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(54) Automatic equipment for feeding cuffs or ribs to loom of cotton type, for production of knitted fabric.

(57) The storage comb (2) matches the feeding combs (6) of the sinker bars (27) by moving forward and/or swinging the supports (12,176) (Figures 1 and 27), which are borne by the carriage (1) moving along the loom ; the selection means (5,105) break down the rib (3) from the pack (4) with strips of gripping material (46) and/or with retractable hooks (84,184) ; a pusher comb (17,117) moves between the matched comb needles (2 and 6) to transfer the rib ; the feeding combs (6), supported on pairs of pivotal arms (29,129), are rotated by extending lower double cylinders (32) and an amplified transmission (48,49,50), or by a direct transmission (150,154) independently actuated ; said combs (6) are shifted towards the sinker bar by the extension of sub-horizontal cylinders (33).

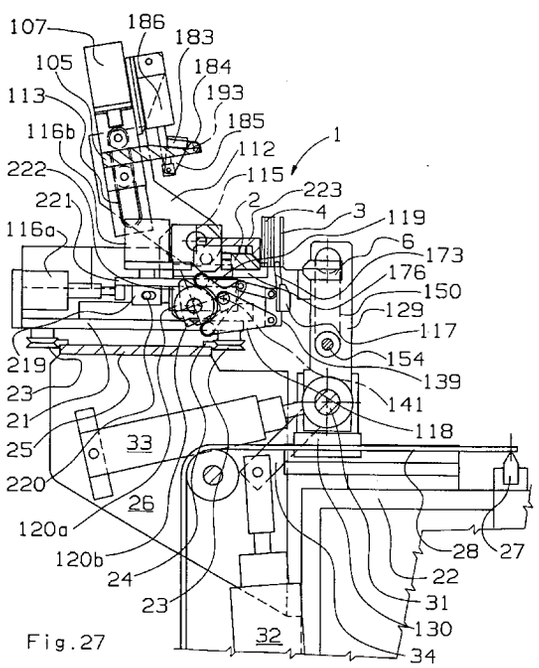

Fig.27

EP 0 510 577 A2

DESCRIPTION OF THE INVENTION

The invention relates to an automatic equipment for feeding cuffs and ribs to loom of Cotton type, for production of knitted fabric, i.e. a transfer device which delivers a knitted item, more commonly known as ribs, to the various sinker bars of the machine from which the fabric to make up the sleeve, the front or the back of the finished item is then produced: delivery and feeding that taking place without manual intervention of the operator.

The state of the art comprises semiautomatic rib transfer devices which require the presence of the operator to manually making the transfer from the storage comb to the feeding comb.

Poor results have been obtained from the conveyor type device, which transfers the feeding combs successively by a conveying chain to a single manual transfer position of the ribs, mainly because of inherent mechanical imprecision due to the length of the chain.

The manual carriage type device most commonly used, instead, requires the movement of the feeding combs from their housing positions and their alignment on the carriage, with the storage comb, followed by manual transfer, first working on the rib, then controlling the complete transfer of the stitches one by one.

An improved type of carriage, then, relieves the operator from working on the feeding comb in the successive sinker bars; it is matched to the storage comb, however, the presence of the operator is always required to complete the transfer of the rib, pushing it by hand.

In each of these previous devices the operator has to act manually, either handling the feeding comb, moving it from the housing of the automatic coupler of the loom, and/or moving the rib from the storage comb to the feeding comb: it may happen that during said operations the needles of the combs are not well matched and that one or more stitches are not transferred but remain free, with the consequence to initiating the production of a defective fabric panel on the loom; this join between rib and the fabric must then be repaired by hand. Furthermore, a wrongly position of feeding comb can lead to an irreparable damage of the needles of the relative sinker bar, with consequent halt of production, necessary for substitution of the damaged needles.

What is more, the transfer operation of the ribs from the storage comb, requiring the intervention of the operator, does not allow him to attend to other control tasks of the loom and its production, with sufficient calm needed for a careful surveillance. During work where the production rhythm is high, i.e. that where the fabric is short and large stitced, with a low density of stitches, the operator finds difficulty in following the cycle of the loom, expecially if it has 12 or 16 sinker bars.

Such state of the art may be subject to remarkable improvements regarding the possibility of setting up a device which can carry out the delivery automatically and is adaptable to the different makes of loom, which although working in a similar way may differ in disposition of parts and relate dimensions.

From what has been said so far, the necessity arises of solving the technical problem of setting up an equipment which, moving along the loom on every sinker bar, releases a rib to each feeding comb and is also provided with a device for handling the feeding combs; such an equipment must be completely automatic and fit any make of Cotton type loom. Moreover, these equipment and device, must be equipped with operative controls in order to avoid any damage to the final product and/or the comb needles and the sinker bars. It also must be able to work with ribs of a variety of dimensions as well as any kind of knitting yarn for knitted fabric.

The present invention solves the above-mentioned technical problem by adopting: a carriage moving on guides along the loom, equipped with means of motion and clamping registered to the sinker bar, bearing the storage comb on supports rotating or oscillating on an axle longitudinal to the loom, thus matching the feeding comb; means of selection of the rib from the pack, connected to the said supports; the said means of selection are equipped with rib grips, as wide at least as the rib itself; a pusher comb with fine teeth which are intercalable with the needles of both the storage comb and feeding comb, both of which are matched to the pivoting/swinging of the said supports: the pusher comb is driven upward/downward and forward/backward by lifting and pushing actuators; the single feeding comb is coupled to means of rotation, which are cross-running to be able to approach the sinker bar, driven by pushing actuators and one or more rotation actuators.

Adopting, in a preferred embodiment: said means of selection consisting of a pivoting selection hanger, in order to set at least its "engagement" and "selection" positions of the rib; this selection hanger has one or more strips of gripping material of the rib and/or a plurality of retractable hooks, coupled in rotation to the hanger, which stand out in the gripping-area of the rib to transfer. Alternatively, adopting: said means of selection consisting of a shifting selection pusher, to set at least the "engagement" and "selection" positions of the rib; this selection pusher has one o more strips of gripping material of the rib and/or a plurality of retractable hooks, coupled in rotation to the pusher, which stand out in the gripping-area of the rib to transfer. Also, adopting: supporting means for the selection hanger or the selection pusher, rotating on a longitudinal axle that does or does not coinciding with the oscillation/rotation axle of the storage comb, driven by rotation actuator means; pneumatic cylinders, in two

parts, for rotating the said selection hanger to set three characteristic "engagement", "selection" and "disengagement" positions, adjustable on the said supporting means; pneumatic cylinders for shifting the said pusher, coupled to the said supporting means.

Adopting for the coupling of the storage combs and the feeding combs: means of advancing and/or swinging the supports of the above storage comb towards the feeding comb; also means guiding of the needles of the said combs during the coupling; the means of advance/swing for the supports of the storage comb in two parts which are independently operated, to set a half-way position of reduced swing/advance from the comb matching; said means of guiding the needles consisting of the flat dents of the pusher comb, or consisting of a mobile spacer section of the needles of the storage comb, to press the opposite side of the rib pack of the comb.

Adopting for the handling of the pusher comb: means of control consisting of four-bar linkage levers driven to lose one's shape by actuators acting upon the rotation and/or the length of the rods; also some cams or some pairs of cams, as means of rotating the rods, acting through rockers upon the said four-bar linkage; alternatively, pneumatic cylinders acting upon the leverage rods or even replacing the rods.

Adopting, for working with rib of different length, in the case of the selection hanger: said supports of the above selection hanger in form of a pair of wings, with slots in which the selection hanger pivots run and can be secured in a chosed position by ring nuts; a flat spacer of the selection hanger pivot and its rotation cylinder/s reaction pin.

Adopting, in addition to one or more of the previous features: pneumatic cylinders to make up the said push and rotation actuators of the arms bearing the feeding combs: the pneumatic cylinders for rotating the arms are in two parts to set a half-way sub-horizontal "approach" position and the "end" position that matches the sinker bar; a transmission of the relative rotation motion of the arms with respect to the loom, which is amplified and rotates the feeding comb by a wider angle than the one covered by the cylindrical bar and by the arms; alternatively, as a means of relative rotation of the feeding combs on the said arms, a belt coupled to a shaft driven by an electric motor synchronously for all the feeding combs; some ball sliding blocks, as means of guiding and sliding the said arms on the loom frame.

The advantages accomplished by the present invention are: the operator is relieved from working manually as the ribs are delivered and, consequently, the surveillance time of the operation is reduced; a longer time is then available for a direct check on the running of the loom as well as on the quality of the production and, moreover, a single operator will be able to survey two looms at a time; also, the expected operative controls avoid frequent and expensive repairs of damaged sinker bar needles, thus a more reliable running of the loom is achieved, thereby saving a great deal of money on maintenance and avoiding break in production. By using means of guiding during the matching of the combs, the storage comb needles, which are damaged more easily during the continual production movement, are driven in a more direct and safer way. Finally, the presence of retractable hooks allows the machine to work safely on very smooth yarns, even on worsted ones. The equipment can be fitted, in an advantageous manner, on many different makes of existing Cotton type looms as well as, of course, on new machines.

A few embodiment of the invention are shown in the fourteen drawing tables attached, where for the sake of a better comprehension the pneumatic and electric connections do not appear, in which: Figure 1 shows a schematic cross section of the automatic delivery device, according to the invention, positioned to select the rib during the transfer to a feeding comb; Figure 2 shows a schematic transversal view of the rotation device of the storage comb, with the comb just loaded; Figure 3 is a schematic view, like Figure 2, with the comb turned to the pick-up position of the rib; Figure 4 is a view like Figure 3, with the selection hanger break down the rib from the pack; Figure 5 is a schematic transversal view of the levers which handle the pusher comb, with the latter inserted into the storage comb; Figure 6 is similar to the previous view, with the pusher comb working; Figure 7 is a schematic view of the operating levers of the pusher comb in the "end transfer" position of the rib; Figure 8 is the magnified partial longitudinal section, VIII-VIII of Figure 2, of the setting device for the selection hanger; Figure 9 is a schematic transversal view of the handling device for the feeding comb during the production of the fabric panel; Figure 10 is a view like Figure 9, when the production is ended and the feeding comb is in an intermediate position; Figure 11 is a view like Figure 10, at the end of the first rotation phase; Figure 12 is again a view like the previous ones, with the feeding comb aligned with the sinker bar needles; Figure 13 is the XIII-XIII section of Figure 10, of the handling device for the feeding comb on a Cotton type loom; Figure 14 is a schematic cross section of the devices of motion, stop and alignment of the carriage along the loom; Figure 15 is a magnified partial section of the detector of the proximity switch facing the cam, which in Figure 16 is shown as a plan view; Figure 17 is the pneumatic scheme for driving and controlling the various pneumatic cylinder actuators; Figure 18 is a side view of a storage comb needle matching the corresponding feeding comb needle; Figure 19 is a plan view of a part of the said matched combs; Figure 20 is a schematic cross section of the spacer of the storage comb needles, based on a different realization; Figure 21 is the further step following the insertion of

the pusher comb; Figure 22 is a schematic section of a gripping device of the rib during the selection, based on a different realization; Figure 23 is a section similar to Figure 22, with the device in a first intermediate position; Figure 24 is like Figure23, with the device in the "end transfer" position; Figure 25 is similar to the previous ones, in which the device is in a position where the hanger is disengaged from the rib; Figure 26 is a restricted front view of the selection hanger with the latter gripping device.

A second way to realize the invention is shown in the following drawings in which: Figure 27 is a schematic cross section of the automatic delivery equipment while a rib is transferred to a feeding comb; Figure 28 is a partial rear view of the selection pusher and the retractable hooks; Figure 29 represents a schematic transversal view of the selection and swing device of the storage comb, when the selection starts; Figure 30 is a schematic view like Figure 29, with the retractable hooks turned to a rib-grip position; Figure 31 is a view like Figure 29, with the selection pusher break down the rib from the pack, against the dents of the pusher comb; Figure 32 is a magnified schematic transversal view of the double cam and of the levers that handle the pusher comb, with the latter coupled to the feeding comb; Figure 33 is similar to the previous view, with the pusher comb moving to the push position, behind the rib; Figure 34 is similar to the previous view, with the pusher comb in a push position; Figure 35 is similar to the previous view, with the pusher comb at the end of action of transfer of the rib to the feeding comb; Figure 36 is a schematic transversal view of the feeding comb support, of its swing movement and of the set/stop jaw; Figure 37 is the plan view of the storage comb support and the shutter of the clamp; finally, Figure 38 is a partial longitudinal view of the loom, showing the transversal carrier, the means of handling the wings and one double cam.

The indications are as follows: 1 (Figure 1) is the automatic loading carriage bearing the storage comb 2; 3 is a single rib being breaked down of the pack 4 of ribs, which, if they are exceedingly long, are retained by spring pushers 4p; 5 is the selection hanger; 6 is the feeding comb aligned to the storage comb; 7 is a pneumatic cylinder actuator operating on the adjustable control lever 8 of the selection hanger, which pivots around the longitudinal axle 9; 10 is another pneumatic cylinder actuator rigidly connected to the former one, which operates on the adjustable pin 11; 12 are two wings with a setting slot 13; 14 are wing pivots on axle 15, driven by the double pneumatic cylinder actuator 16 consisting of two parts 16a and 16b; 17 is a pusher comb placed under the previous combs 2 and 6 in pivotal connection both to the lifting lever 18 and to the pneumatic push-actuator cylinder; 20 is the pneumatic cylinder operating on the pair of lifting levers; 21 is the baseplate of the carriage 1 running longitudinally on the frame 22 of the Cotton type loom, by means of prismatic wheels rolling on guides 24 fixed to a plate 25, the latter being supported by the carrying shoulders 26; 27 is the single sinker bar that produces the fabric panel 28 via known processes; 29 are the pair of arms for supporting/overturning/moving the feeding comb 6, for each sinker bar; 30 is the transversal slot for approaching the pair of arms rigidly connected to the feeding cylindric bar 31, which is rotated by lower pneumatic double cylinders 32 and driven to the corresponding sinker bar 27 by sub-horizontal pneumatic cylinders 33.

The indications are as follows: 34 is a turn-over lever driven by the said pneumatic double cylinders 32; 35 (Figure 2) is the join hanger of the cylinders 7 and 10, which work successively to set three operative positions for the selection hanger 5, kept by short pivots 36, materializing the said axle 9; 37 is a plate for joining the wings 12 and supporting the rib pack 4; 38 is a spacer and a support for the feeding comb 6 during the transfer; 39 (Figure 5) are a pair of supports for the pusher comb 17, which swing on the joining bar 40 of the side lifting levers 18; 41 is the oscillation fulcrum of the levers 18; 42 (Figure 8) is a spacing plate between the short pivot 36 and the adjustable pin 11; 43 are ring nuts of the pin 11 and of the bush 44, wherein the short pivots 36 spin inside anti-friction elements 45; 46 is a strip of gripping material for the rib 3, provided with many tiny hooks of synthetic material (Velcro type); 47 is a section bar joining the upper edges of the wings 12; 48 (Figure 9) is a gear, coaxial with the cylindric bar 31 shifting only sidewards along the slot 30, which is meshed by another smaller gear 49 connected by a toothed belt 50 to the feeding comb 6; 51 (Figure 11) are hooks, of a commonly known type, for pulling the fabric panel 28; 52 (Figure 12) are the sinkers of the single sinker bar 27; 53 is a sub-horizontal position of intermediate advance of the arms 29 to bring the feeding comb closer to the sinker bar needles, such a position being obtained by extending a first part 32a of pneumatic double cylinders 32, which are provided with a second part 32b in order to finally approach the sinker bar; 54 (Figure 13) is a shaft joining the gear 49 and the pulley 55 paired to a belt 50, which transmits the movement to an identical pulley 55 on the pivot 56 of the feeding comb; 57 is a ring nut for setting the gear 48; 58 (Figure 14) is the electric motor to moving of the automatic loading carriage, working via a reduction unit 59 and a shaft 60 on the gear 61 that meshes the pack 62; 63 is the proximity switch detector that faces the cam 64 which can be disengaged by rotating it around the screw 65; 66 is one of the two pneumatic cylinders that act upon the shutters 67 frusto-conical for an accurate matching of the storage comb 2 to the feeding comb 6 of each sinker bar 27; 68 is the jig locator with the corresponding conic holes for the said shutters; 69 is the shelter of the carriage; 70 (Figure 15) is an elastic pin stopping the cam 63 in the "sinker bar on"-alert posi-

tion.

The indications are also as follows: 7V, 10V, 19V, 20V, 33V and 66V (Figure 17) are pneumatic valves, provided with single solenoid control and spring reversal of the pneumatic cylinders 7, 10, 19, 20 and at least a pair of cylinders 33 and 66; 10S is a one-way flow control valve to regulate the back stroke of the cylinder 10; 16aV, 16bV, 32aV and 32bV are pneumatic valves, again provided with single solenoid control and spring reversal, to regulate respectively the first parts 16a and 32a and the second parts 16b and 32b of the double cylinders 16 and 32 working at least in pair together; 71 (Figure 18) is a needle of the storage comb 2, matching the corresponding needle 72 of the feeding comb 6; 73 (Figure 19) is a spacer section of the said needles 71; 74 (Figure 20) is a pair of side squares supporting the said spacer section 73, in pivotal connection on the axle 15 and retained by a pair of springs in a horizontal position, such springs being hooked between the said squares and blocks 76 supporting the storage comb; 77 is a bar supporting the feeding comb needles 72; 78 is a pair of swinging supports of pusher comb 17, provided with some plaques 79 which can lower the said squares by acting on their curved surfaces 80; 81 is a grub screw for adjusting the squares and the said spacer section; 82 (Figure 22) is a selection hanger provided with a pivoting cylindrical bar 83, bearing a plurality of hooks 84, on its wraped round and driven via a lever 85 by a pneumatic actuator cylinder 86, to control the rotation of the said bar; the said hooks 84 stand out all around the guard 87 bearing gripping strips 46; 88 is a shaped bar supporting the feeding comb 6; 89 is one of the supports connecting the pivoting cylindrical bar 83 to the selection hanger 82; 90 (Figure 25) is a pusher of the rib pack 4, provided with an air-jet tube 91-92 to lay even long ribs down completely .

Finally, in the second realization of the invention, the indications are as follows: 105 (Figure 27) is the selection pusher moving along the wings 112 in the slots 113, driven by a pair of pneumatic cylinder actuators 107; 115 is the rotation axle of the said wings 112; 186 is a pair of pneumatic cylinder actuators controlling the retractable hooks 184 and connected to each support carrier of the said pusher, such hooks being locked to a flat bar 183 rotating on an axle 193 made out of two short pivots at the ends of the said bar which are connected to the corresponding supports of the pusher 105 as shown in Figure 28; 185 is the lever connecting the said cylinders 186 to the flat bar 183; 116a is a pair of pneumatic cylinders actuating a cross advance of the pair of transversal carriers 221, whose function is to bring closer the storage comb 2 and the feeding comb 6: the said carriers 221 slide on ball sliding blocks 222 and are coupled to the swinging supports 176 of the comb 2 and to the wings 112 on the axle 115; a pair of pneumatic cylinder actuators 116b controls the swing of the supports 176 by pins running in slots 220, which are carved in blocks 219 fitted on the carriers 221; 223 is the clamp of the storage comb 2 on the supports 176.

The indications are also as follows: 117 is the pusher comb provided with flat dents 173; 139 is a pair of side swing-supports of the pusher comb 117; 118 is the pair of lifting rockers of the said comb; 119 is the pair of push rockers of the said comb; 141 is the oscillation axle of the said rockers, driven via rolls or bearings by a pair of double cams, where 120a are lifting cams and 120b are push cams; 216 is a pair of pneumatic cylinders, actuating the rotation of the wings 112, set to a "selection" or "transfer" position.

Finally, the indications are as follows: 130 are ball sliding blocks for the cross-slide guide of the pair of arms 129 supporting and rotating the feeding comb 6; 150 is a toothed belt connected via some pulleys to the shaft 154 and to the comb 6, driven via the said shaft 154 by an electric motor not shown; 230 (Figure 35) is a pair of pneumatic cylinders actuating the double cams 120a-120b via a rack-and-gear coupling 231-232; 224 (Figure 36) is the rotation axle of the clamp locking the comb 2; 225 are grub screws adjusting the comb 2 with respect to the support 176 and to the clamp; 227 (Figure 37) is a rack operating on the wings 112 by means of their sector gear 228 and driven by the cylinder 216; 215 are two short segments of shaft locked to the said supports 176 and coupled by bearings to the wings 112 and to the vertical lugs 214 of the carriers 221; 241 are manual shutters for locking the said clamp 223; 171 are some broken needles, at the end of the comb 2, inserted into the corresponding holes of the projecting part 271, as a fine longitudinal reference of the comb 2 with respect to the supports 176.

The equimpent works in the following way: the operator loads the storage comb 2 in its housing on the wings 12 and starts the automatic delivery cycle (Figure 2), the carriage 1 being ready at the first sinker bar of the loom: the fine alignment is previously secured by a pair of shutters 67 frusto-conical within the corresponding holes in the jig locator 68 and actuated by the pneumatic cylinders 66; the delivery cycle only starts when all the feeding combs 6 are in the transfer position, as shown in Figures 1-7; so the selection hanger 5 comes from the outer position down to the inner position to press the rib pack 4, by a combined successive extension of the pneumatic cylinders 7 and 10; at the same time the wings rotate by 90 degrees (Figure 3) driven by the combined action of the two parts of the double cylinder 16; the storage comb needles 2 are thus matched to the feeding comb needles 6, which are driven and supported by the spacing bar 38; then, the reverse action of the sole cylinder 10 is driven via a pneumatic valve 10V, which is sequentially controlled by a processor; the hanger 5 is thus withdrawn to the intermediate position separating the rib 3 from the pack 4 (Figure 4); the applied stress and

the speed of execution can be finely tuned by the valve 10S.

Such a separation is caused by the pulling action of the strip 46, provided with many tiny hooks of a synthetic material which grip the knitted panel; subsequently, the pusher comb 17 (Figure 5) is inserted between the storage comb needles 2, behind the stitches of the rib 3, via the retraction of the pneumatic cylinder 20; the latter is controlled by the valve 20V which causes the levers 18 to rotate around the fulcrum 41, lifting the end connected to the joining bar 40 and to the pair of supports 39 of the pusher comb: the length of the cylinder rod 19 is set so that the pusher comb dents are inserted behind the said stitches of the rib 3; in the next step, (Figure 6) the pneumatic push cylinder 19 is extended, controlled by the corresponding valve 19V, making the stitches of the rib 3 move onto the needles of the feeding comb 6, because of the action of the pusher comb 17 pivoting on the axle of the joining bar 40 with the supports 39; the pusher comb is then pulled downward, inverting the control to cylinder 20: once the magnetic detector has ascertained the completion of the extraction, noted by magnetic detection of the end of stroke, both cylinders 19 and 7 retract, removing the electric piloting from the respective valves 19V and 7V, (Figure 7); the pusher comb is thereby brought back to the initial incline and the selection hanger 5 is moved away from the rib 3 which is left on the feeding comb 6: the return of the two cylinders 19 and 7 may take place contemporarily and is verified via magnetic detection of the end of stroke.

After the limited rotation of wings 12 to a sub-vertical position, via the elimination of the piloting of valve 16bV and the consequent retraction of the shorter second section 16b of the double cylinder 16, controlled by the magnetic detection of the end of stroke, the shutters 67 are retracted, thereby allowing carriage 1 to advance towards the next sinker bar site: the electric motor 58, via the reduction gear 59 and the shaft 60, causes the toothed gear 61, which meshes with rack 62, to rotate; rack 62 consisting of a length of toothed belt fixed to plate 25. Carriage 1 stops when the sensor 63 detects the presence of the closest cam 64, meaning that the sinker bar is active.

The delivery cycle can in this way resume, as described above, for each active sinker bar of the loom: when empty the carriage returns automatically to the loading station of the next storage comb, with a new pack of ribs, or to the first sinker bar if there is not enough room for a separate station; the operator, after substitution of the empty storage comb with the full one, signals the start of the delivery cycle which doesn't begin until the loom has finished the old fabric panel and commenced the new one, thereby emptying the feeding combs.

The beginning of the knitting of the fabric panel takes place as follows: during the final instants of knitting of the previous panel (Figure 9), the storage comb 2, which can still be aligned with the feeding comb of the last sinker bar must, however, be retracted by completely rotating wings 12 to a horizontal position, in order to start the transfer cycle of the ribs 3 from the feeding combs to the needles of the respective sinker bars, at the same time for all the sinker bars of the loom. At the end of knitting, (Figure 10), the fabric panels 28 fall into the baskets underneath, whilst the longer first part 32a of the pair of double cylinders 32 is rotated via lever 34 onto the cylindrical bar 31 on which are keyed the pair of sustaining arms 29 of the feeding combs 6; the rotation of arms 29 is not directly transmitted to the comb but is multiplied by gear 28 coaxial with the cylindrical bar 31: the said gear (Figure 13) cannot rotate within slot 30, it can only run along, this acts as a rack circling the meshing gear 49, keyed onto the joining shaft 54 which in turn transmits the rotational motion to the pivots 56 of the feeding comb 6 via the toothed belt 50 and the pulleys 55. The feeding comb therefore makes a rotational angle greater than 180°, finishing the first phase of the rotation as shown in Figure 11; the next approach takes place as the cylindrical bar 31 runs horizontally along the slots 30, driven by at least a pair of pneumatic cylinders 33 which are controlled via the pneumatic valve 33V, until reaching the sub-horizontal intermediate position 53 as shown by the dotted line in Figure 12. The loom, which is obviously ready to align the feeding combs 6 with the needles of the respective sinker bars 27, starts the production after the shorter second part 32b of the double cylinders 32, extending, has aligned the said feeding combs with said needles, and after the sinkers 52, retaining the stitches of the rib 3, have allowed the loom to knit the first stitch of the new fabric panel 28. The rib 3, during the alignement rotation of the feeding comb, is held by pulling hooks 51.

Then the return of feeding combs 6 to the initial positions, to receive the next ribs, takes place in an inverse manner: i.e. via retraction of the second part 32b of the double cylinders 32, which brings the pairs of arms 29 into a sub-horizontal intermediate position; such a retraction therefore, of cylinders 33 is accompanied by horizontal movement of the cylindrical bar 31, and subsequently retraction of the first parts 32a of the double cylinders 32, with the rotation of the pairs of arms 29 (the latter via the amplifying mechanism): gear 48, gear 49, shaft 54, belt 50 and pulleys 55, which each pair of arms 29 is provided with, make the feeding combs complete the inverse rotation greater than 180°, returning to the starting position shown in Figures 1-7. The equimpent is thus ready to perform a new delivery cycle of the ribs to the feeding combs.

In the case of change of production, with a variation of the dimensions of the ribs, it may be necessary to adjust the position of the selection hanger, loosen-

ing the ring nuts 43, (Figure 8), then moving the short pivots 36 nearer or further away and also contemporarily moving the adjustable pin 11 fixed on wing 12 of the pair which supports the pneumatic actuator cylinders 7 and 10; said ring nuts are then tightened to allow the device to work properly: the gripping-position of the selection hanger on the rib 3 must be projected at a short distance from the bottom stitches of the rib, but far enough away to allow an easy rotational movement of the hanger on the axle 9 without, on the other hand, subjecting said rib to excessive strain, avoiding tearing of the stitches.

In the realization with the spacer section 73 (Figure 20), the needles 71 of the storage comb 2 are guided and well spaced during the matching phase with the needles 72 of the feeding comb 6: the spoon shape of the former eases and subsequently keeps the matching when, in the following steps, there is no further guiding by the said section: furthermore, the pusher comb 17 is kept in a resting position, from underneath by the extended pneumatic cylinder 20, and from the front by the extended cylinder 19, their position being controlled by the magnetic detector of the end of stroke: once the rib 3 is selected, the cylinder 19 is retracted and contemporarily the pusher comb rotates acting, via the platens 79 pressing the curved surfaces 80, upon the squares 74 and therefore also upon the section 73, pulling it off the storage comb 2; the retraction of cylinder 20 following retraction of cylinder 19 causes the comb 17 to be inserted between the needles 71, and is controlled by magnetic detection of the end of stroke, said comb pushing the stitches of the rib 3 onto the needles 72 of the feeding comb 6, caused by the successive extension of cylinder 19. The screw 81, double in order to secure the locking of the position, allows the length of the run of section 73 to be set to avoid banging against needles 71 of the storage comb 2 as the squares 74 are released. In this case, the connecting pipes of valve 19V, controlling cylinder 19, must be inverted, like cylinder 20 in the pneumatic scheme of Figure 17: said arrangement allows the extension of cylinder 19 when in the resting position or in the case of loss of electricity to the valve. The realization with the selection hanger 82 (Figure 22), works as follows: once hanger 82 has advanced to push the rib pack 4, caused by successive extension of pneumatic cylinders 7 and 10, cylinder 10 retracts, the speed of which is controlled by valve 10S; when the rib is very close to the pack, cylinder 86 extends under time-control, and rotates the cylindrical bar 83 with hooks 84, via lever 85; the slightly detached position of rib 3 (Figure 23), allows said hooks to grip it without picking up the following rib: the delicate action of separation of the ribs is assured by the strips of gripping material 46. From Figure 24 one sees how the rotational movement of hooks 84, following retraction of cylinder 86, controlled by a pneumatic valve 86V not indicated in Figure 17, eases the detachment of the rib, which is completed by retraction of cylinder 7 (Figure 25), with rotation to the outer position of hanger 82 on the axle 9: the proper sequence of the actions is assured, via magnetic detection of the end of stroke, both by cylinder 86 acting on the hooks, and cylinder 7 acting on the hanger.

To ease the fall of the rib onto the feeding comb 6, the spring presser 90 of the rib pack 4, is provided with a longitudinal tube 91, fed by compressed air: this tube has a series of small holes in rows which shoot jets of compressed air 92 against rib 3 as it leaves the selection hanger.

The second realization (Figures 27-38) works in a similar way to that previously described except for the following specifications. Note that the references 1xx indicate means with a function similar to means xx of the first realization (Figures 1-26).

The pair of wings 112, bearing the guiding slots 113 of the selection presser 105, rotate into the position indicated in Figure 27 so as not to obstruct the area of combs 2 and 6 during the transfer of the rib 3; the selection, as shown in Figures 29-31, takes place with said wings 112 in a horizontal or sub-horizontal position, in such a way that the side of the presser pushes against the rib pack 4, present on the storage comb 2; the rotation of these is driven by pneumatic cylinders 216, acting via a rack (227) sector gear (228) coupling (Figures 37-38); the run of the presser along the slots 113 is driven by cylinders 107 and guided by means of a pair of wheeled carriages (drawn but not numbered) which in turn support cylinders 186 actuating retractable hooks 184; the end of the presser is thus positioned near the gripping area of the ribs 3, an ideal situation for the selection of any type of rib.

The flat bar 183, bearing retractable hooks 184, is forced to rotate around the axle 193 which is close to said end of presser 105, by cylinders 186 acting via levers 185: the hooks 184 are always extended and retracted through a constant angle, gripping in a uniform way from the first to the last rib in the pack; said hooks (Figures 29-31) are rotated as selection begins and grip the outer rib 3 of the pack 4; subsequently cylinder 107 retracts and the rib is separated from the pack up against the flat dents 173 of the pusher comb 117; said separation takes place with the storage comb at a distance from the feeding comb: this renders the selection process possible even when carriage 1 moves from one station to the next; said retractable hooks 184 are withdrawn before the matching of the two combs 2 and 6, in order to allow wings 112 and presser 105 to rotate as shown in Figure 27.

The pair of carriers 221, joined by the clamp 225, by the shaft bearing the pair of double cams 120a-120b, by the storage comb 2 when it is locked on the supports 176, and by the pusher comb 117 to the two side leverages, make up the transversal carrier for the matching of combs 2 and 6, before they are definitive-

ly matched, by oscillation imparted to said supports 176 by pneumatic cylinders 116b.

The transversal carrier is forced to advance in order to bring the needles of the storage comb closer to those of the feeding comb (Figures 32 and 71-72, Figures 18-19), caused by the action of the pneumatic cylinders 116a; the small lowering rotation of needles 71 is obtained oscillating supports 176 (Figure 36) on axle 115, caused by the action of cylinders 116b, controlled in the throw and/or bleed, to adjust the matching strength of the needles; the flat dents 173, fixed to the ends of the needles 71, guide them and overshooting their points, also guide the corresponding needles 72 of the feeding comb during the alignement and the matching, whilst the transversal carrier advances, whilst the supports 176 oscillate downwards, lowering said needles 71 of the storage comb 2 against the corresponding needles 72 of the feeding comb 6.

The pusher comb 117 (Figures 32-35), is then moved downwards to be transferred from the coupling position to the pushing position, behind the selected rib 3; side supports 139 making part of a four-bar linkage along with rockers 118 and 119, are driven by a pair of double cams 120a and 120b as shown in the said figures: the lifting/lowering is driven by cams 120a, acting on rockers 118, whereas advance/retraction is driven by cams 120b, acting on rockers 119; the cams rotate on the same shaft and, after the adjustment, are rigidly connected together; their rotation is driven by a pair of pneumatic cylinders 230, acting via rack-and-gear coupling 231, 232 (Figures 35 and 38).

The comb 2 is locked on the said swinging side supports 176 by clamp 223, against a projecting section 271 of said supports 176; comb 2 is also set by screws 225 having lock nuts, because the storage combs may have different bed dimensions even with the same fineness of weave (Figure 36); moreover comb 2 is set longitudinally via the matching of the broken needles 171 to the corresponding holes in said projecting section 271; said clamp rotates around axle 224 to replace comb 2, and is locked by shutters 241 which is manually operated (Figure 37).

The arms 129 work in a similar way to arms 29 and working takes place as described above: the rotation of the feeding comb 6 is no longer driven by a mechanical connection to the rotation of the cylindrical bar 31, i.e. of said arms, but by action of an electric motor that rotates shaft 154, which is as long as the loom and acts on said comb 6 via pulleys and toothed belt 150; the run towards sinker bars 27, arms 129, and comb 6 takes place by extending cylinder 33 which acts on the cylindrical bar 31 on guides 130, which being low friction type, assure a uniform advancement along the length of the loom.

If in practice the materials, dimensions and operative details should be different from those indicated, but technically equivalent, the patent will still apply. So, the detection of the end of stroke of the pneumatic cylinders may be extended to all the cylinders present in the equimpent beside those already indicated above. So, the means of gripping the rib, in the case of the selection presser, may be also or only made from strips of gripping material (Velcro type) beside the said retractable hooks.

Claims

1. An automatic equipment for feeding cuffs and ribs to loom of Cotton type, for the production of knitted fabric (28), comprising a carriage moving on guides along the loom, bearing the storage comb (2), which can be aligned to the feeding combs (6) of the sinker bars (27), characterised in that of the carriage is provided with means of motion (61,62) and clamping (67,68) registered to the sinker bar, bearing the storage comb on supports rotating (12) or oscillating (12,176) on an axle (15,115) longitudinal to the loom, thus matching the feeding comb; means of selection (5,105) of the rib (3) from the pack (4), connected to the said supports; the said means of selection are equipped with rib grips (46,84,184) as wide at least as the rib itself; a pusher comb (17,117) with fine teeth which are intercalable with the needles of both the storage comb and the feeding comb, both of which are matched to the pivoting/swinging of the said supports (12,176): the pusher comb is driven upward/downward and forward/backward by lifting (18,20,118,120a) and pushing actuators (19,119,120b); the single feeding comb is coupled to means of rotation (29,31,129), which are cross-running (30,130) to be able to approach the sinker bar, driven by pushing actuators (33) and one (32,50,54) or more rotation actuators (32,150,154).

2. Automatic equipment according to claim 1, characterised in that of said means of selection consist of a pivoting selection hanger (5), in order to set at least its "engagement" and "selection" positions of the rib; this selection hanger presents one or more strips of gripping material of the rib (46) and/or a plurality of retractable hooks (84), coupled in rotation to the hanger, which stand out from the gripping-area of the rib (3) to transfer.

3. Automatic equipment according to claim 1, characterised in that of said means of selection consist of a shifting selection pusher (105) to set at least the "engagement" and "selection" positions of the rib; this selection pusher has one or more strips of gripping material of the rib (46) and/or a plurality of retractable hooks (184), coupled in ro-

tation to the pusher, which stands out in the gripping-area of the rib (3) to transfer.

4. Automatic equipment according to one of the previous claims, characterised in that of the supporting means (12,112) for the selection hanger (5) or the selection pusher (105) rotate on a longitudinal axle that does or does not coinciding with the oscillation/rotation axle (115) of the storage comb, driven by rotation actuator means (16a,16b,116b,216,227,228).

5. Automatic equipment according to one of the previous claims 2 and 4, characterised in that of the rotation of the selection hanger (5) is achieved by pneumatic cylinders (7,10), in two parts, to set three characteristic "engagement", "selection" and "disengagement" positions, adjustable (9,11,13) on said supporting means (12).

6. Automatic equipment according to one of the previous claims 3 and 4, characterised in that of the shift of said pusher (105) is obtained by pneumatic cylinders (107), coupled to said supporting means (112).

7. Automatic equipment according to one of the previous claims, characterised in that of for the coupling of the storage comb and the feeding comb, means of advancing (116a,221) and/or swinging (16a,16b,116b,220) towards the feeding comb are employed, of the supports (12,176) of the above storage comb and means of guiding (73,77,173) of the needles of said combs (2,6) during the coupling.

8. Automatic equipment according to the previous claim, characterised in that of the means of advance/swing of the supports (12,176) of the storage comb are divided in two parts (16a,16b or 116b,220 and 221,116a) which are independently operated, to set a half-way position of limited swing/advance from the matching of the combs (2,6).

9. Automatic equipment according to one of the previous claims 7 and 8, characterised in that of said means of guiding of the needles consist of the flat dents (173) of the pusher comb (17,117), or consist of a mobile spacer section (73) of the needles of the storage comb, to press the opposite side of the rib pack (4) of the comb (2).

10. Automatic equipment according to one of the previous claims, characterised in that of for the handling of the pusher comb (17,117) means of control consisting of fourbar linkage levers (18,19,21,39 or 118,119,139) are employed, driven to lose one's shape by actuators acting upon the rotation (20,120a,120b) and/or the length (19) of the rods.

11. Automatic equipment according to the previous claim, characterised in that of some cams (120a,120b) or some pairs of cams, as means of rotating of the rods, acting through rockers (118,119) upon said four-bar linkage, alternatively, pneumatic cylinders (20) acting upon the leverage rods or even replacing the rods (19).

12. Automatic equipment according to one of claims 3, 5, 7 and 10, characterised in that of for working with ribs of different lengths, the selection hanger (5) has said supports (12) wing-shaped, with slots (13) in which the selection hanger pivots (36) run and can be secured in a chosed position by ring nuts (43,44); a flat spacer (42) of the selection hanger pivot (5) and its rotation cylinder/s (7,10) reaction pin (11).

13. Automatic equipment according to one of the previous claims, characterised in that of pneumatic cylinders are employed to make up the said push actuators (33) and rotation actuators (32) of the arms (29,129) bearing the feeding combs (6): the pneumatic cylinders (32) for rotating the arms are in two parts (32a,32b) to set a half-way sub-horizontal "approach" position (53) and the "end" position that matches the sinker bar (27).

14. Automatic equipment according to claim 13, characterised in that of a transmission is employed (48,49,50) of the relative rotation motion of the arms (29) with respect to the loom, which is amplified and rotates the feeding comb (6) by a wider angle than the one covered by the cylindrical bar (31) and by the arms (29).

15. Automatic equipment according to claim 13, characterised in that of as a means of relative rotation of the feeding combs on said arms (129), a belt is employed (150), coupled to a shaft (154) driven synchron-mode by an electric motor for all the feeding combs (6).

16. Automatic equipment according to claim 13, characterised in that of are employed some ball sliding blocks (130), as means of guiding and sliding of the said arms (29,129) on the loom frame.

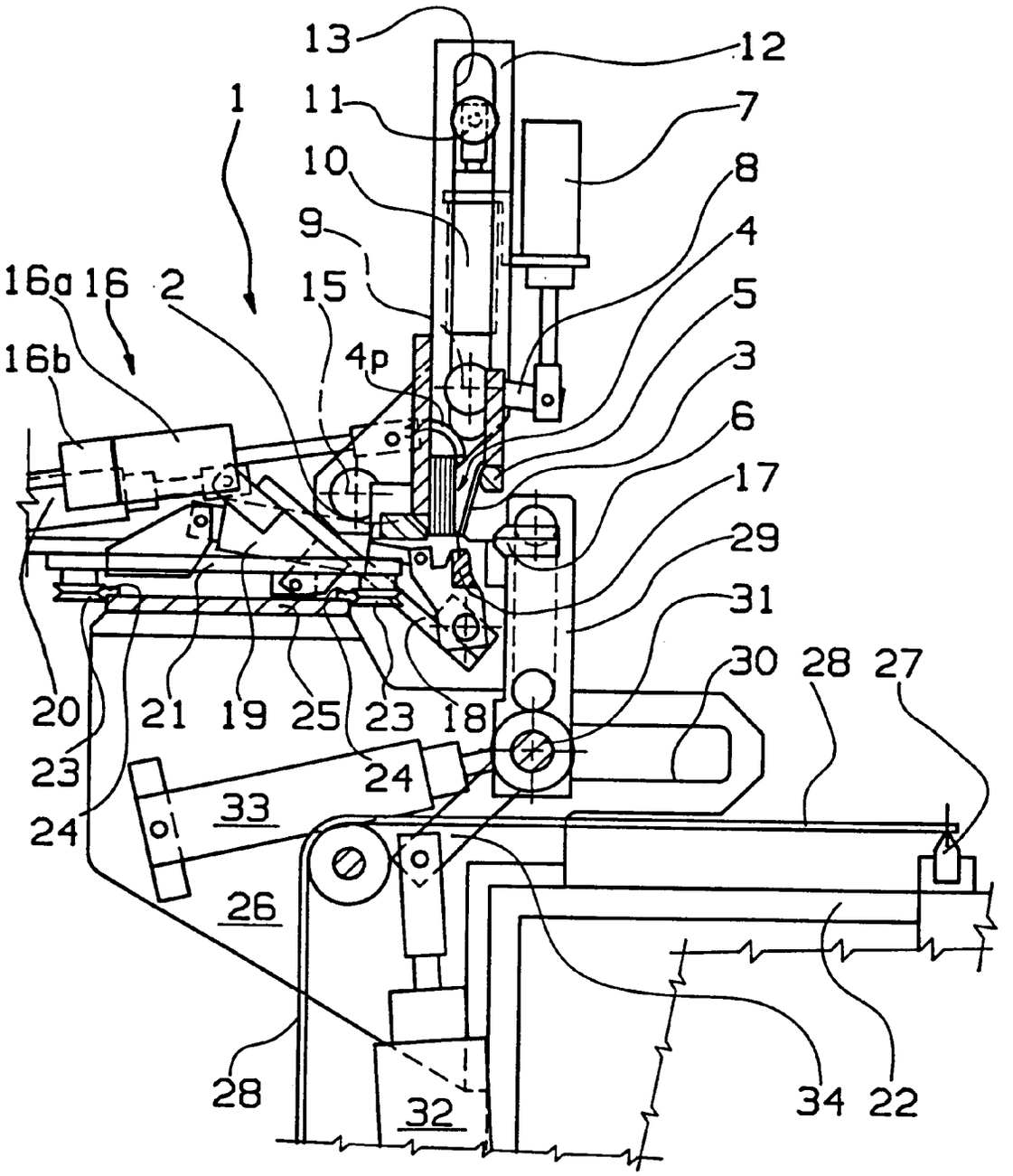
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Fig.1

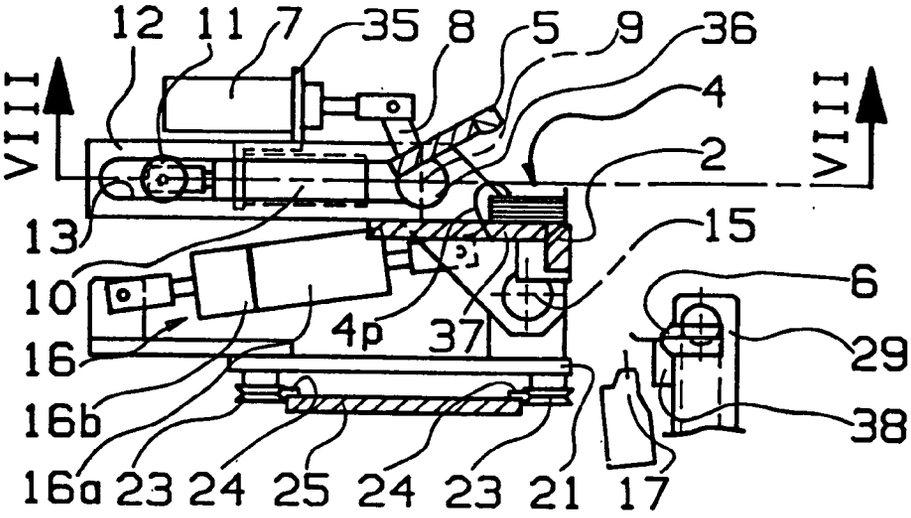

Fig.2

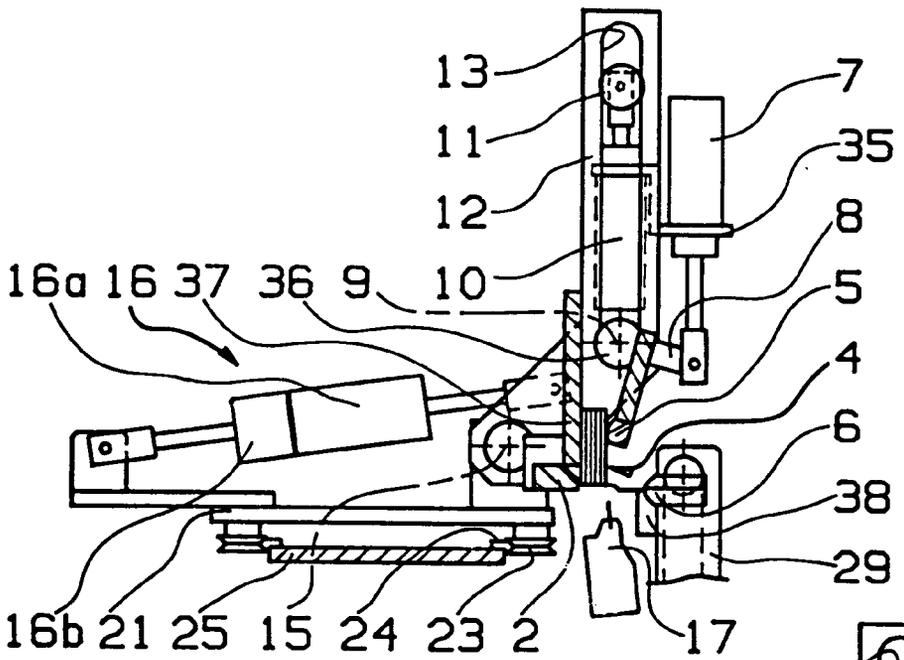

Fig.3

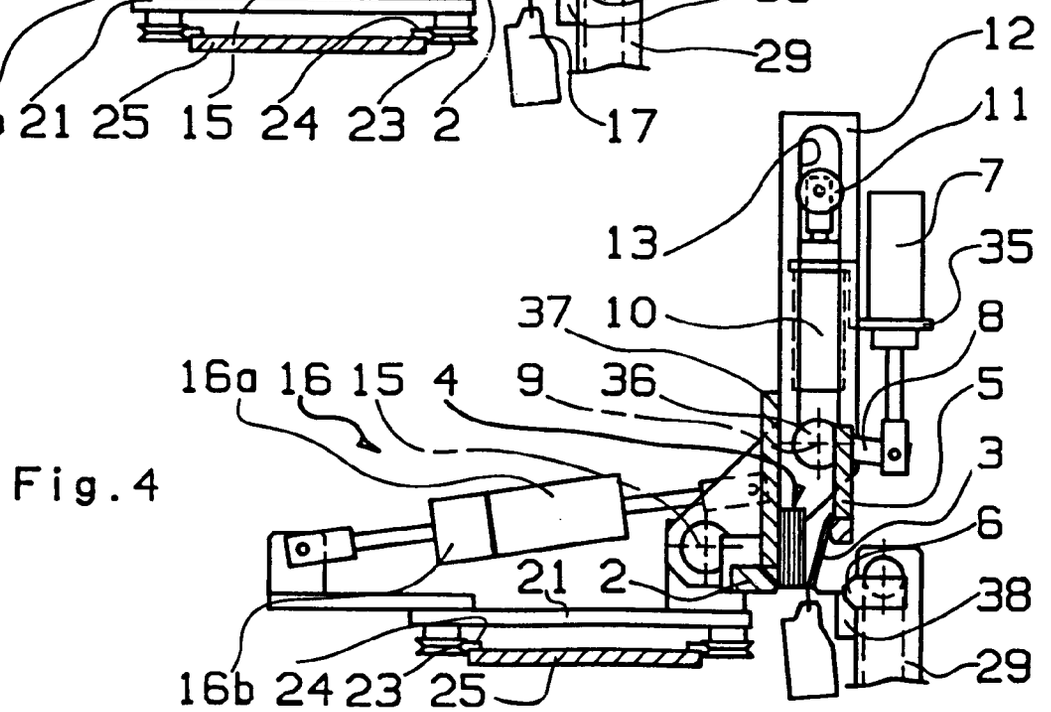

Fig.4

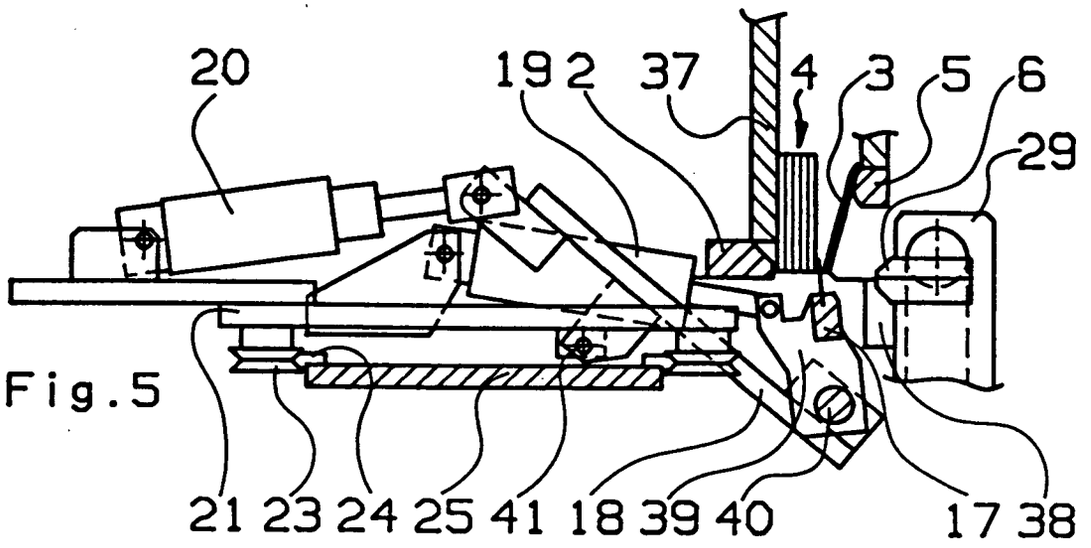

Fig.5

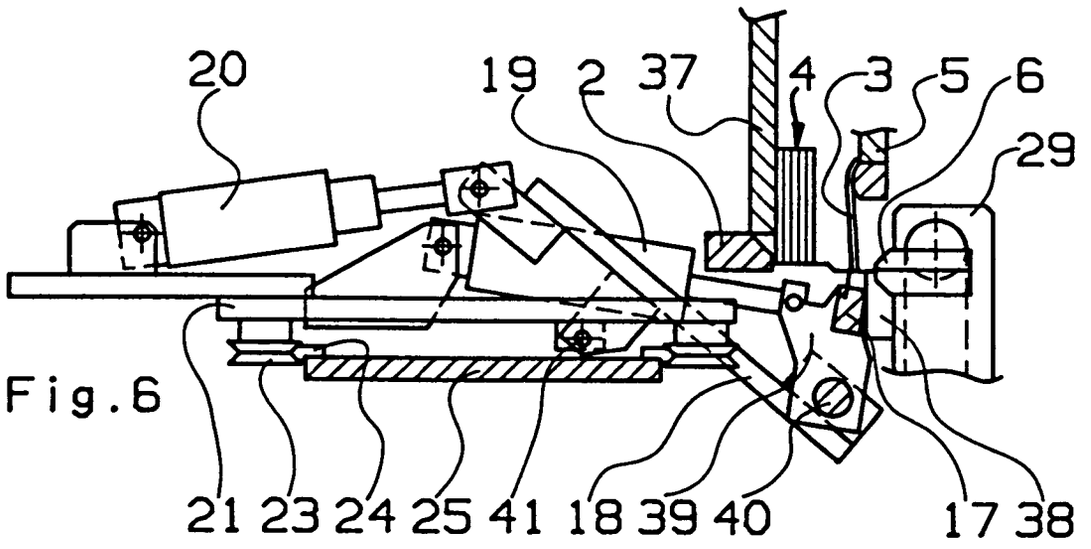

Fig.6

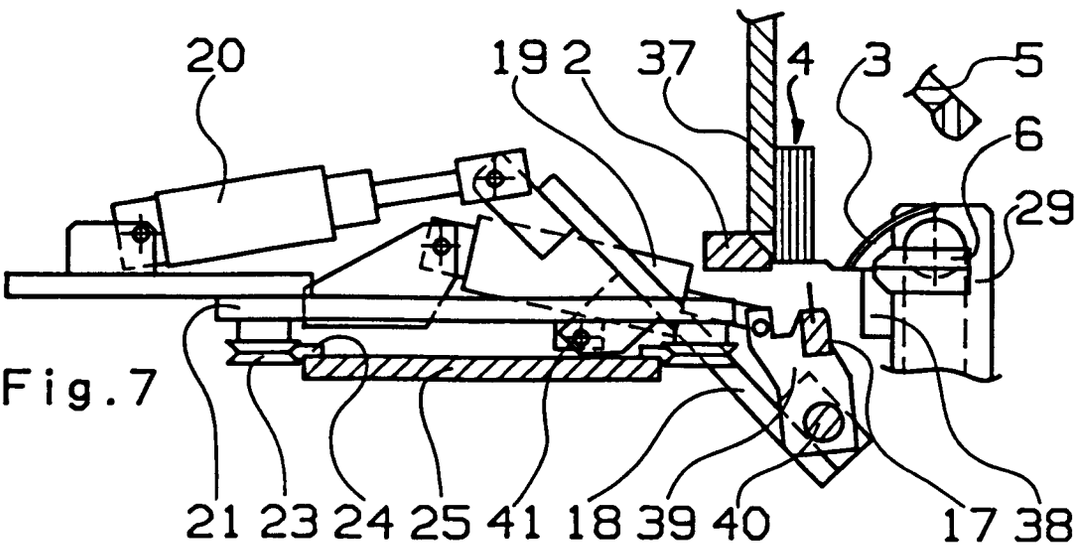

Fig.7

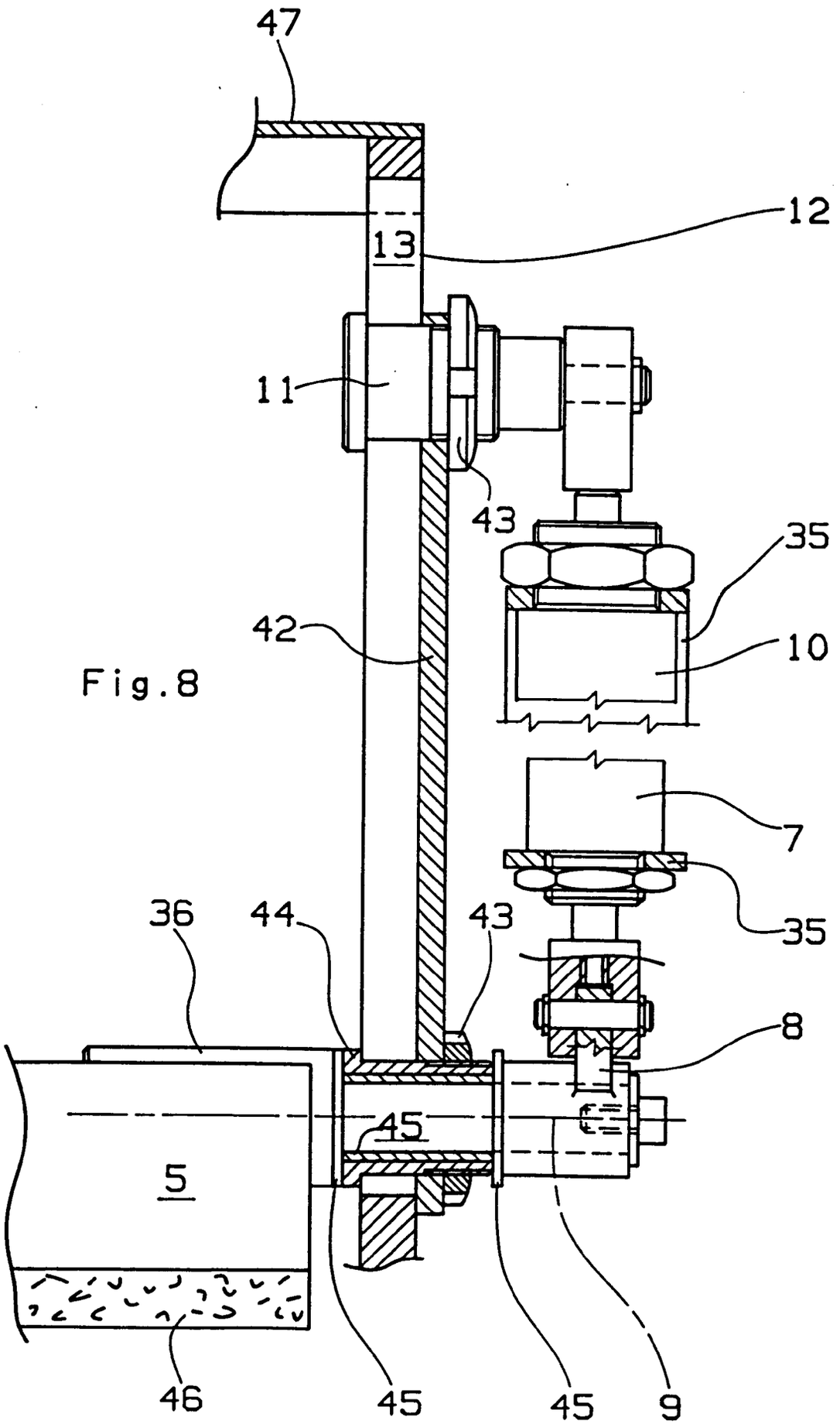

Fig.8

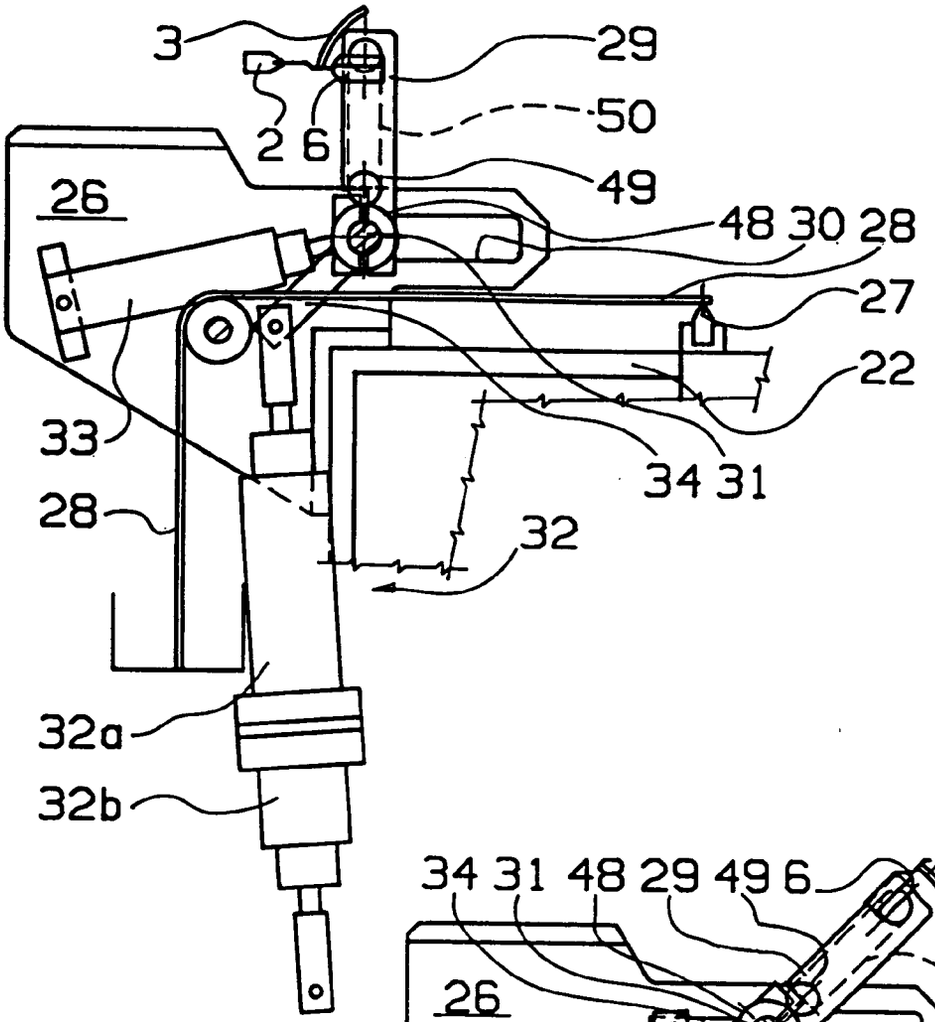
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Fig.9

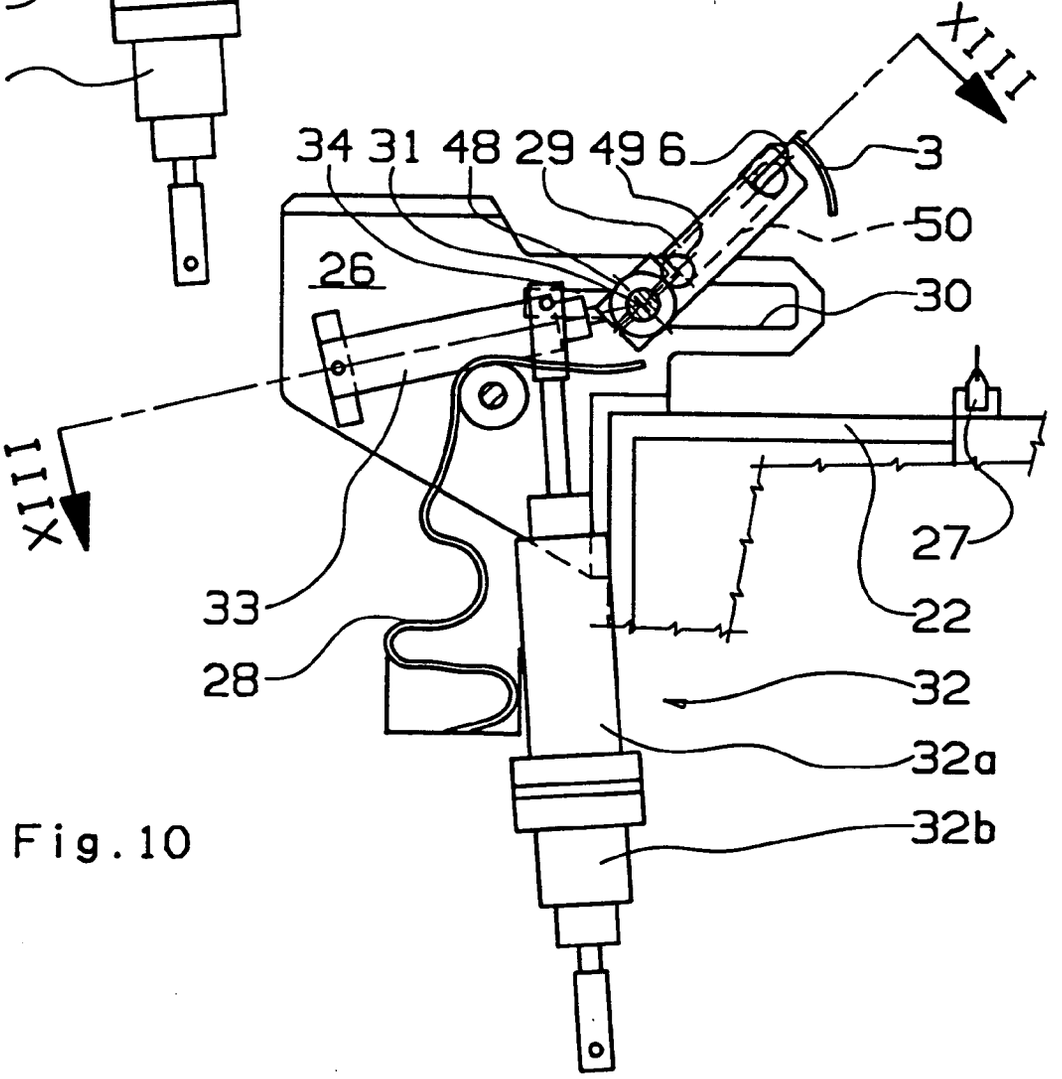
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Fig.10

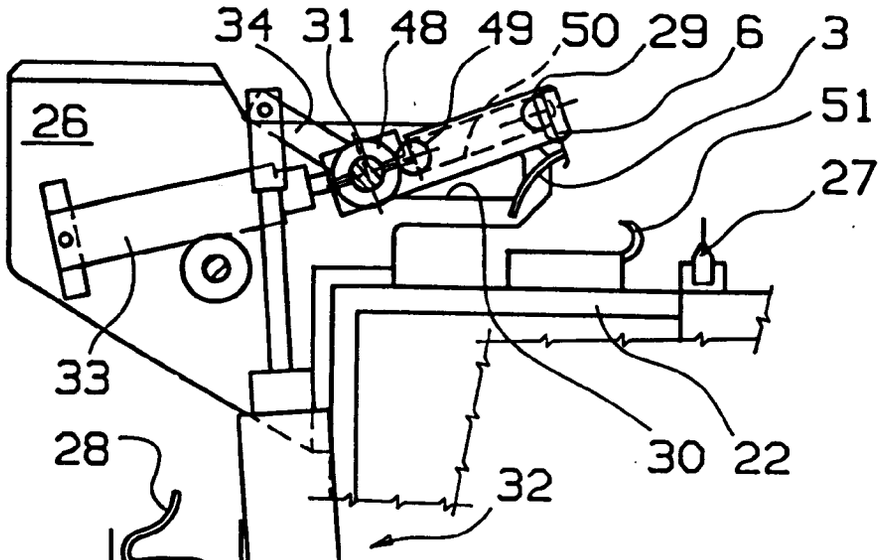
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Fig.11

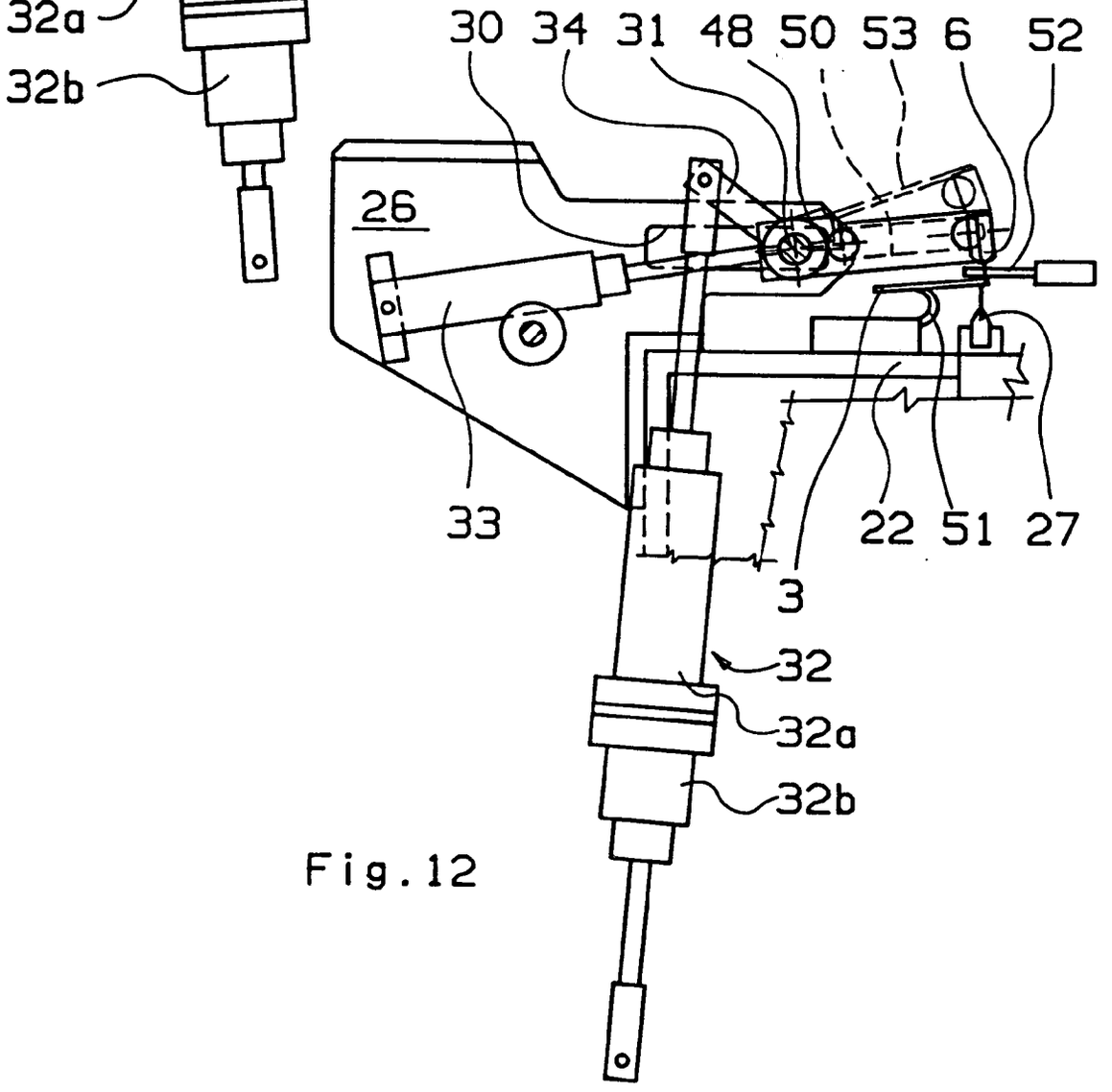
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Fig.12

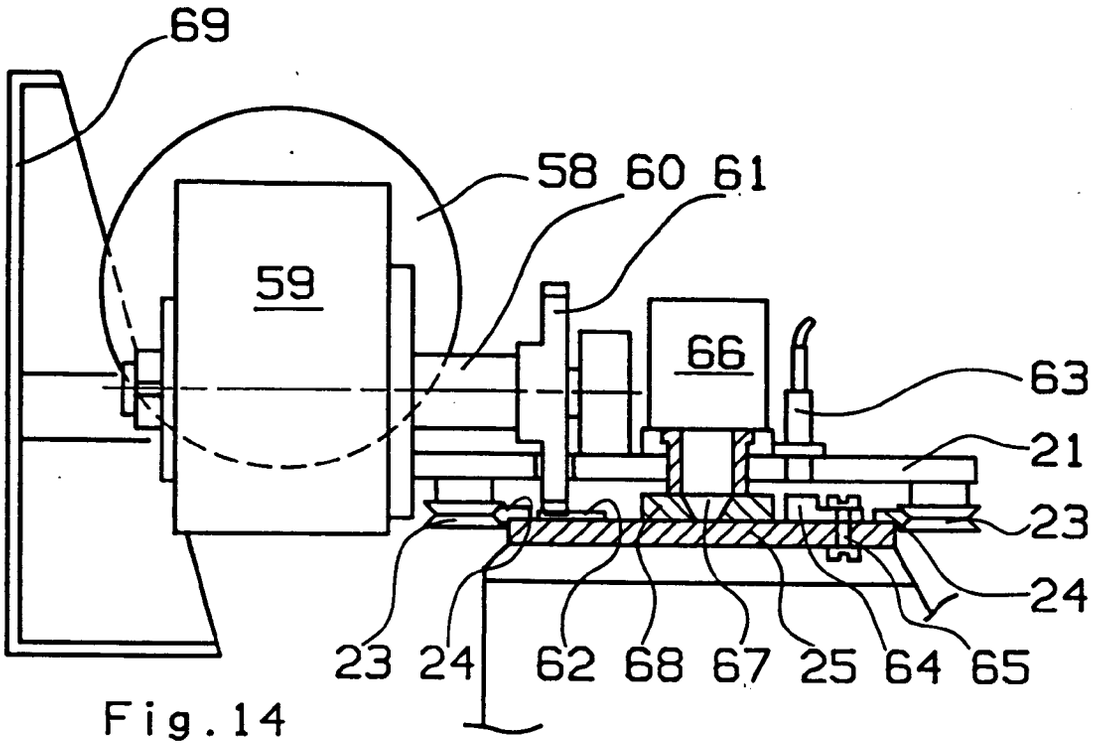

Fig.14

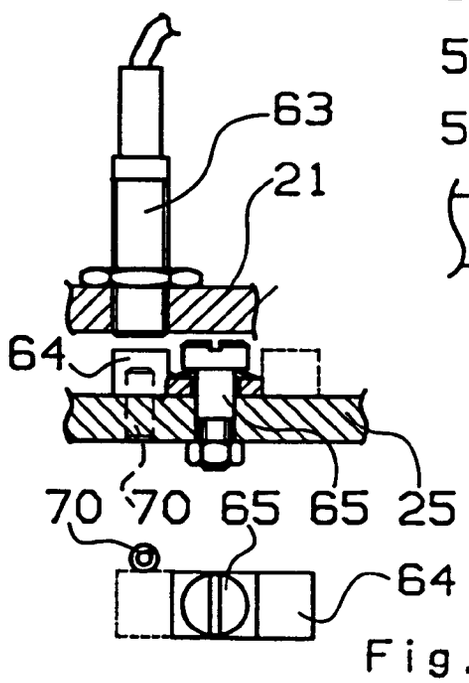

Fig.16

Fig.15

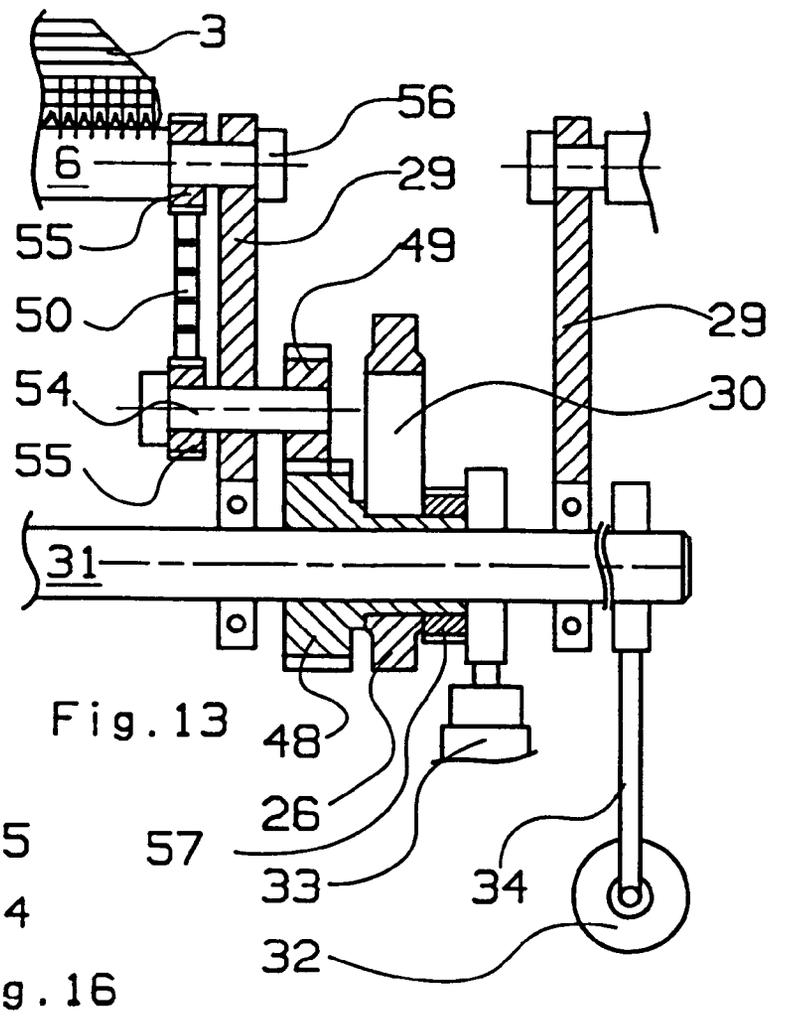

Fig.13

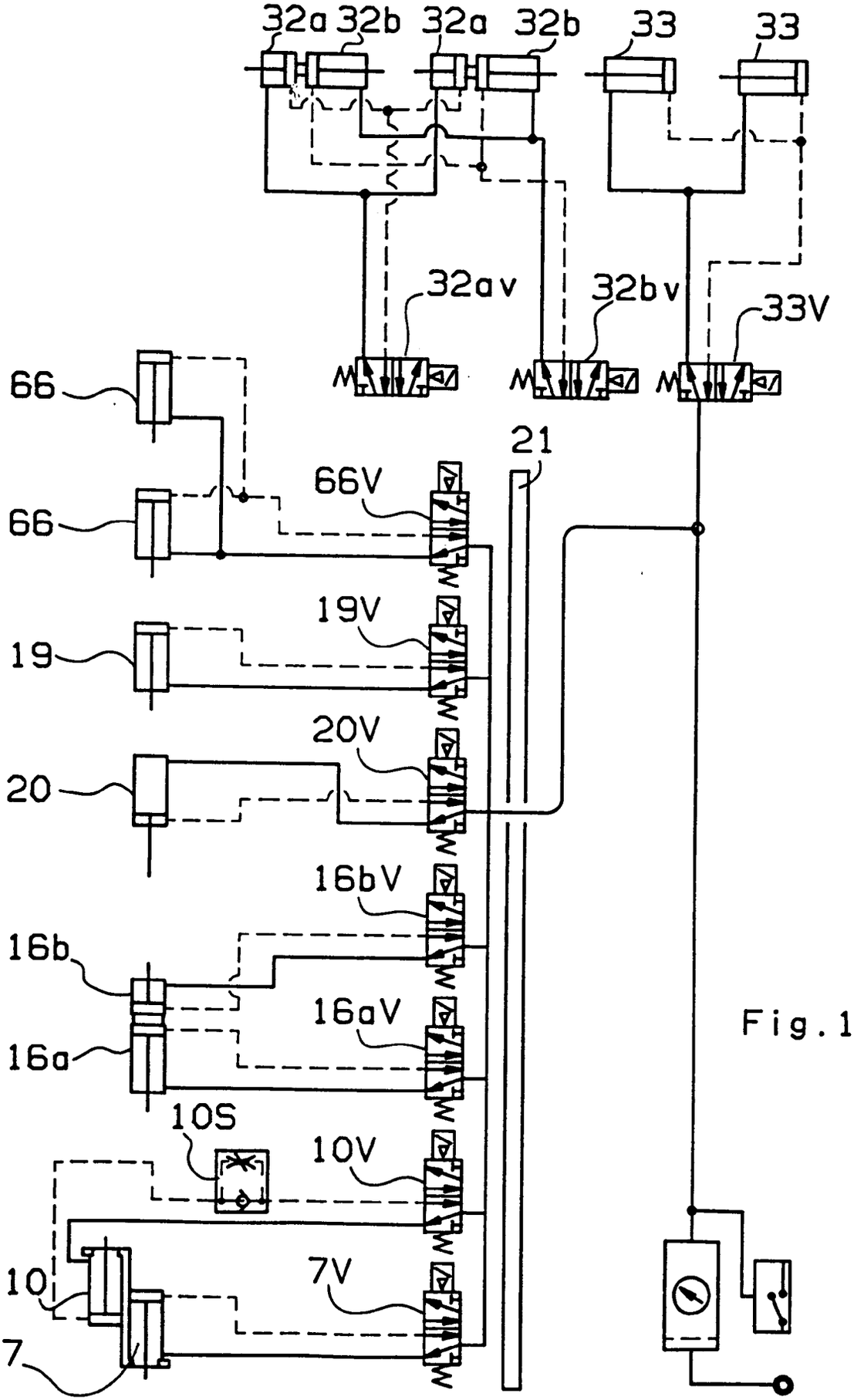
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Fig.17

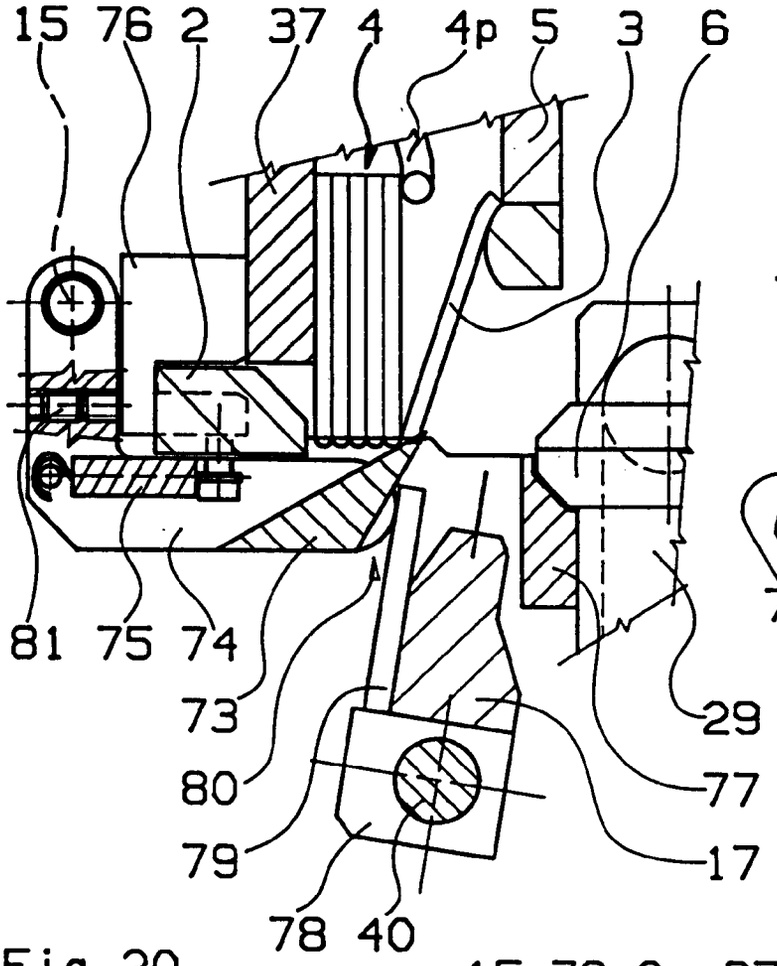

Fig.20

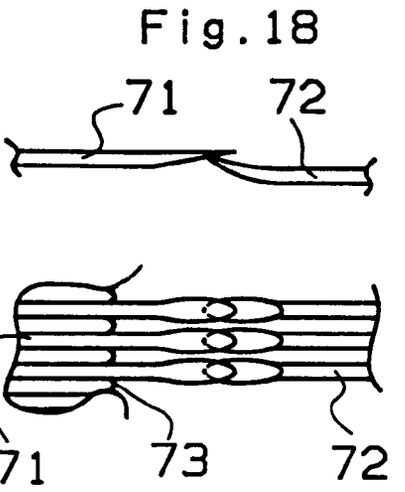

Fig.19

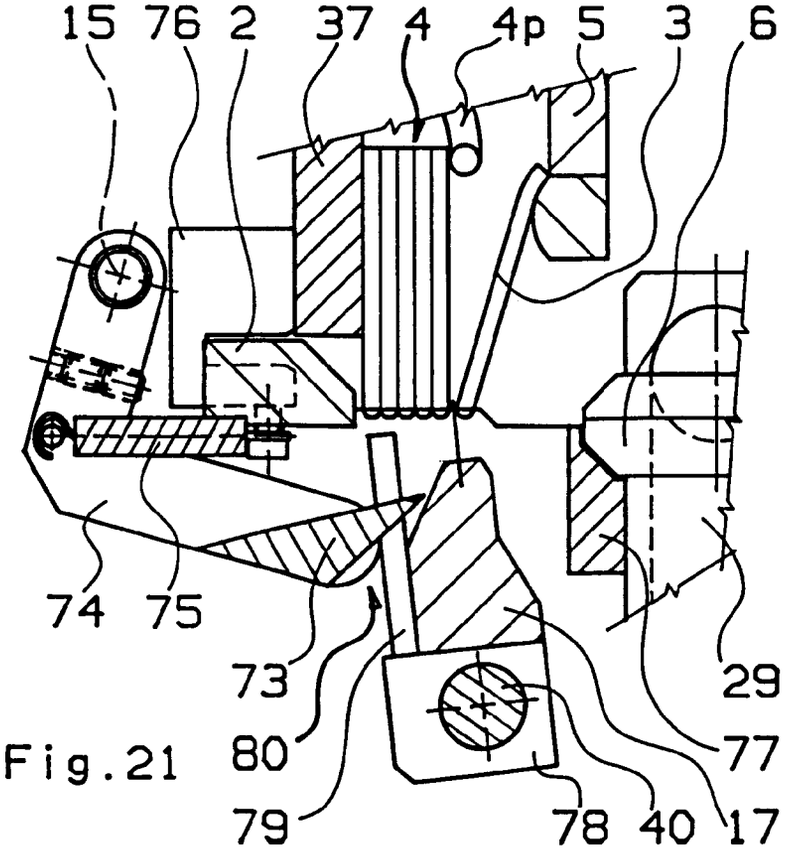

Fig.21

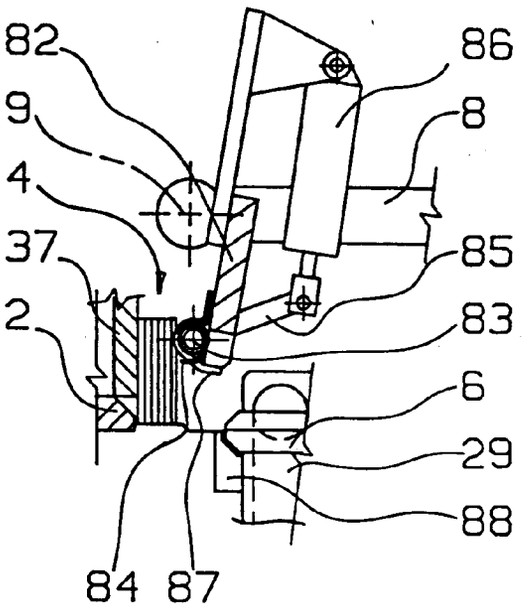

Fig.22

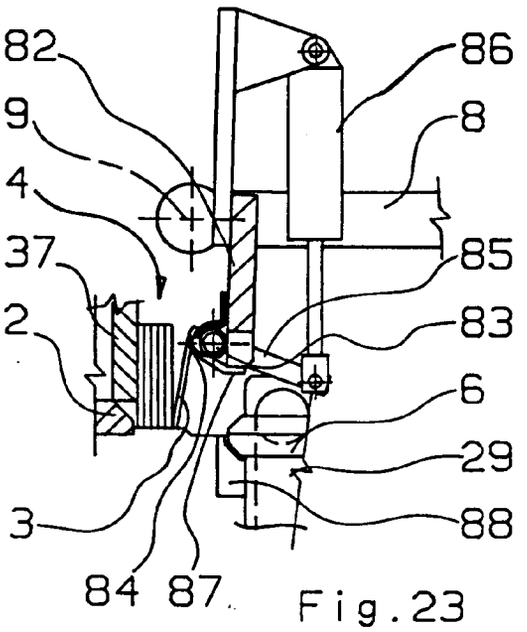

Fig.23

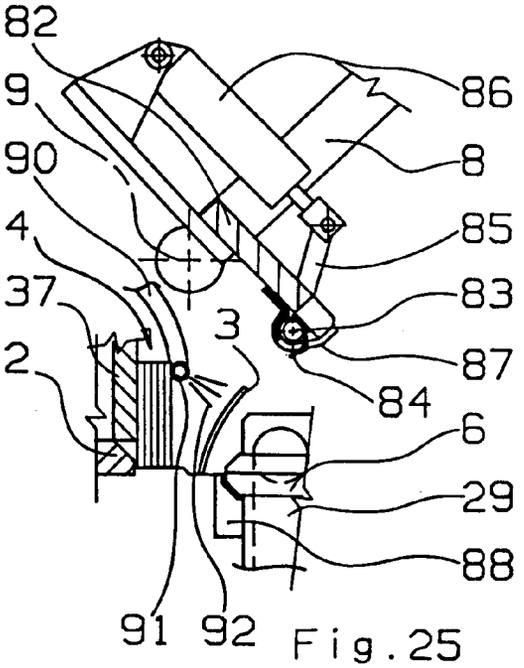

Fig.25

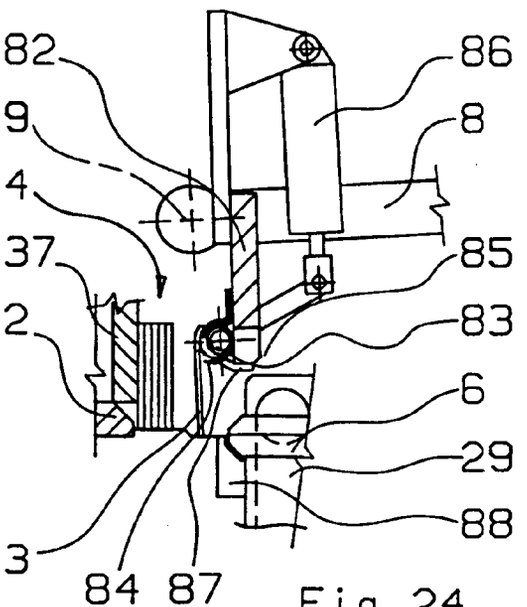

Fig.24

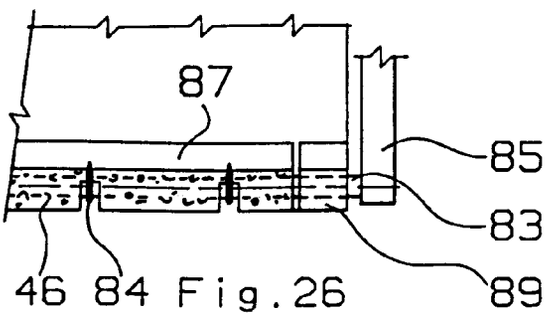

Fig.26

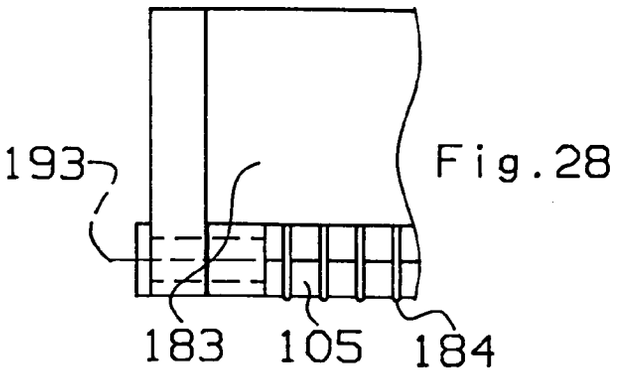
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Fig.28

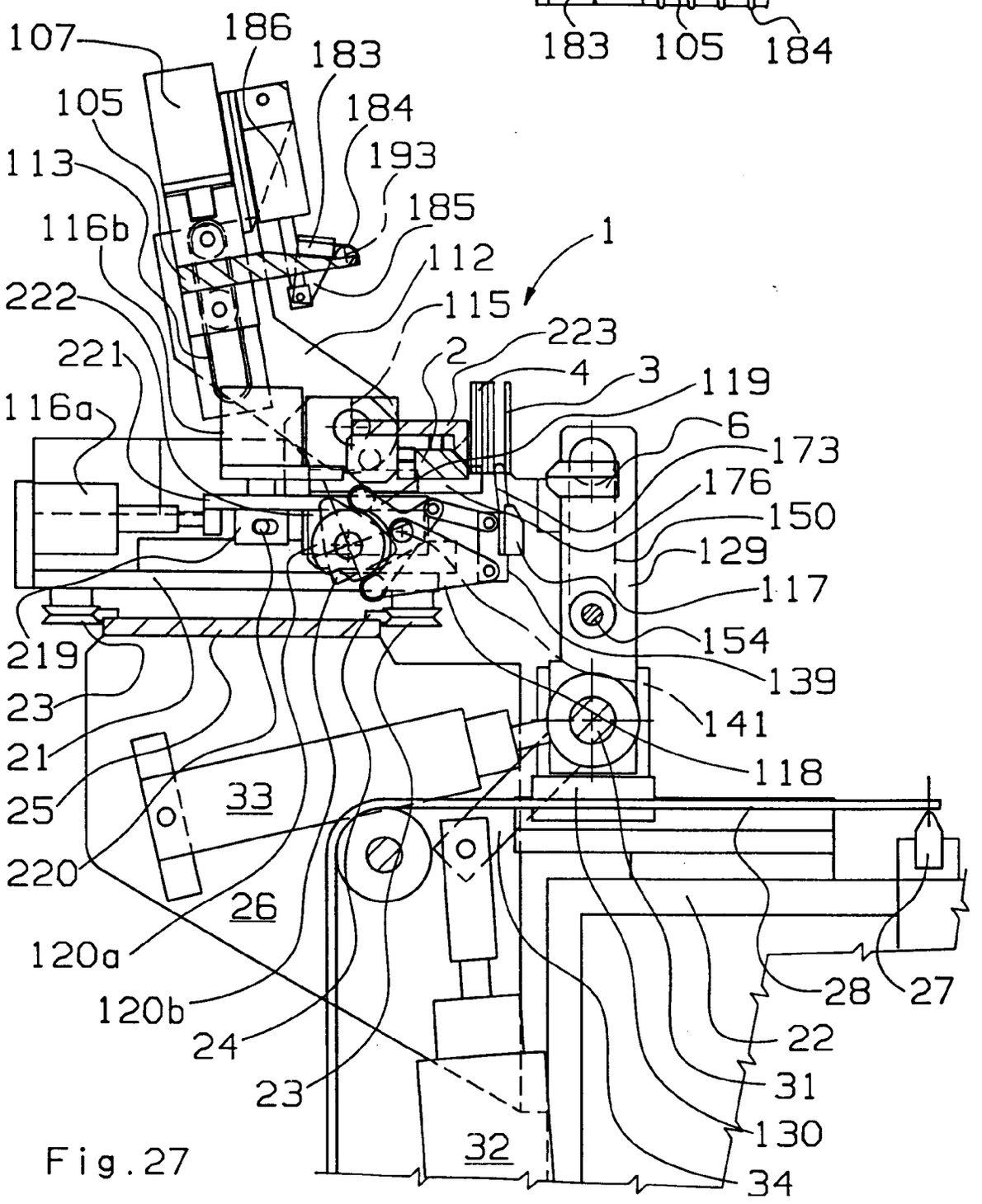
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Fig.27

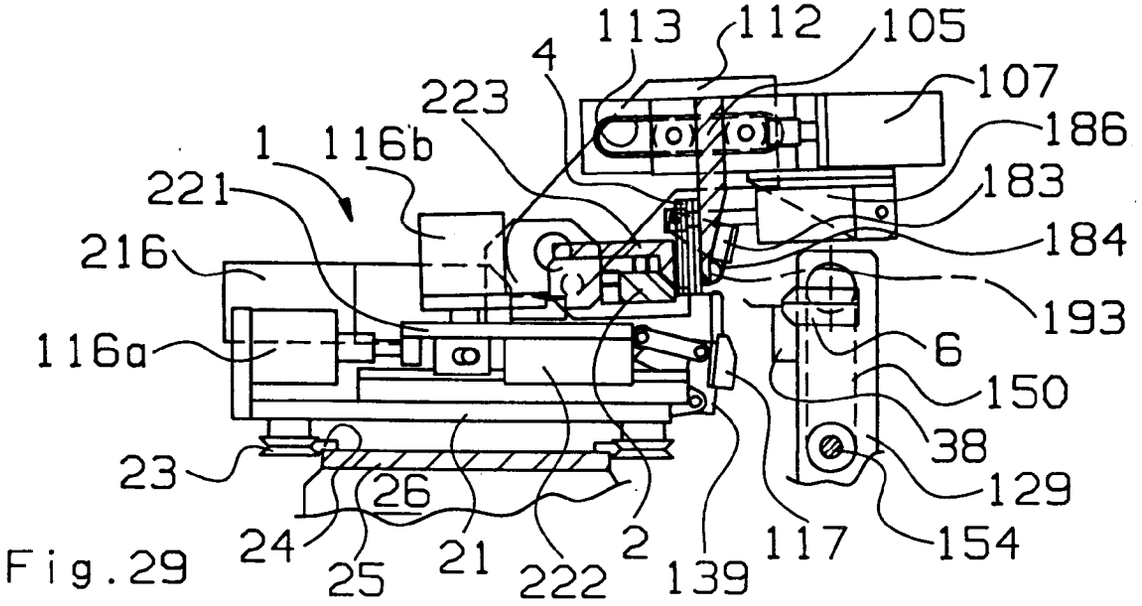


Fig.29

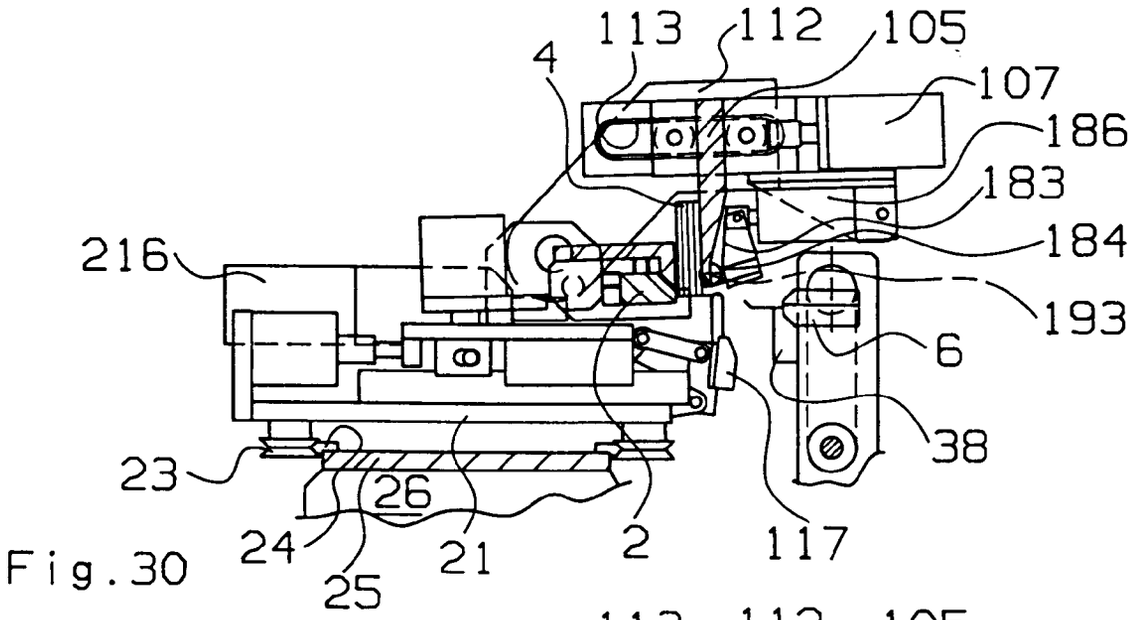


Fig.30

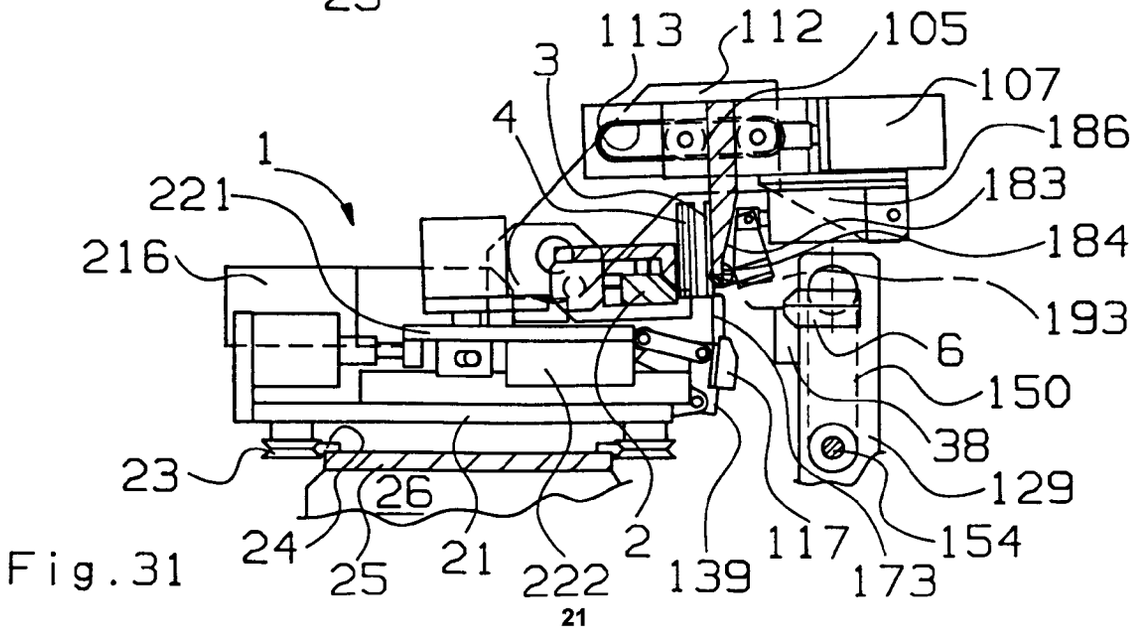
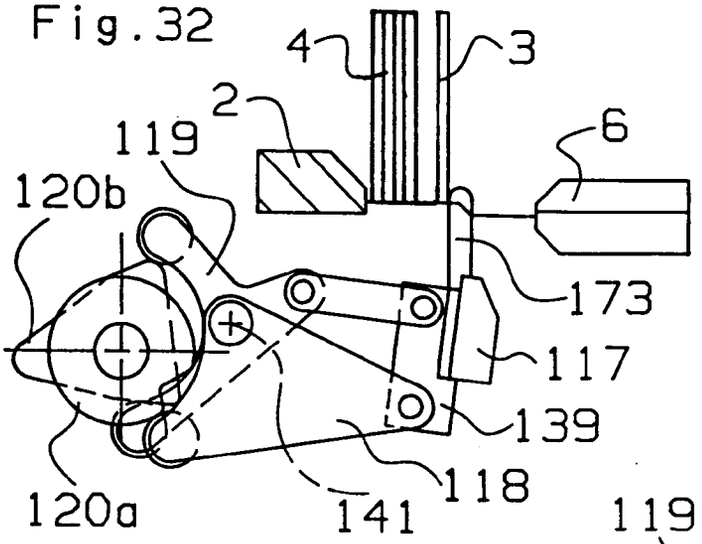


Fig.31

Fig.32



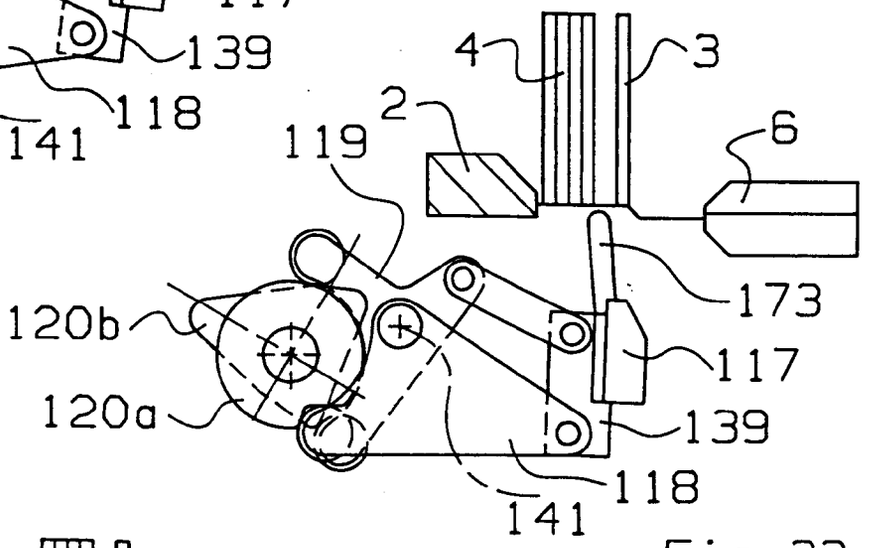
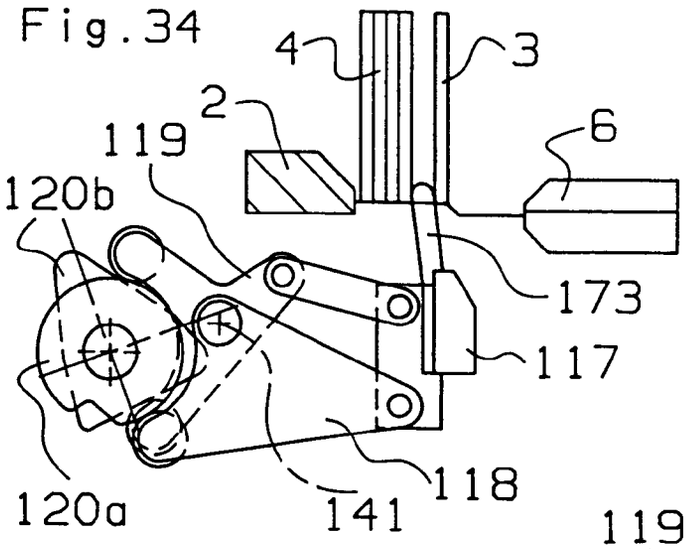


Fig.33

Fig.34



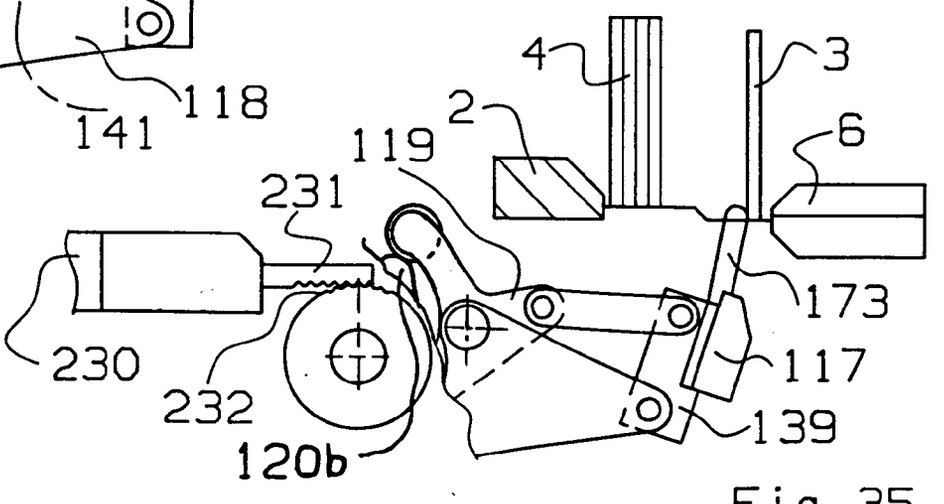


Fig.35

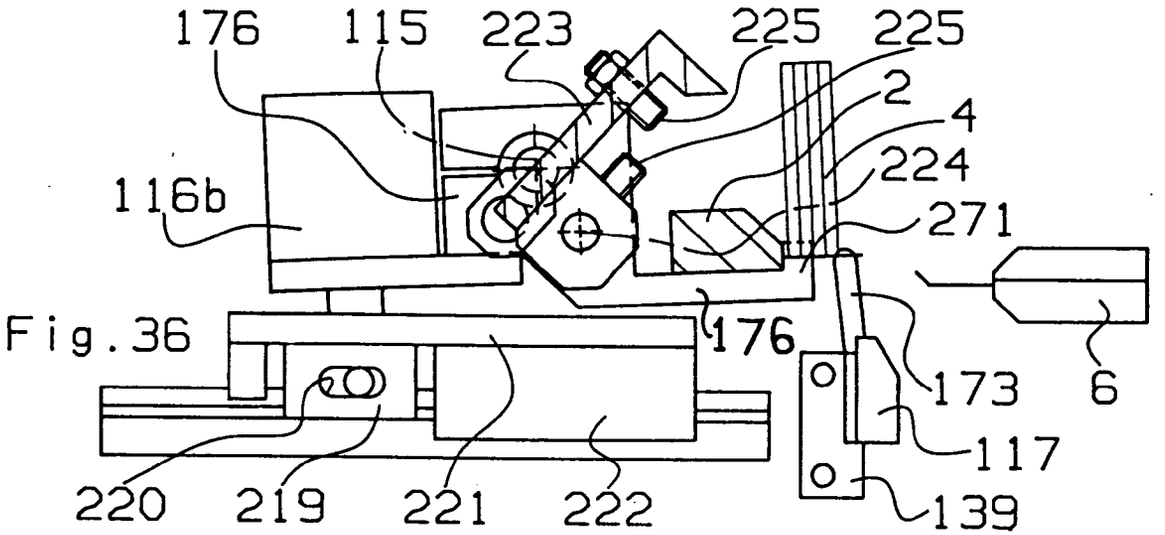


Fig.36

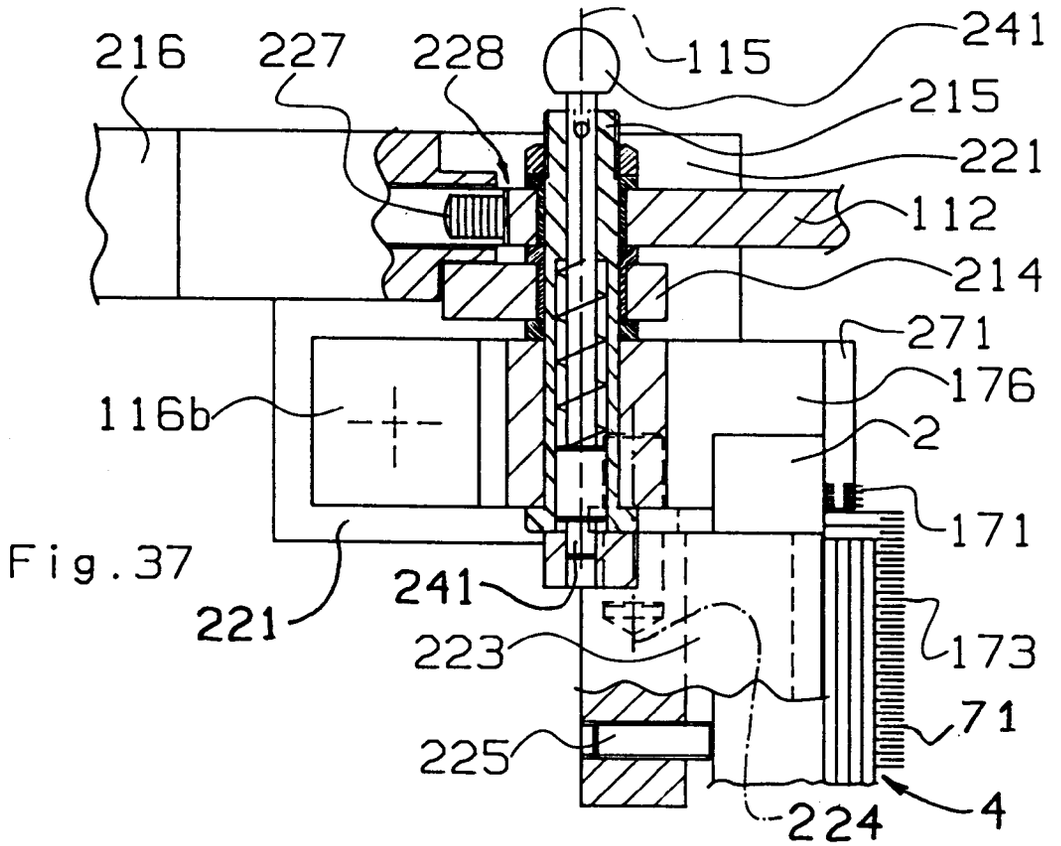


Fig.37

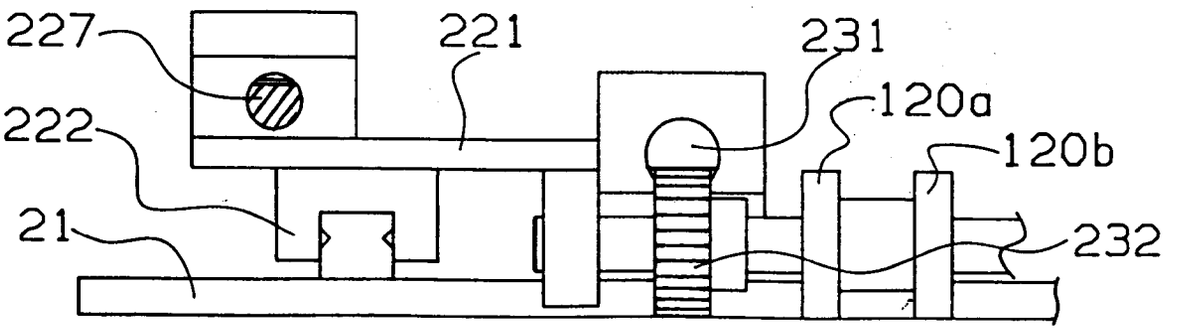


Fig.38