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(54) Printing assembly for quick sleeve replacement in flexographic printers

(57) The invention relates to a printing assembly suitable for quickly replacing the sleeves and the inking and printing cylinders in a flexographic printing machine provided with a central drum and controlled by an electronic control unit (EC). The printing assembly comprises a frame (13, 14) supporting an inking sleeve carrying cylinder (18) and a printing sleeve carrying cylinder (20) displaceable close to the central drum (4). The frame (13, 14) comprises a first side (14) on which the said inking sleeve-carrying cylinder and printing sleeve carrying cylinder are overhangingly mounted for rotation about their axes of rotation at a respective end thereof, and a second side (13) spaced from the first side (14) and having a removable support (13a, 13b) for the other end of each of the inking sleeve carrying cylinders and printing sleeve-carrying cylinders so that a sleeve (19,19a) and/or one of or both inking sleeve-carrying cylinder and printing sleeve-carrying cylinder (18, 20) can be replaced after their respective removable support (13a, 13b) has been moved away.

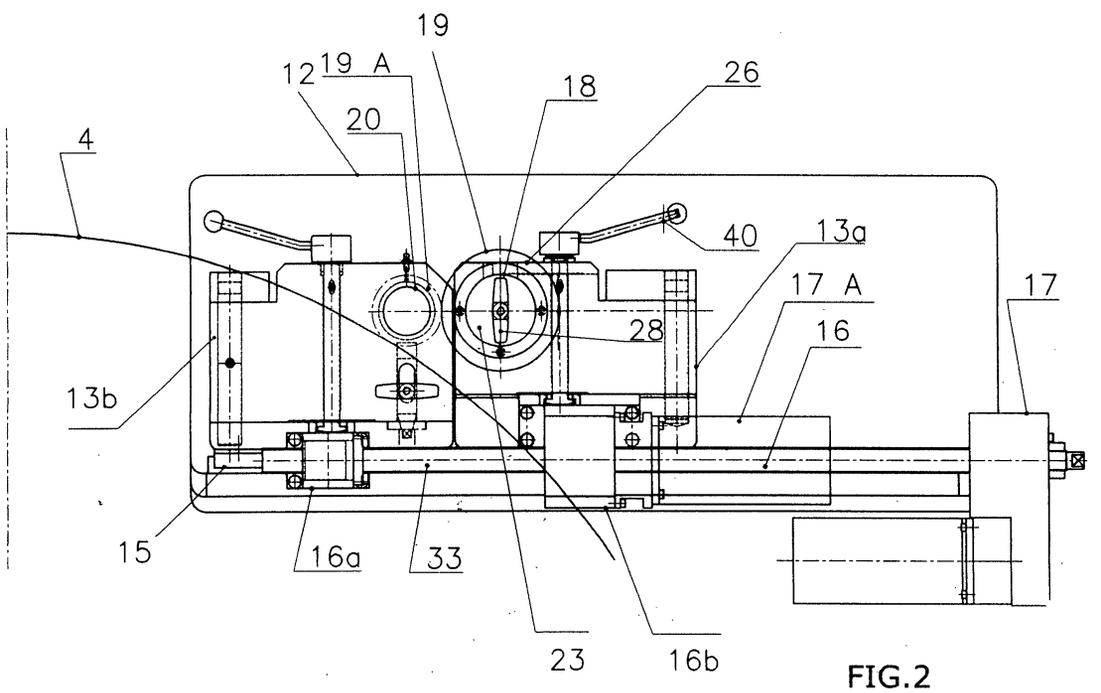

FIG.2

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Description

[0001] The present invention relates to a device for quickly and expeditiously replacing the sleeves provided on an inking cylinder and/or a printing cylinder in a printing assembly of a flexographic printing machine.

[0002] As known, flexographic printing machines, particularly those having a centrally located printing drum, are provided with as many printing units, angularly spaced around the printing drum, as the number of colours to be printed. Usually some printing units or colour units, *e.g.* four in number, are arranged on one side of a vertical plane including the axes of rotation of the central drum, and some others, *e.g.* typically another four of them, are located on the opposite side. Thus, at the end of a printing operation, the inking cylinder sleeves and/or possibly the printing cylinders themselves need to be replaced in order to set up the printing machine for a different printing operation (*e.g.* with different colours or fonts).

[0003] In conventional flexographic printing machines this operation is very lengthy and laborious to be carried out, and entails considerable dead times. In fact first each inking cylinder is disengaged from its lateral supports or from one of its lateral supports, and from the kinematic connection to the printing cylinder, then it is raised or displaced by being caused to slide along support sides in a transverse direction to their axes of rotation, so that one end of the inking cylinder is brought at an opening or recess provided in its respective lateral support, and the sleeve engaged therewith can be withdrawn, and a new one inserted. The next operation is then carried out in reverse, by sequentially placing the inking cylinder back to its lateral supports, operatively connecting it to the printing cylinder and locking it in its working position.

[0004] Obviously, besides being a laborious operation even for particularly well-trained personnel, sleeve replacement in conventional flexographic printing machines also brings about serious adjustment problems since even small deviations from correct positioning of the inking or printing cylinder could jeopardise the quality of the final printing.

[0005] Expensive and complicated robotized apparatus and automated devices were thus resorted to for locking and releasing inking and printing cylinders in order to ensure a correct and precise positioning thereof at any time, whilst allowing them to be removed or replaced. Of course this involves a considerable increase in the overall production costs of flexographic printing machines.

[0006] The main object of the present invention is to eliminate the above mentioned shortcomings to be faced with the prior art technology by providing a solution to the problem of replacing printing sleeves and/or cylinders in flexographic printing machines, that is easy and straightforward and can be carried out even by not particularly well-trained personnel.

[0007] A further object of the present invention is to provide a simple technical solution that can be easily carried out at competitive costs.

[0008] These and other objects that will be better apparent below are accomplished by a printing assembly with quickly and expeditiously replaceable sleeves and inking and printing cylinders in a control-drum flexographic printing machine, the printing assembly comprising a support structure for an inking sleeve carrying cylinder and a printing sleeve-carrying cylinder that can be displaced close to the central drum, and being characterised in that the said support structure comprises a first side on which the said sleeve-carrying cylinders and the said printing sleeve-carrying cylinders are overhangingly mounted for rotation about their own axes of rotation at an end thereof, and a second side spaced from said first side and having a removable support on which the other end of each of the said inking sleeve-carrying cylinders and printing sleeve-carrying cylinders rests, whereby a sleeve, and/or one or both sleeve-carrying cylinders can be replaced, once the said removable support has been removed.

[0009] Further aspects and advantages of the present invention will be better apparent from the detailed description given below of a preferred not exclusive embodiment of a printing assembly for a flexographic printing machine shown by way of not limiting example in the accompanying drawings, in which:

Figure 1 is a diagrammatic side elevation view of a flexographic printing machine having a central drum with eight printing or colour units;

Figure 2 shows a perspective side elevation view (outer side) on an enlarged scale of a printing assembly peripherally located with respect to the central drum;

Figure 3 is a view with partly cutaway sections of the support side of the printing unit shown in Fig. 2, seen from its outer rear portion;

Figure 4 is a side elevation view of the removable support side for an inking sleeve-carrying cylinder;

Figure 5 shows a top plan view of Fig. 4;

Figure 6 is a side view from the left when viewing Fig. 4;

Figure 7 is a cross-section view taken along line VII-VII of Fig. 4;

Figure 8 is a partial top plan view, with parts cutaway of the printing sleeve-carrying cylinder supported by a support structure according to the present invention;

Figure 9 shows a cross-section view taken along line IX-IX of Figure 8;

Figure 10 is a cross-section view taken along line X-X of Fig. 8;

Figure 11 shows a side elevation side view of the removable support side for a printing sleeve-carrying cylinder;

Figure 12 shows a top plan view of Fig. 11;

Figure 13 is a simplified side view from the left when viewing Fig. 11; and

Figure 14 is a side view, with parts cutaway, from the left when viewing Figure 11.

[0010] In the accompanying drawings the same or similar parts or components have been designated by the same reference numerals.

[0011] First, with reference to Fig. 1, it will be noted that a flexographic printing machine 1 substantially comprises a bridge support frame 2 carried on the one side by support sides 3 of a central drum 4 having a horizontal axis of rotation and, on the other, a pair of upright members 5 designed to support a plurality of cylinders 6 for feeding tape material 7 to be printed from an unwinding device 8 and for feeding the already printed material 9 to a winding device 10. Starting from the unwinding device 8, the material to be printed 7 is fed to the drum 4 where it is printed, and is then directed upwards and away from a drum 4 to a drying chamber 11 before reaching winding device 10. The whole assembly is controlled by an electronic control unit CE, *e.g.* placed close to an upright member 5.

[0012] A number of printing units 12 is arranged around the central drum 4. Printing units 12 are also referred to as colour units, because they are each designed to print a specific colour. Figure 1 also shows eight printing units arranged and angularly spaced around drum 4.

[0013] Each printing unit 12 is formed by two support sides, as it is better shown in Figures 2 to 12, namely a front support side 13 and a back support side 14, which are in turn supported by slides 15 slideably mounted on the sides 13 and 14 in a longitudinal direction. Sides 13 and 14 can be controlled by a pair of ball screws 16 engaging with nut screws 16a rigid with a respective side by means of a bracket 16b. Ball screws 16 are in turn controlled by a motor-reduction gear unit 17 for the attachment, detachment and setting operations.

[0014] Sides 13 and 14 in each printing unit 12 support for rotation an inking cylinder, or a sleeve-carrying cylinder 18 onto which a sleeve 19 can be inserted, and a printing sleeve-carrying cylinder 20 onto which a sleeve 19a can be inserted, designed to be inked by the inking cylinder and to print the tape material 7 passing past it while being carried on the central drum 4. Sides 13 and 13a comprise two upper support sections 13a and 13b, the former being designed to support one end of hold 18a of the inking sleeve-carrying cylinder, and the latter being designed to support one end of hold 20a of the printing sleeve-carrying cylinder 20.

[0015] Inking sleeve-carrying cylinder 18 is overhangingly supported (in any suitable way) by side 14 and is driven by an electric motor-reduction unit 21 by means of suitable drive means, *e.g.* by means of a toothed belt 22 (Fig. 3). At its other or overhanging end 18a, the sleeve-carrying cylinder can be removeably placed in a blind bush element 23 slidingly mounted in an opening or a through hole 24 provided in the side 13a (Figs. 5 and 7). Between blind bush 23 and end 18a of sleeve-carrying cylinder 18 a suitable rolling means, *e.g.* a bearing 25, is preferably provided.

[0016] On the outer face of the side wall 13a the bush member 23 extends outwardly from side wall 13a and is supported by a metal ring 26 fixed by means of bolts 27 in coaxial position with respect to the hole 24. The bush member 23 terminates outside the metal ring 26 with a manual control handle 28. Furthermore, a longitudinal seat for a key is formed on the outer surface of blind bush member 23, said longitudinal seat being slidingly engageable with a stud bolt or dowel 30, so that the bush member can be caused to slide into hole 24 and flange 29 only to a predetermined extent, whereby preventing bush member 23 from being fully withdrawn from side wall 13a to which it thus constrained.

[0017] The support side 13a rests on one or more longitudinal guides 31 fixed to, or integral with, an underlying shoulder 32 of the support frame or structure of each printing unit 12 by means of at least one slide 15, or the lower portion of side 13 fixed to slide 15. At the outer side of guide 31, side 13a has an abutment 34 the purpose of which will be explained below.

[0018] The support side wall 13a is hinged to a lower portion of side 13, or else to slide 15 about a vertical pin 35, so that by acting on knob 28, while pulling it outwards, bush member 23 is caused first to withdraw from end 18a of the sleeve-carrying cylinder 18, thus be released from side 13a, and then, once dowel 30 has been brought to abut against the inner end of recess 29, while still acting on knob 28, side wall 13a is moved away from its working position by rotating about pin 35, as better shown in Fig. 5, thereby leaving the front of the sleeve-carrying cylinder 18 clear in order to comfortably and swiftly replace a sleeve 19.

[0019] Side 13a can be locked in or released from, its working position, *i.e.* in engagement with end 18a of sleeve-carrying cylinder 18 by means of a clamping mechanism comprising a stem 36 which is inserted into a vertical through hole 37 formed in the side 13a, and extends from the said through hole 37 both upwards and downwards. The upper portion of the stem 36 has a threaded section 38 screwed into a respective threaded section 39 of hole 37 and terminates with a control lever 40 at its end. At its lower end instead, stem 36 has an enlarged head 41, designed to slidably engage within a double undercut converging guide 42 formed either in the lower portion of side 13 fixed to slide or slides 15, or directly in the slide or slides 15. Thus, by acting onto lever 40, causing stem 36 to rotate in one direction, side 13a is locked in its working position, whereas urging it to rotate in the opposite direction, head 42 is disengaged from double guide 42 and side 13a can be moved away towards its rest position, as explained above.

[0020] Figures 8 to 14 show the support frame of a printing cylinder 20. At the side wall 14, cylinder 20 is overhangingly supported at its hold 20b. More particu-

larly, hold 20b is inserted into sleeve 50 which is fixed into a through hole 51 formed in side wall 14 and overhangingly extends on the opposite side to printing cylinder 20. Between hold 20 and sleeve 50 a rolling means is provided, *e.g.* a bearing 52. At its head, hold 20b is also engaged by a mandrel 53 which is designed to rotate printing cylinder 20 and is in turn keyed on output shaft 54 of an electric motor 55. Preferably, a bearing 53a is provided between mandrel 53 and sleeve 50.

[0021] A tubular member 56 is wholly or partly inserted onto the overhangingly protruding portion of sleeve 50, and can slide on sleeve 50, whilst being fixed at its head to motor 55 and thus to mandrel 53. Furthermore, tubular member 53 is rigid with a cross-arm 57 extending parallel to side 14. Arm 57 is formed with a through hole 58 in which a nut screw 59 is fixedly fitted. A threaded shaft 60 is screwed in the nut screw and is overhangingly mounted for rotation, although being prevented from being axially displaced from side 14.

[0022] A gear wheel 61 which, driven by a reversible electric motor 63 through toothed belt 62, is keyed onto threaded shaft 60. Owing to this arrangement, clearly as motor 63 is set in rotation in one direction, moveable unit comprising arm 57, tubular member 56, mandrel 53 and printing cylinder 20 is caused to be displaced a controlled length D, *e.g.* to the right of Fig. 8, whereas as motor 63 reverses its direction of rotation, the moveable unit is displaced in the opposite direction.

[0023] If desired, in order to ensure greater structural stability, arm 57 is slidably inserted onto a guide pin 64 overhangingly carried by side 14 and extending parallel to threaded shaft 60 (Fig. 8).

[0024] At side 13, printing cylinder 20 is supported by a respective portion 13b which, just like portion 13a, is carried by a lower portion of side 13 fixed to, or integral with, one or more slides 15 slidingly mounted onto a guide 31 carried, in turn, by a shoulder 33 located underneath. Portion 13b is pivoted about a vertical pin 66, and thus it is angularly displaceable between a working position in alignment with support guide 31 and matching with hold 20a of printing cylinder 20, and a rest or open position (Fig. 12), in which it is located away from the printing cylinder.

[0025] More particularly, portion 13b has a through hole in which hold 20a can be inserted with interposition of a bearing 68, thus being supported in its working position. Moreover, lock/release means is provided, *e.g.* comprising a stem 36 seated in a vertical through hole 37 formed in side 13b and extending both upwards and downwards therefrom. In its upper portion, stem 36 has a threaded section 38 screwed into a respective threaded portion 39 of hole 37 and terminates with a control lever 40. At its lower end, stem 36 terminates with an outer enlarged head 41, designed to slidably engage within a double undercut converging guide 42 formed in the slide or slides 15, similarly to what has been shown with reference to side portion 13a.

[0026] In order to prevent printing unit 12 from being started before portions 13a and 13b of side 13 being brought accurately back to their working position after the same have been opened, a safety snapping device can be provided which comprises *e.g.* a pin 70 slidingly arranged in a vertical seat 71 formed in portion 13a and/or 13b (Fig. 14). Pin 70 has its lower portion 72 which is frusto-conical in shape and designed to engage with a respective frusto-conical seat 73 formed in lower portion 15a of section 13b, or in slide 15, and is resiliently loaded by a helical spring 74 that urges it towards groove 73. A handle 75 is provided to manually control pin 70, the said handle being integral with pin 70 and extending outside seat 71 through a vertical slot 76, and thus when handle 75 is lifted, pin 70 is released from seat 73, thereby releasing portion 13a or 13b from slide 15 to spread them angularly apart about their respective pins 35 and 66.

[0027] A proximity sensor 77 is also provided at seat 73, said proximity sensor being suitable for detecting the presence of frusto-conical head 72 within seat 73.

[0028] In case full insertion of head 73 in seat 73 fails to be detected, proximity sensor 77 sends a signal to electronic control unit CE that prevents the respective printing unit and, in case, the printing machine 1 from being started.

[0029] The above described invention is susceptible to numerous modifications and variations within the scope as defined by the tenor of the claims.

[0030] The disclosure in Italian patent application No. VR2001A000130 from which priority is claimed is incorporated herein by reference.

[0031] Any reference sign following technical features in any claim has been provided to increase intelligibility of the claim and shall not be construed as limiting the scope of the claim.

Claims

1. A printing assembly for quickly replacing sleeves and inking and printing cylinders in a central drum flexographic printing machine, controlled by an electronic control unit (CE), which printing assembly comprising a support frame or structure (13, 14) for an inking sleeve-carrying cylinder (18) and a printing sleeve-carrying cylinder (20) displaceable close to said central drum (4), **characterised in that** the said support frame (13, 14) comprises a first side (14, 14a) on which said sleeve carrying cylinders (18) and printing cylinders (20) are overhangingly mounted for rotation about their axes of rotation at one end thereof, and a second side (13, 13c) spaced from the said first side (14, 14a) and having a removable support (13a, 13b) for the other end of each said inking sleeve-carrying cylinder (18) and printing sleeve-carrying cylinder (20), whereby a sleeve (19) and/or one or both sleeve-carrying cylinders (18, 20) can be replaced once its

respective removable support (13a, 13b) has been moved away.

2. A printing unit according to claim 1, **characterised in that** each removable support (13a, 13b) is hinged about a respective pin (35, 66) constrained to said second side (13, 13c).

3. A printing unit according to claim 2, **characterised in that** each removable support (13a, 13b) has a respective seat (24, 67) arranged to receive and support overhanging ends (18a, 20a) of said inking sleeve-carrying cylinder (18) and said printing sleeve-carrying cylinder (20), respectively.

4. A printing unit according to claim 3, **characterised in that** it comprises at least one rolling support means (25, 68) in each receiving support seat (24, 67).

5. A printing unit according to any claim 2 to 4, **characterised in that** the said removable supports (13a, 13b) each comprise locking means for locking in working position comprising a partly threaded pin or stem element (36), which is mounted for rotation in and in, screwing engagement with, a respective seat (37) and extends therefrom at both ends thereof, a control lever (40) in engagement with one end of the said stem element (36), an enlarged head (41) at the other end of the said stem member (36), at least one undercut guide (42) for each removable support (13a, 13b) formed in the said second side (13, 13c) for removably engaging with the said enlarged head (41) that can be tightened thereagainst by acting on said control lever (40).

6. A printing unit according to claim 5, **characterised in that** it comprises sensor means (77) suitable for detecting correct positioning of said at least one of said supports (13a, 13b) in its working position on said second side (13, 13c).

7. A printing unit according to any claim 3 to 6, **characterised in that** said removable side (13a) on the opposite side with respect to said end (18a) of the said sleeve-carrying cylinder (18) is provided with a bush member (23) slidingly mounted in the said receiving seat (24) and designed, on the one side, to receive said end (18a) of said sleeve-carrying cylinder (18) and, one the other, to support a manual control element (28) to cause longitudinal displacements of said bush member (23) to lock/release it into/from the said end (18a) of the said sleeve-carrying cylinder.

8. A printing unit according to any preceding claim, **characterised in that** the said printing sleeve-carrying cylinder (20) is mounted for rotation on, and overhanging from, the said first side (14) and comprises driving means (63) for automatically displacing it in a longitudinal direction.

9. A printing unit according to claim 8, **characterised in that** the said printing sleeve-carrying cylinder (20) comprises a support sleeve (50) carried by said first side (14) and designed to receive rotatably therein a hold (20b) of the printing sleeve-carrying cylinder (20), a mandrel (53) mounted for rotation in said support sleeve (50) on the side opposite with respect to said hold (20b) and has an end thereof that is rigid in rotation with the said hold (20b), a tubular member (56) slidingly mounted on, and overhanging from, a portion of said support sleeve (50), a drive means (55) carried by an overhanging end of the said tubular element (56) and designed to drive the other end of the said mandrel (53), a cross-arm (57) fixed to, or integral with, the said tubular element (56) and extending transversely thereto, a nut screw (59) carried by the said cross-arm (57), a threaded shaft (60) mounted for rotation on said first side (14) and in screwing engagement with said nut screw (59), a reversible driving motor (63), and a motion transmission (61, 62) from said motor (63) to said threaded shaft, (60) whereby, when said reversible driving motor rotates in one direction or the other, said cross-arm (57) and said sleeve (56), said mandrel (53) and said printing cylinder (20) are correspondingly moved closer to, or away from, said second side (13).

10. A printing unit according to claim 9, **characterised in that** it comprises at least a rolling means (51) between said hold (20b) and said sleeve (50) and at least one rolling means (53a) between said mandrel (53) and said sleeve (50).

11. A printing assembly according to claim 10, **characterised in that** the said cross-arm (57) comprises a guide pin (64) overhangingly carried by said first side (14) parallel to said threaded shaft (60) and in sliding engagement with said cross-arm (57).

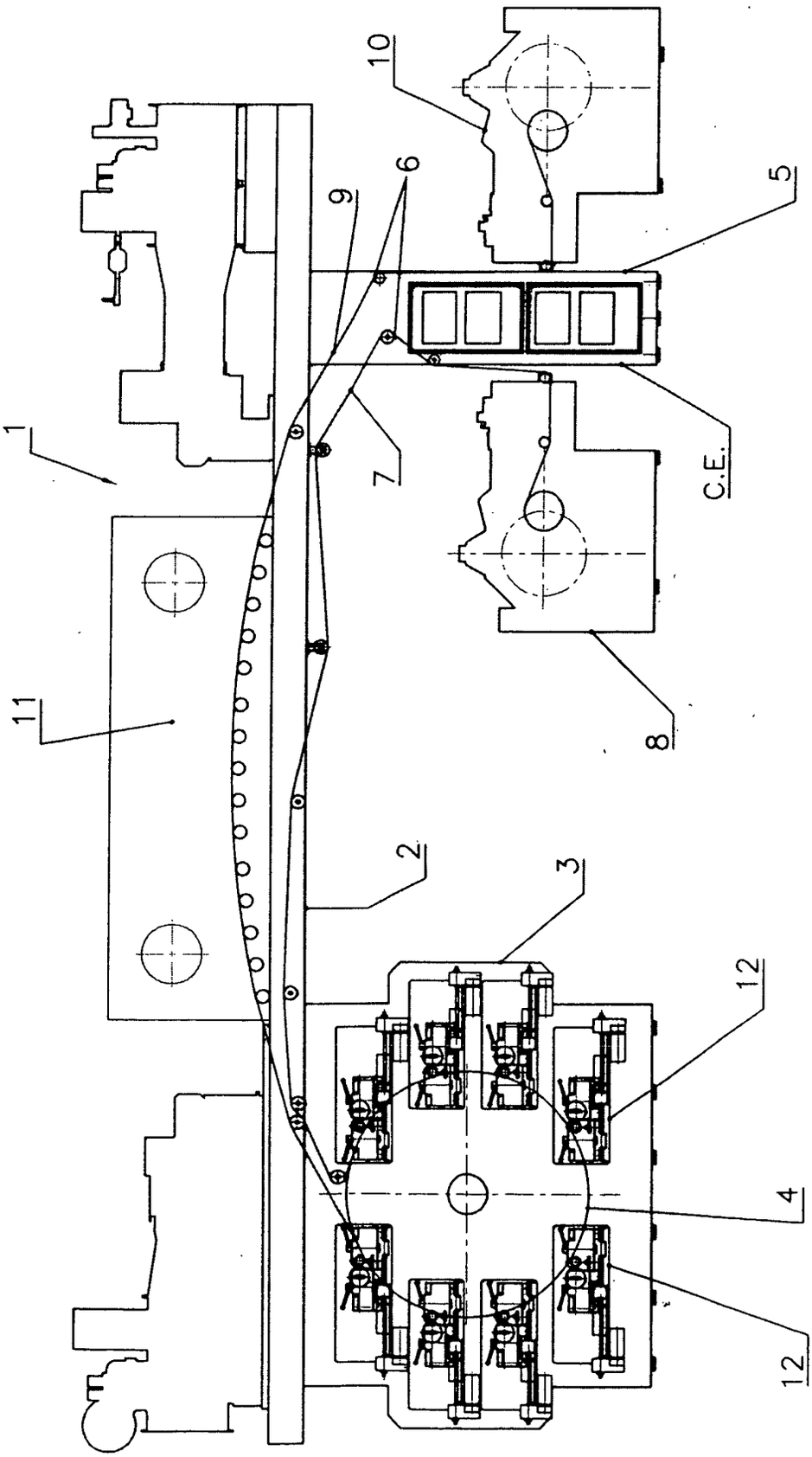

FIG.1

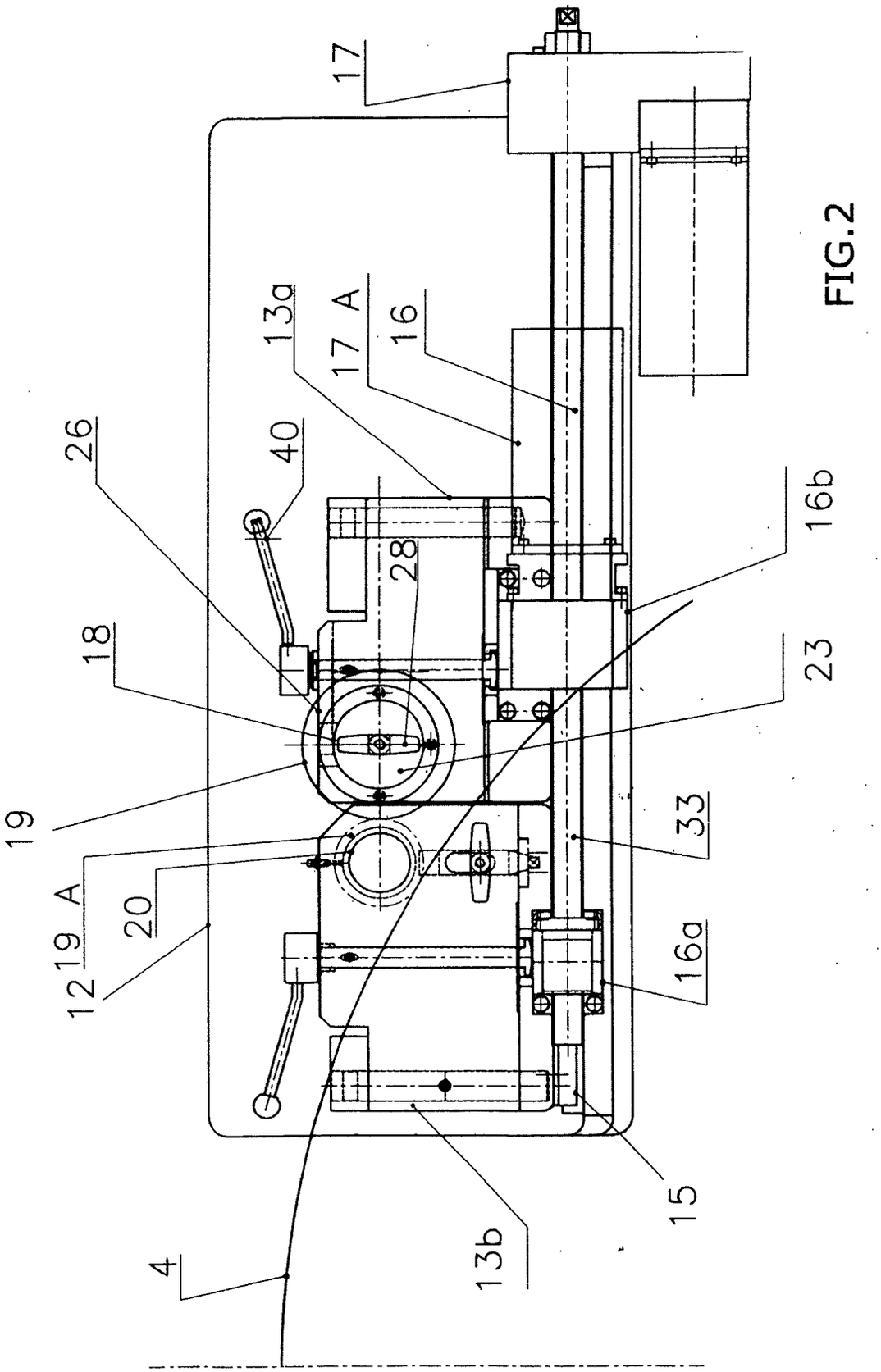

FIG.2

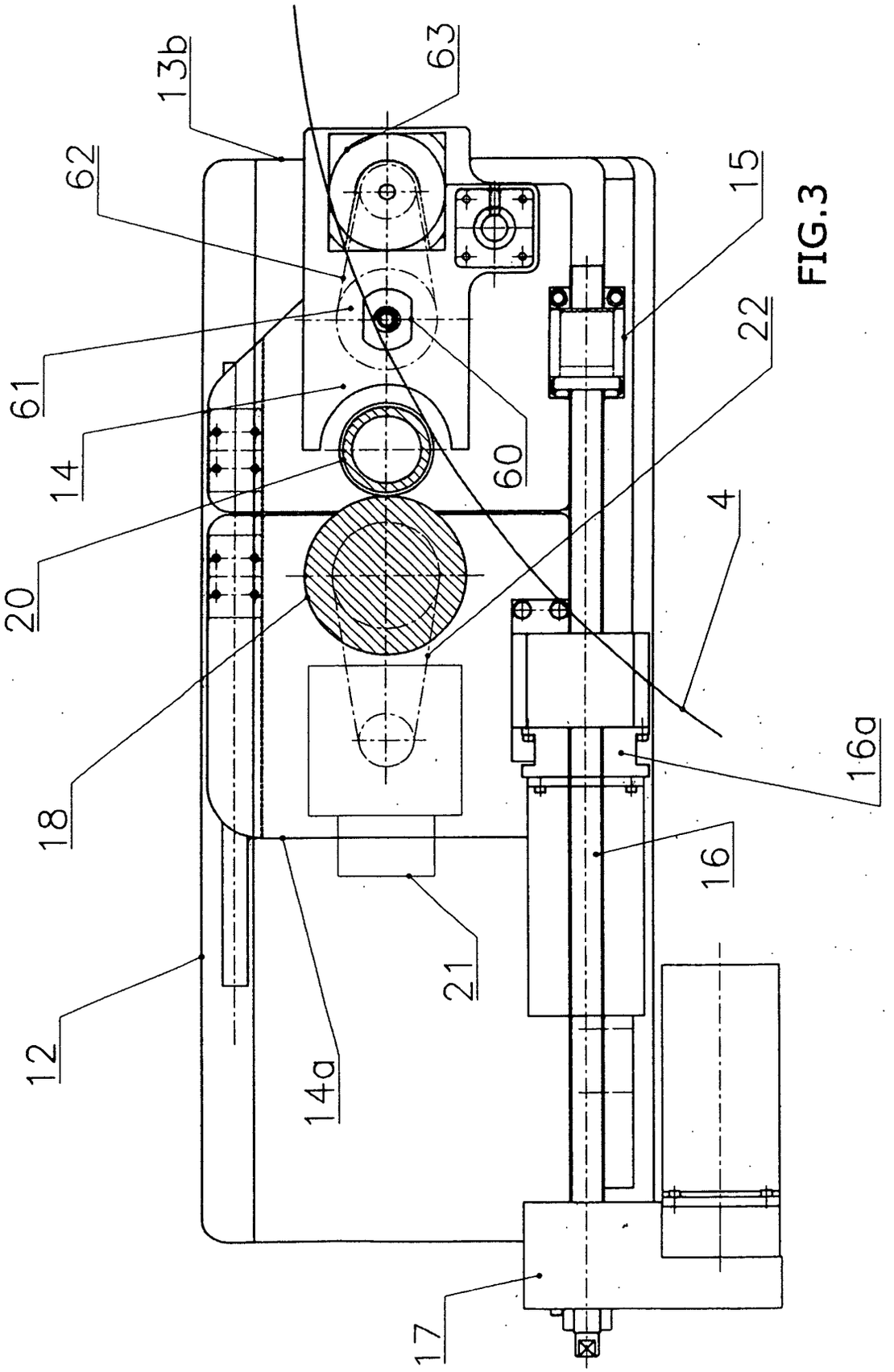

FIG.3

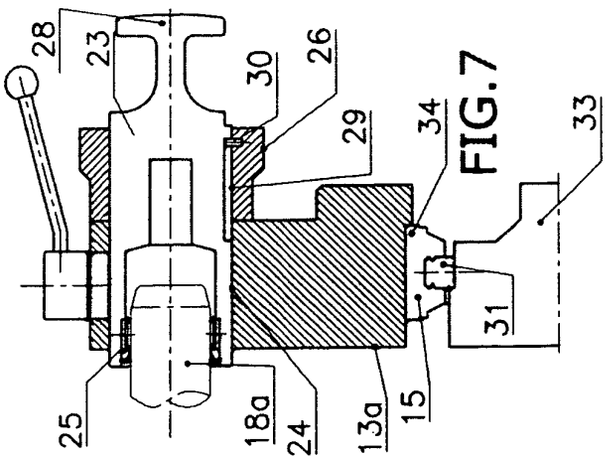

FIG.7

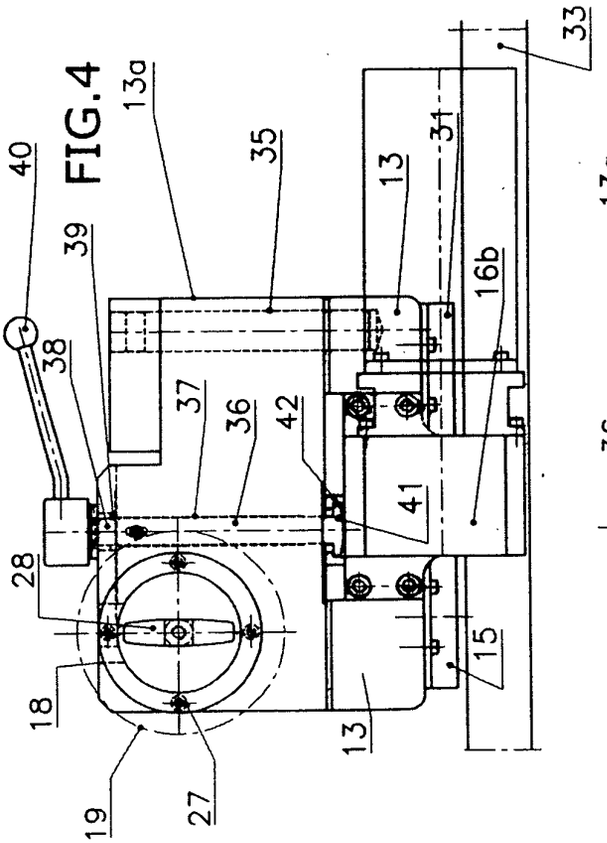

FIG.4

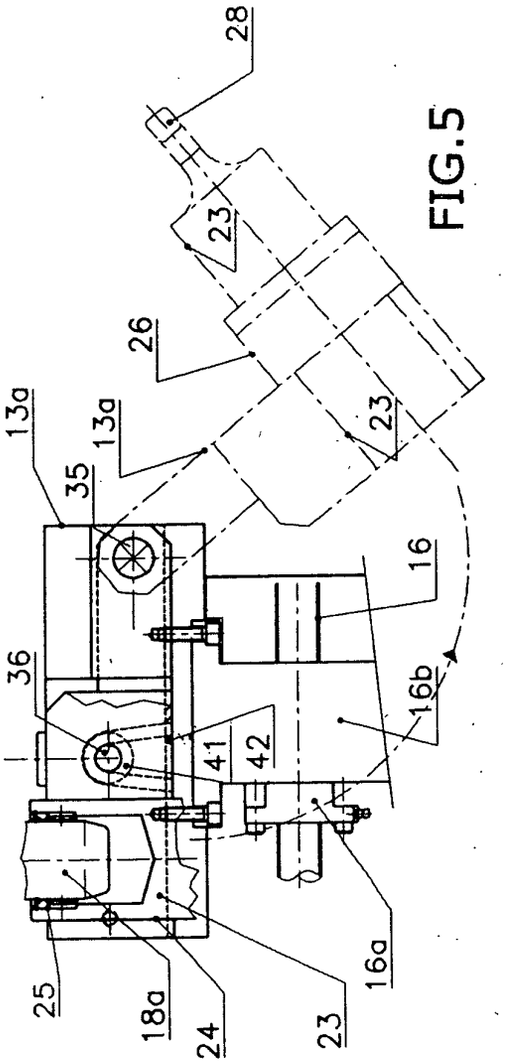

FIG.5

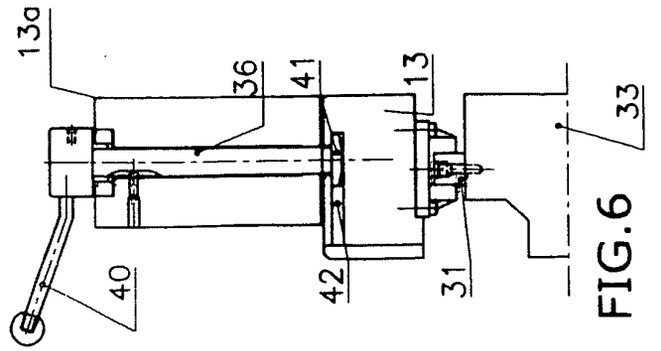

FIG.6

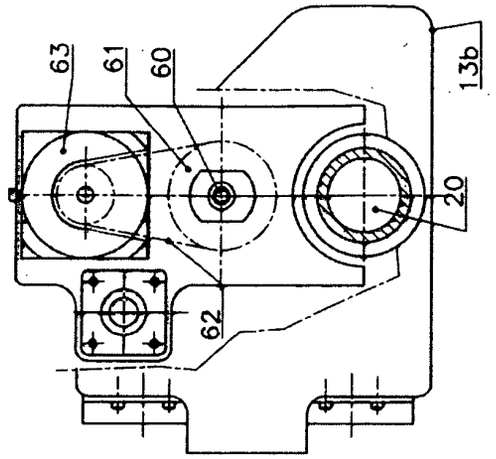

FIG.9

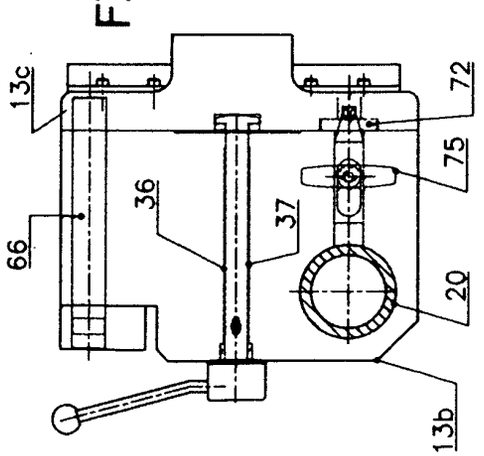

FIG.10

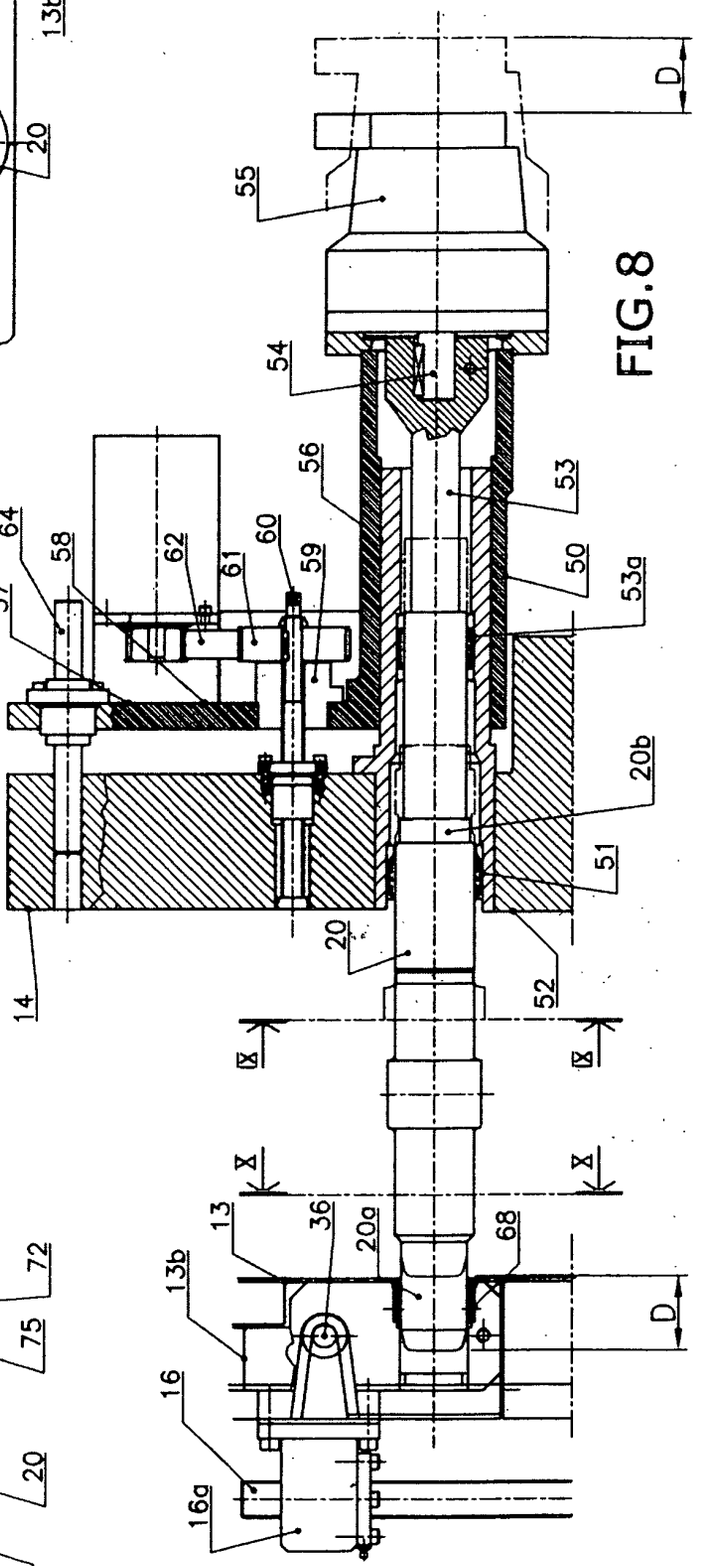

FIG.8

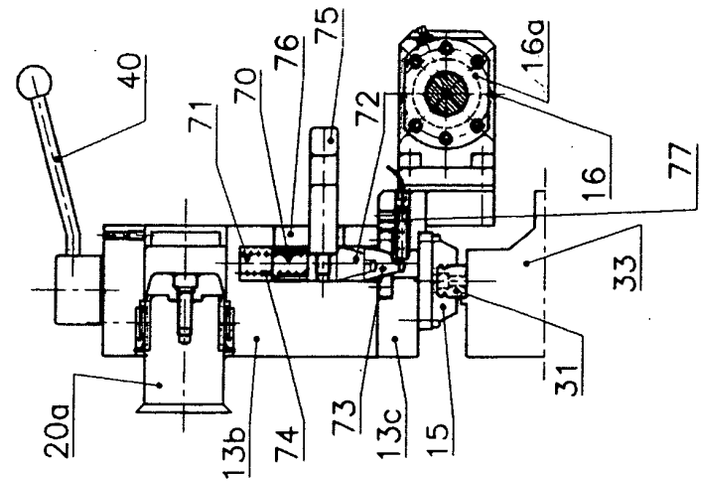

FIG.14

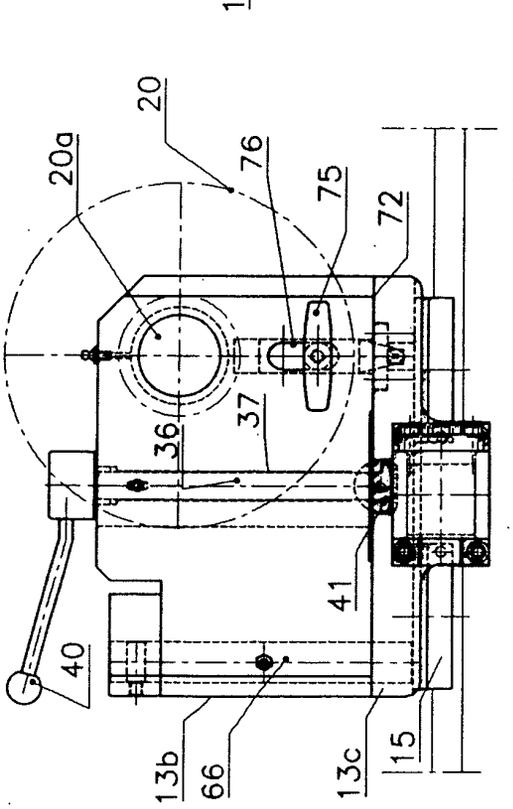

FIG.11

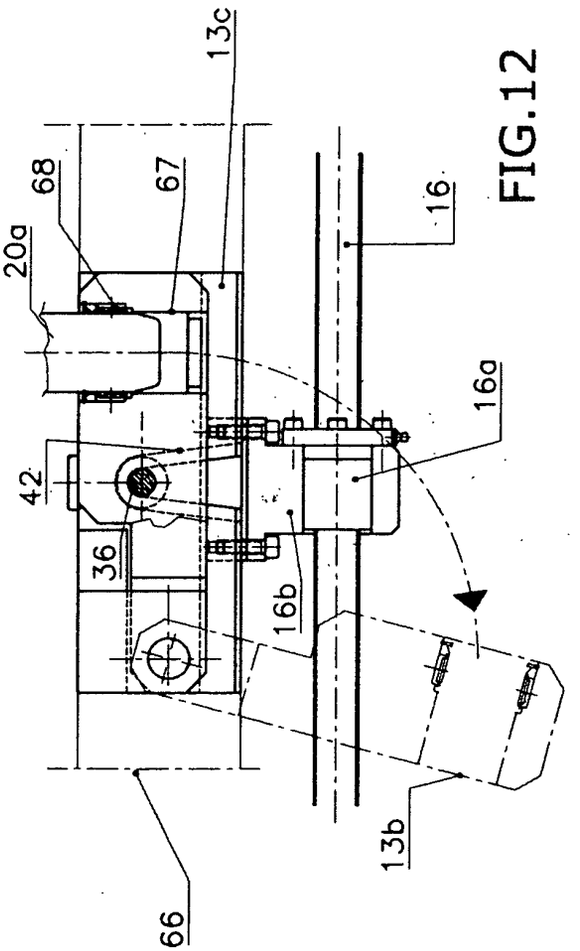

FIG.12

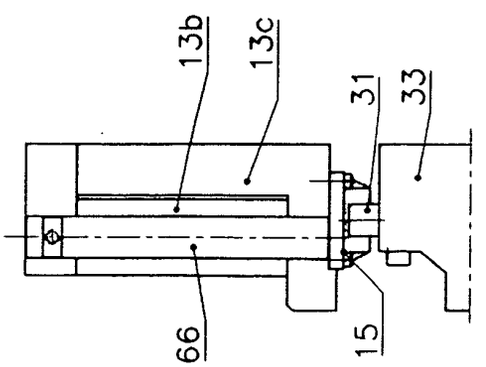

FIG.13