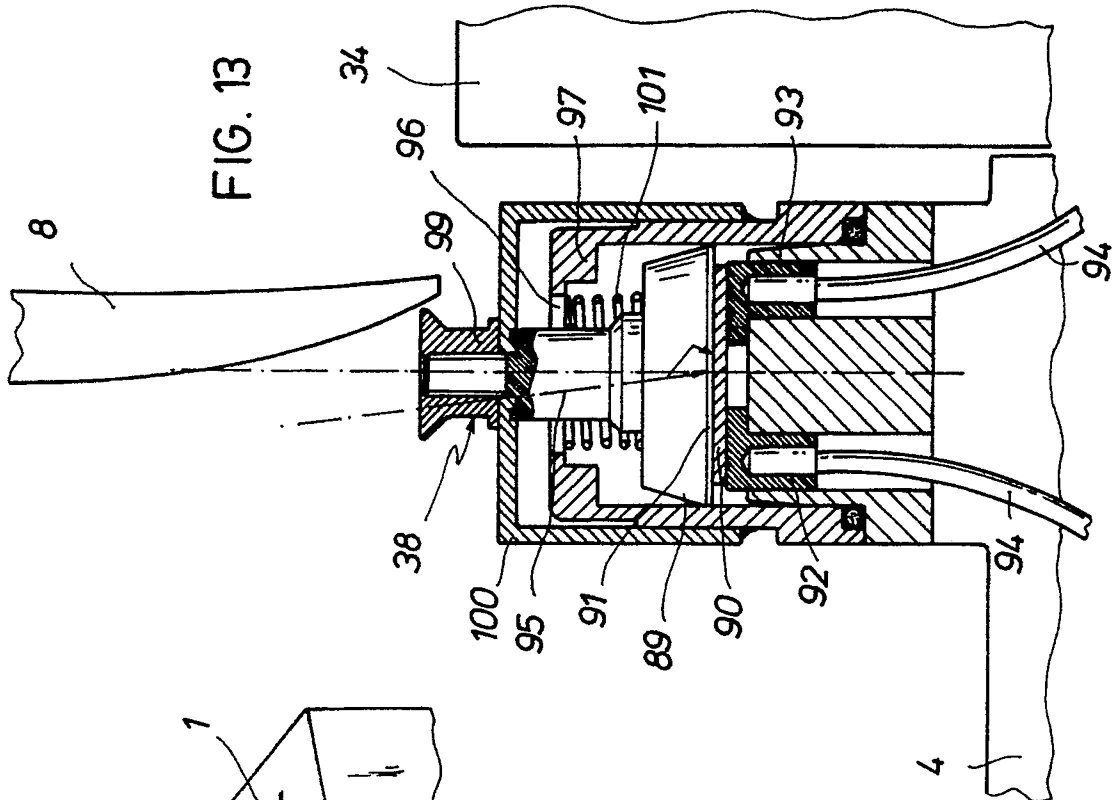

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FIG. 13

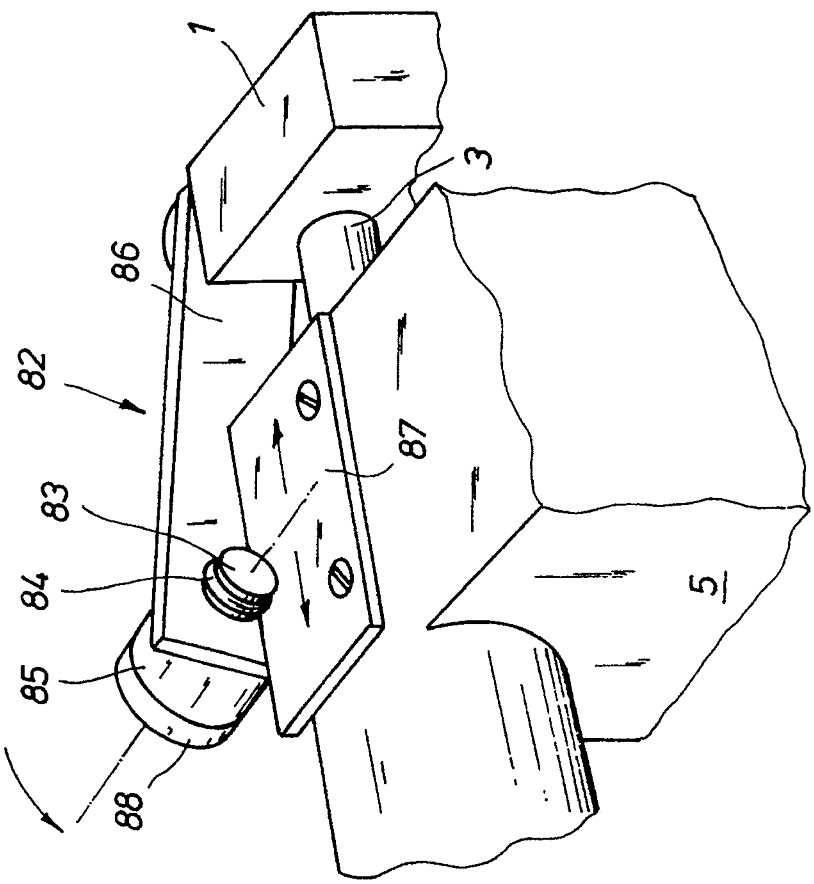
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FIG. 12

FIG. 14