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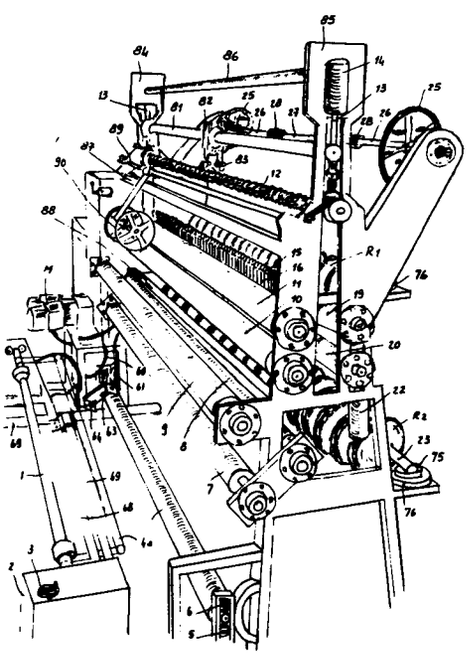
(54) Apparatus for cutting ribbons from rolls of textile fabrics made of heat weldable yarns.

(57) An apparatus for cutting ribbons from rolls of textile fabrics made of heat weldable yarns is disclosed, essentially comprising means (1, 2, 4, 5, 6) for unwinding the fabric with a controlled adjustable tension, means for controlling and synchronizing speed of the fabric driving rollers, means (63, 64, 68) for automatic pneumatic centering of fabric fed to rotary cutters, means for removing electrostatic charges present on the fabric surface and finally means for controlling pick up and winding tension of the cut ribbons and selvedges. This apparatus avoids jamming and entanglement of the ribbons, does not require the constant control of an operator, carries out the cutting operation at high speed, still maintaining a high degree of precision and reliability.

Figure 1 of the drawings illustrates the general structure and the main features of the apparatus.



EP 0 006 507 A2

"Apparatus for cutting ribbons from rolls of textile fabrics made of heat weldable yarns"

The present invention relates to an apparatus for cutting and winding ribbons obtained from rolls of textile fabrics made of heat weldable yarns.

It is known that heat weldable yarns are usually heat cut and there are already available some simple devices with rotary cutters to obtain ribbons from pieces of said textile fabrics, but these equipments require a continuous control of the operator to avoid jamming, entanglement and other drawbacks always resulting in time consumption and damages, to materials due to lack of effective systems for controlling and adjusting the several operations of the devices.

In addition to removing these drawbacks by a highly automated apparatus with rotary cutters, which does not require the constant control of an operator, the present

invention allows to carry out the operation of cutting ribbons at high speed, still maintaining a high degree of precision and reliability, the whole allowing a far greater output.

The particular features of the apparatus for cutting ribbons according to the present invention essentially comprise means for unwinding the fabric with a controlled adjustable tension, means for controlling and synchronizing speed of the fabric driving rollers, means for automatic pneumatic centering of fabric fed to rotary cutters, means for removing eletrostatic charges present on the fabric surface and finally means for controlling pick up and winding tension of the cut ribbons and selvedges.

In the following detailed description of a preferred embodiment of the apparatus according to the present invention, the main particular features will be pointed out, besides the additional features which are also to be considered for carrying out some operations in an optional manner; also the operation of the apparatus will be described and the various advantages obtainable will be pointed out too; it has to be noted that such a preferred embodiment is given merely as an illustrative example only and it has not to be construed as limiting the scope of the invention. With reference now to the accompanying drawings:

Fig. 1 is a perspective view of the entire apparatus according to the principles of the present invention;

Fig. 2 is a rear view of the apparatus, particularly showing the rollers for winding the cut ribbons and selvedges;

Fig. 3 is a diagram of the apparatus feed showing the complete processing path from the roll to the ribbons;

Fig. 4 is a diagram of the connection of gearing controlling feed and cutting of ribbons and also cutting and recovery of selvedges;

Fig. 5 is a diagram of the connection of gearing controlling recovery and winding of cut ribbons;

Fig. 5A is a diagram of the connection of two complementary parts of the shaft bearing the cores for winding cut ribbons;

Fig. 6 is a partially sectioned view of the dry friction adjustable coupling between driving pulley and shaft for winding cut ribbons or selwedges;

Fig. 7 is a diagram of the pneumatic servo control circuitry for automatic centering of the fabric piece;

Fig. 8 is a detailed view of the sensor of the pneumatic control circuit for centering the fabric;

Fig. 9 is a diagrammatic detailed view of the system for supporting one of the shafts on which cut ribbons are wound;

Fig. 10 is a schematic and sectioned view of the shaft bearing the assembled rotary cutter and relevant accessories;

Fig. 11 is a sectional detailed view of a cutter element;

Fig. 12 is a detailed view showing the system for keying single cutters or cutter groups on the rotary shaft;

Fig. 13 is a diagrammatic view of a part of the system comprised of rotary cutters, spacers, tensioning rollers and a shaft for winding cut ribbons;

Fig. 14 is a detailed view of a tensioning roller and the corresponding pretensioning spring;

Fig. 15 is a view of the device consisting of a proximity rod and rotary roller for removing electrostatic surface charges of the fabric; and

Fig. 16 is a fragmentary view of the console for controlling the device for removing the electrostatic charges.

In the course of the following detailed description of the various elements of the apparatus reference will be made to one or more of the Figures 1-16 showing said elements, but it is obviously also possible to check their relative arrangement and cooperation by contemporaneously looking at the general view of Fig. 1.

Fig. 3 shows the traveling path of the fabric in the apparatus. Roll B of the fabric to be cut is placed on an unwinding roller 1 supported in a particular moving frame for automatic roll centering, which will be better described hereinafter with reference to Figures 7 and 8.

At this time it is necessary to point out that the unwinding roller 1 is provided with a pneumatic brake 2 which puts the fabric under tension while being unwound: the rate of this action is controlled through the adjustment handwheel 3. The brake for the unwinding roller may also be provided of the disc type, like those for motor vehicles. A manual pressure regulator (not shown) is coupled with the brake and may be preset on the described load.

From the unwinding roller 1, fabric T being unwound from roll B, is directed downwardly to pass around a dandy roller 4 balanced between spring 5 and countersping 6, so as to make uniform the fabric feed and remove the shake caused by the roll unwinding.

The fabric T is then directed upwardly to alternately pass around the tensioning rollers 7, 8 and 9 having the purpose of perfectly stretching the piece, and finally comes to the pair of driving rollers 10 and 11 both with variable speed, whose mechanical control will be hereinafter described with reference to Fig. 4.

The fabric T then goes horizontally to the cutting operation: the cutting station is formed by a cutter holding shaft 12, whose particular structure will be described with reference to Figures 10, 11 and 12; such a shaft is urged downwardly in the cutting position or raised therefrom by means of rods

13 of two pneumatic control jacks 14 arranged at the ends of said cutter holding shaft 12.

The up and down motion of the cutter holding shaft 12 could also be controlled by other mechanical means, e.g. by a rack 91 shown in Fig. 4, moved by a sprocket 92 controlled by a motor (not shown), or by a worm screw system, also controlled by a motor, or other equivalent means.

On the opposite surface, the fabric is urged against the cutters by counterblades consisting of ball bearings 15 whose pressure contact is given by springs 16, comb-like mounted on an adjustable bearing bar.

As it is well known, the cutting operation of these textiles made of heat weldable yarns is carried out in the hot condition, i.e. the cutters of the shaft 12 are heated in a manner to be described.For some kinds of fibers, in order to avoid that the ribbons, after the cutting operation effected by the rotary cutters by melting the textile material, are again welded together, it is necessary to provide immediately after the cutting station, a set (Fig. 13) of spacing severing blades 17, holding apart the just now cut ribbons, just as much as necessary so as the separtion of the ribbons becomes definitive; in fact after the heat cutting operation, the edges of the ribbons are hardening and it is sufficient to keep them apart until their temperature is higher than the adhesion

temperature.

The individual cut ribbons are now being stretched by the contact with a ball bearing 102, supported by a structural bar 103 with square section, axially tensioned by a spring 104 arranged inside said bar.

After an idler roller 18 for horizontal alignment of the fabric, said fabric now cut into ribbons, goes downwardly passing between a driving roller 19, synchronized with the motion of the driving rollers 10 and 11 and controlled in a manner which will be hereinafter described with reference to Fig. 4, and a movable counterroller 20 which may be detached from contact with roller 19 by rods 21 of a pair of hydraulic jacks 22 arranged at its ends, so as to be able to introduce the tip of the piece at the beginning of processing a new fabric roll. Slightly before the contact with roller 19 there is the bar 25a for removing electrostatic charges built up on the surface of the fabric in the course of the operative cycle.

The antistatic system illustrated in Fig. 15 in one of its possible embodiments, consists of a rectangular bar 25a controlled by a feeder 106 diagrammatically shown in Fig. 16; such a bar when placed close to the cut ribbons, discharges to the ground network the electrostatic charges built up in the course of the operation. The adjustment of the position of bar 25a close to roller 19 is carried out by hand adjustment

of rod 19b being securely fixed to angle 19c connected with the apparatus frame by a bolt and slot system 19d, also to be adjusted manually. The feeder illustrated in Fig. 16 is provided with a control 104 of the voltage and an on-off switch 105. The system is contained in a box 106 having openings 107 for aeration of the electronic components. The main switch 108 of the apparatus is also shown in Fig. 16.

It is to be noted that the idler guide rollers 7,8,9 and 18 as well as the dandy roller 4 have generally a smooth metal surface, while the surface of the driving rollers 10, 11 and 19 and its counterroller 20 is made of rubber or other material adapted to guarantee a sufficient driving grip on the fabric, however without damaging it.

Coming out from the nip between driving roller 19 and counterroller 20, the cut ribbons are alternately divided into two sets of ribbons N_1 and N_2 , which are directed to the winding shafts 23 and 24 respectively, forming two banks of ribbon rolls R_1 and R_2. The motion of the winding shafts 23 and 24 is controlled by the general control mechanism by means of the manually adjustable friction giving the desired winding pull, which must be lower than that of the rollers 10, 11, 19 so as not to damage the finished ribbons. This control system will be described in greater detail with reference to Figures 5 and 6.

The marginal waste bands of the piece or selvedges C are also picked up and wound into rolls R_3 on two reels 25 (Fig. 1) mounted on two interrupted shafts 26 fixed to the shoulders of the apparatus and joined together by connecting bar 27 clamped with bushings 28 (Fig. 1). Also the motion of the reels 25 and therefore of the shafts 26 on which they are keyed, is subject to friction to adjust the suitable winding tension which must be equal to or slightly different from that of the ribbons. The position of reels 25 on the shafts 26 may be varied according to the width of the piece which is being processed.

From the preceding description of the feeding system of the apparatus according to Fig. 3, it comes out in practice also its operation, so that the schemes of Figures 4 and 5 will now be described, illustrating the devices controlling the motion of the moving parts of the apparatus.

On the shaft of an electric control motor, which can be run in both directions of rotation, with built-in, manually or automatically adjustable speed variator (motor shown in Fig. 1 with reference character M) two coaxial gearwheels 29 (Fig. 4) and 30 (Fig. 5) are keyed. Gearwheel 29 controls the cycle of the feeding, cutting and selvedge picking devices, while gearwheel 30 controls the devices for winding the cut ribbons.

It will be described first the cycle of the devices of Fig. 4 driven by motor M through the gearwheel 29 which moving the control chain 31, drives a first gear 32 being fixed to driving roller 11 and also coaxial with gear 33 and gearwheel 34.

The function of gear 33 is to be always meshed with the underlying gear 35 which is fixed to the driving roller 10 so that the motion is transmitted to the latter. It is to be noted that the pitch diameter of gears 33 and 35 is greater than the diameter of the corresponding rollers 11 and 10 so that these latter are spaced as it can be seen in Fig. 3.

Gearwheel 34 has the function of trasmitting motion through a short chain 36, to sprocket 37 being coaxial and fixed to gear 38, which is a simple transmission gear but drives gear 39 when it is lowered in its operative position by rod 13 of the pneumatic cylinder 14. The contact between gears 38 and 39 causes the rotary cutters to turn as gear 39 is just fixed to the cutter bearing shaft 12.

The control chain 31 transmits motion also to gear 40 fixed to the driving roller 19. As gear 40 has the same pitch diameter of gears 33 and 35, it is clear that driving rollers 10 and 11 and driving roller 19 have all the same speed and therefore the same advancement speed is obtained

for both the fabric feed and the ribbon pick up.

After a chain stretcher 41, motion transmitting chain 31 passes on gear 42 controlling shaft 26 for picking up the selvedges, through an adjustable clutch which will be described hereinafter. Then the control chain 31 completes the loop returning to the gearwheel 29.

With reference now to Figure 5 it is to be noted that gearwheel 30 controls only a second chain 43 moving gears 44 and 45 driving through an adjustable clutch the winding shafts 23 and 24 for the sets of cut ribbons N_1 and N_2 and then returns through a chain stretcher 46 to the gearwheel 30.

Both shaft 26 for picking up the selvedges and the winding shafts 23 and 24 for the cut ribbons are not rigidly moved by the corresponding gears controlled by the chains driven by the motor, but through a coupling with adjustable clutch which is now being described with reference to Fig.6.

Shaft 26 (as well as shafts 23 and 24) receives motion from gear 42 (or gears 44 and 45 respectively) through a friction disc 47 interposed between a plate 48 fixed to shaft 26 and a plate 49 fixed to gear 42. The torque transmitted by the clutch may be adjusted by varying the pressure of discs 49 and 48 on the friction disc 47; this is effected by screwing the control wheel 50 on the

partially threaded shaft 51, on which gear 42 is idler; this screwing presses spring 53 supplying through the thrust bearing 52, the axial force required for motion transmission. Shaft 26 for picking up the selvedges rotates at a speed which is slightly higher than that of shafts 23 and 24 so that the selvedges are undergoing a major part of the pull.

The automatic system for centering the piece is now illustrated, as it is diagramatically shown in Fig. 7; this system is made by a pneumatic servo control device with high pressure primary circuit (illustratively about 6 atm) and low pressure secondary circuit (illustratively about 0.8 atm). In Fig. 7 the high pressure primary circuit is indicated with solid thick lines and the low pressure secondary circuit with phanton thin lines.

From a compressor 54 high pressure air filtered by filter 55 continuosly feeds an alternative distributor 56 which is controlled by a commutator 57, whose function will be explained below, and can supply high pressure air either to line A or line B, each line being connected to one of the two chambers of a double acting pneumatic cylinder 58.

High pressure air continuously feeds also a pressure reducer 59, from which starts the low pressure secondary circuit. From the reducer, low pressure air passes through

a first leg 60 directly to commutator 57, and through a second leg 61 with cutoff cock 62 (when it is desired to exclude control during some control move) to an outlet nozzle 63, which is mounted in such a way as to be arranged upon the edge of fabric T being supplied from unwinding roller 1 to idler roller 4a and to dandy roller 4 (Fig.1). At the beginning of the operation the positioning of nozzles 63 and 64 may be made according to the width of the piece of fabric to be cut. The preliminary centering operation of the nozzles on the edges of the pieces is made manually, with pneumatic circuit switched off, by cunscrewing the threaded knob 63a and sliding bushing 64a on profile 62a shown in Fig. 8; when the pneumatic control system is started, the fabric will be kept always centered in the preset initial reference position, in the manner which is now to be described.

When the fabric is not on the path of the air blow coming out from nozzle 63 and therefore does not break it, said low pressure air blow is picked up by funnel 64 and through line 65 this air arrives at commutator 57; when commutator 57 receives air both from line 60 and line 65, it moves the valve of the alternative distributor 56 so as to supply high pressure air to line B and therefore move piston 66 within cylinder 58 to the left, so as to draw

through rod 67 the movable frame 68 bearing the unwinding shaft 1 (see also Fig. 9) until the edge of fabric T is brought to break the air blow between outlet nozzle 63 and picking up funnel 64.

The interruption of the low pressure air flow between nozzle 63 and funnel 64 being so effected, the commutator 57 will receive air only from line 60 and therefore it moves the valve of the alternative distributor 56, which will supply high pressure air to line A, causing piston 66 jointly with rod 67 and movable frame 68 to move to the right, until the connection between outlet nozzle 63 and picking up funnel 64 is again uncovered. To sum up, the roll B is in a condition of continuous unstable oscillation which allows however that it is always centered in an optimal way. It is also to be noted that the movable frame 68 runs inside a fixed frame formed by slides 69 partially shown in Fig. 1.

Fig. 9 shows the support system for the shafts on which cut ribbons are wound. Shaft 23 (or 24) must be able to swing easily to the outside of the apparatus, when the cylinder bearing the cores for winding the cut ribbons must be extracted. To this purpose the shaft has a lip-slip end 70 to be joined to the complementary end 71 of a short supporting arm 72 fixed to the shoulder of the

apparatus. A sliding sleeve 73 can cover the joint of the two lips 70 and 71 and be fixed in such a position by knob 74.

Once the end 70 is disengaged, shaft 23 may be swung outwards for extracting the rolls of ribbon, its other end being pivoted to the apparatus through a support 75 consisting of a moving plate rotating on the underlying plate 76 which is fixed to the other shoulder of the apparatus by means of a crown of thrust bearing balls interposed inside it.

In Figs. 10, 11 and 12 the structure of the cutter bearing shaft 12 is shown in greater detail. Said shaft is hollow and inside it there is a longitudinally extending, helically wound electric resistance 77 which is connected at both ends with a rotary slip ring 93 fixed on shaft 12, said slip ring 93 picking up current from a relevant brush 94 receiving power through a lead 95 from a current regulator (not shown) of a conventional type, so as to change the working temperature according to the kind of textiles material being processed, speed and other parameters. The resistance is of a particular miniaturized type with winding of very little diameter between 10 and 30mm.

On shaft 12 rings 78 (Fig. 11) are keyed; a cutting blade 79 with circular sharp edge is machined on each ring

78. Also these rings 78 are miniaturized with diameters of 30 to 60 mm and made of materials which are particularly suitable for a continuous service under heavy conditions due to the mechanical stresses discharged on them.

Spacers 80 are keyed on the shaft 12 between rings 78. It is obvious that shaft 12 may be replaced by other similar cutter bearing shafts having cutters with blades of different height or different pitch according to the width of the cut ribbons desired to be obtained.

In order to overcome the upward thrust exerted by counterblades 15 and to avoid tendency to bowing of the shaft 12 due to the working temperature, the cutter bearing shaft 12 is held pressed in the cutting position by a thrust bearing system connected to said shaft 12 and therefore also supported by rods 13 of penumatic cylinders 14.

Such a thrust bearing system which can better be seen in Fig. 1, consists of a shaft 81 on which one or more stands 82 supporting bearings 83 pressing on the cutter holding shaft 12.

The system of locking the cutting rings or blades 78 is implemented as shown in Fig. 12. Rings 78 inserted on shaft 12 are locked by means of a locking screw 97 or the like. At the other end of shaft 12, after the set of rings 78 and

before the fixed ring 96, a pair of rings 98 and 99 forming a turnbuckle, the one having a protruding threaded stem 100 screwed in a corresponding thread of the other; by holding still one ring and turning the other by means of suitable tools engaged in slots 101, the cutting rings 78 are tightened and tensioned, locking them on the cutter holding shaft 12.

At last in Fig. 1 one can also see the general structure of the apparatus, comprising a sturdy frame consisting of two shoulders 84 and 85, joined together by several cross-pieces, of which those indicated with reference numerals 86, 87 and 88 can be seen in the drawing. On a rule 89 it is also arranged a length counter and indicator 90 which is being rotated by the tensioned fabric just before the cutting station, and therefore precisely counts the length of the processed material.

Many variations, modifications, additions and substitutions may be obviously resorted to the apparatus of the present invention, without departing however from spirit and scope of the invention, as defined in the appended claims.

Claims.

1. An apparatus for cutting ribbons from rolls of textile fabrics made of heat weldable yarns by means of a set of rotary blades heated supported by a shaft, characterized by the fact of essentially comprising means for unwinding the fabric with a controlled adjustable tension, means for controlling and synchronizing speed of the fabric driving rollers, means for automatic centering of the fabric fed to the rotary cutters, means for removing electrostatic charges, present on the fabric surface and means for controlling pick up and winding tension of the cut ribbons and selvedges.

2. An apparatus according to Claim 1, characterized by the fact that said means for removing electrostatic charges built up on the cut ribbons, due to friction during the processing motion, consists of a proximity bar (25a) connected to ground network, arranged parallel to a driving roller (19), and controlled and fed by a console.

3. An apparatus according to Claim 1, characterized by the fact that said means for unwinding the fabric with controlled tension consist of an adjustable pneumatic brake (2) or disc brake acting on the unwinding roller (1) from which the fabric piece is being unwound as well as of a spring supported dandy roller (4).

4. An apparatus according to Claim 1, characterized by the fact that said means for controlling and synchronizing speed of the fabric driving rollers consist of a variable speed electric motor (M) driving through a first chain (31) the fabric driving rollers (10, 11) the cutting device and the selvedge pick up device and through a second chain (43) the devices for winding cut ribbons.

5. An apparatus according to Claim 3, characterized by the fact that the gears (33, 35) driving the fabric driving rollers (10, 11) arranged before and after the cutting station, and the gear (39) driving the cutter holding shaft (12), have all the same pitch diameter so as to impart the same speed to the correspondingly driven shaft and rollers.

6. An apparatus according to Claims 1 and 3, characterized by the fact that the device for picking up selvedges and the devices for winding cut ribbons consist of shafts (26, 23, 24) coupled to the corresponding gears (42,44,45) of the control chains (31, 43) through said means for controlling pick up and winding tension of the cut ribbons and selvedges.

7. An apparatus according to Claim 1 and 6, characterized by the fact that said means for controlling pick up and winding tension of cut ribbons and selvedges consist of mechanical clutches (47, 48, 49) hand adjustable by

preloading elastic members such as springs (53), whereby winding tension and speed of selvedges is higher than that of cut ribbons.

8. An apparatus according to Claim 1, characterized by the fact that said means for automatic centering of fabric fed to the cutting station, consists of a pneumatic control causing a double acting cylinder (58) to reciprocate, said cylinder being fixed to a movable supporting frame (68) for the fabric roll being unwound, whereby the fabric roll is kept centered.

9. An apparatus according to Claim 8, characterized by the fact that the pneumatic control comprises an alternative distributor (56) of air to both chambers of the double acting cylinder (58) controlled by a commutator (57) reacting to presence or absence of a pneumatic signal which is generated by the position of the edge of the fabric being unwound.

10. An apparatus according to Claim 1, characterized by the fact that the rotary cutters are associated with blades (17) for keeping the just cut ribbons separated and thereafter rollers (102) preloaded with inner spring (104) are provided for tensioning ribbons before the final winding operation.

11. An apparatus according to Claim 1, characterized by

the fact that one or more thrust bearing stands (82) are associated with the rotary cutters, in order to keep the cutter holding shaft (12) under pressure and aligned with the fabric to be cut.

12. An apparatus according to Claim 1, characterized by the fact that inside the cutter holding shaft there is an electric heating resistance (77) fed through rotary slip rings (93) and bushes (94) by a current regulator so as to change the cutting temperature.

13. An apparatus according to Claim 12, characterized by the fact that the electric resistance (77) is of a miniaturized diameter.

14. An apparatus according to Claim 11, characterized by the fact that the cutter holding shaft (12) can be lowered to the cutting position or raised to the inoperative position by means of a pair of pneumatic cylinders (14), a powered rack (91) or worm screw and like systems.

15. An apparatus according to Claim 1, characterized by the fact that the rotary cutters (78) are locked and rigidly fixed to the cutter holding shaft (12) by means of two fixed locking rings (96) and a pair of expansion rings (98, 99) which being screwed together like a turnbuckle tighten the cutters and lock them on the shaft.

16. An apparatus according to Claim 1, characterized

by the fact that the fabric guide rollers (7, 8, 9, 18) have a metal smooth surface.

17. An apparatus according to Claim 1, characterized by the fact that the fabric driving rollers (10, 11, 19,20) have a surface made of rubber or other material ensuring a minimum friction for moving the fabric.

18. An apparatus according to Claim 17, characterized by the fact that the driving roller (19) arranged after the cutting station is cooperating with a counterroller (20) which may be moved away from the contact with said driving roller for threading the tip of the fabric piece.

19. An apparatus according to Claim 6, characterized by the fact that the shafts (23, 24) for winding cut ribbons can be detached from one of the shoulders of the apparatus and swung outwardly relative to the other shoulder on which they are pivotally connected by means of a rotary support (75) provided with a crown of thrust bearing balls.

20. An apparatus according to Claim 6, characterized by the fact that the shafts (26) for picking up selvedges are two, each fixed to one shoulder of the apparatus and with a selvedge winding reel (25) that can be moved along the shaft, said shafts being connected to each other by a connecting bar (27).

Fig. 1

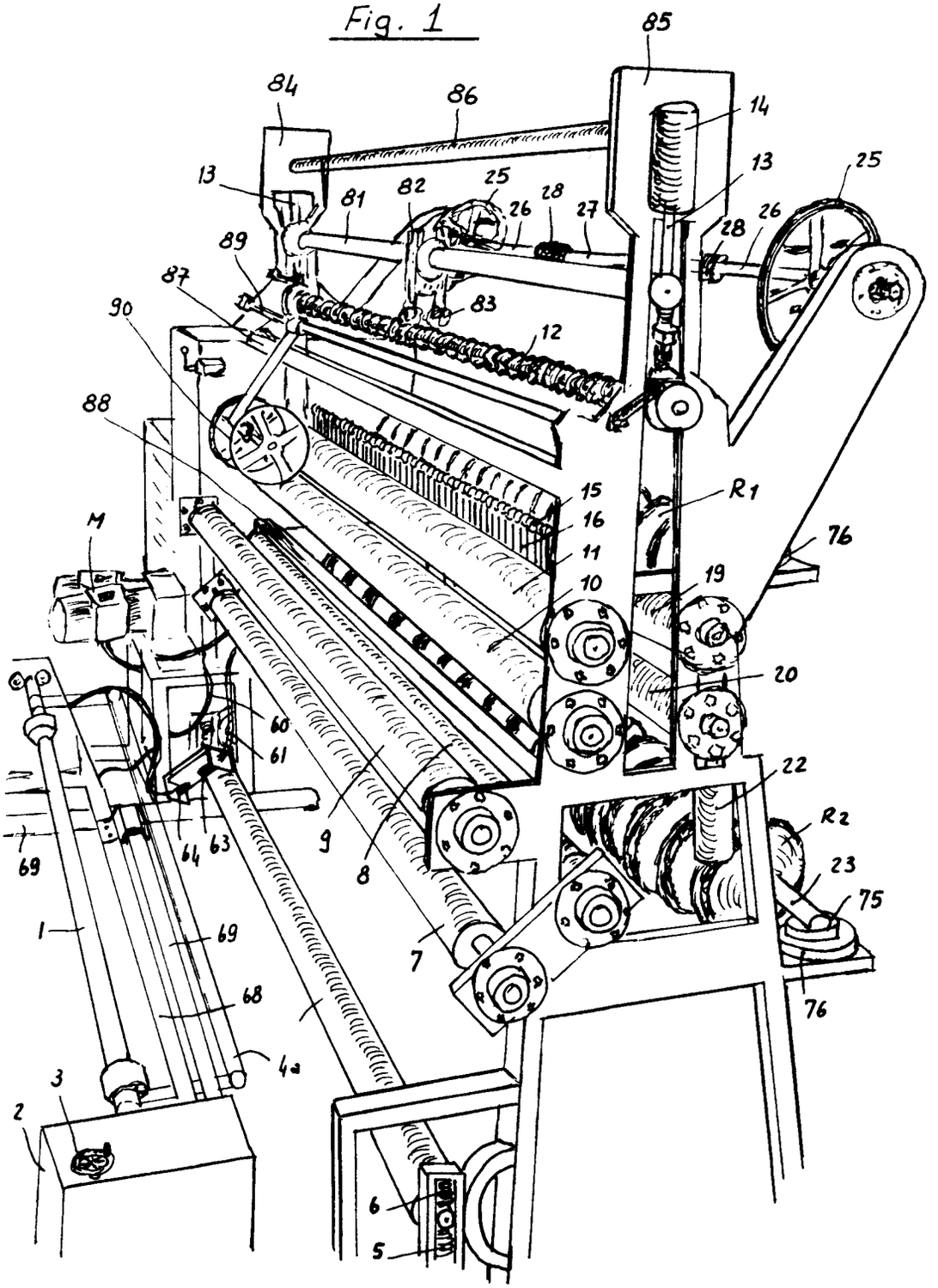

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Fig. 2

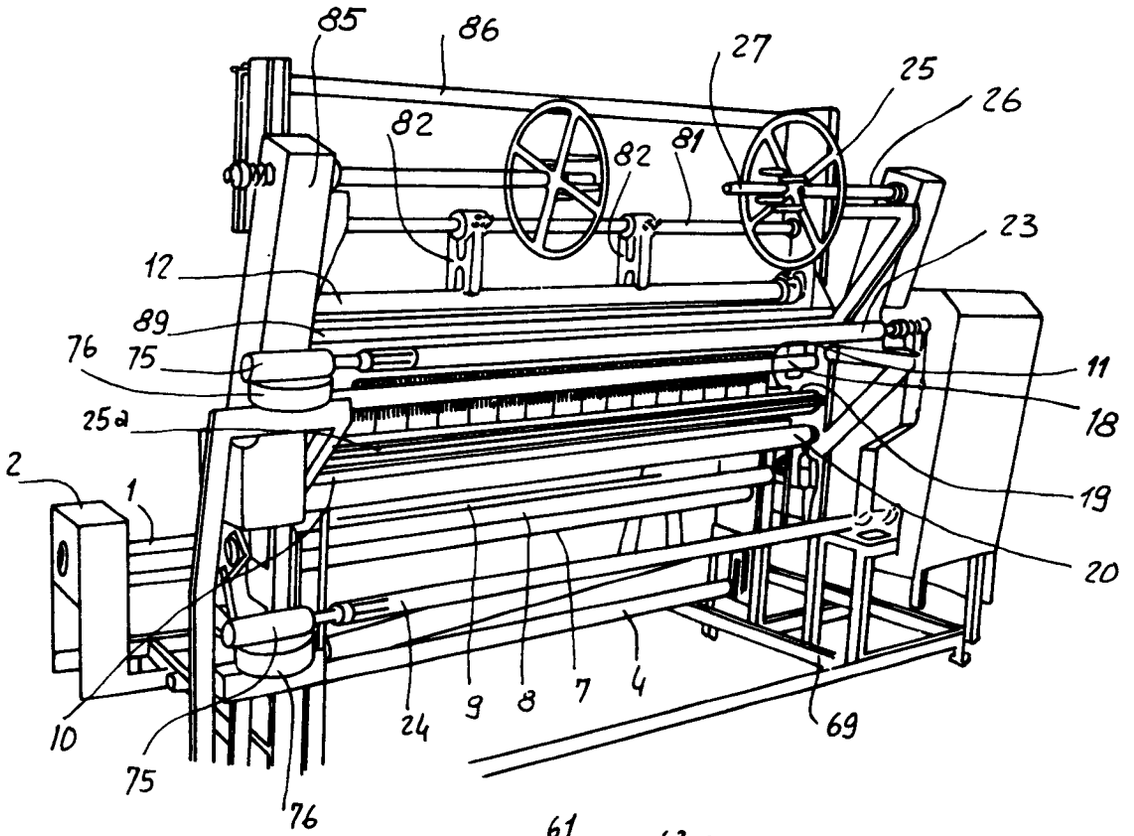
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Fig. 8

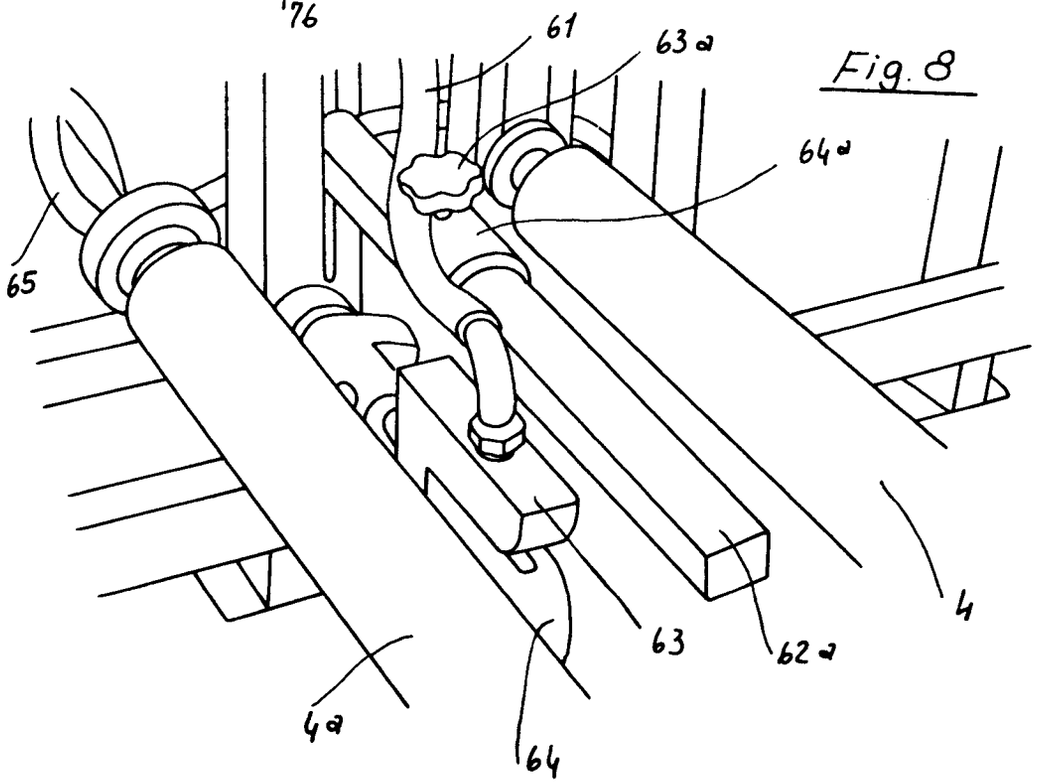
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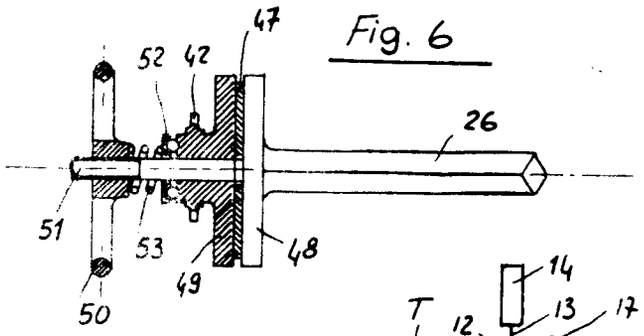
Fig. 6



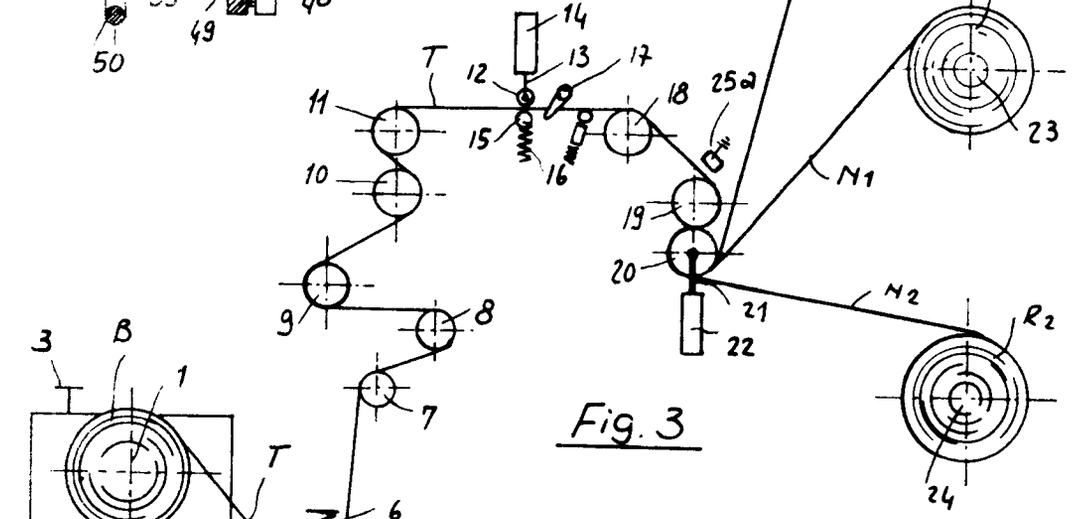


Fig. 3

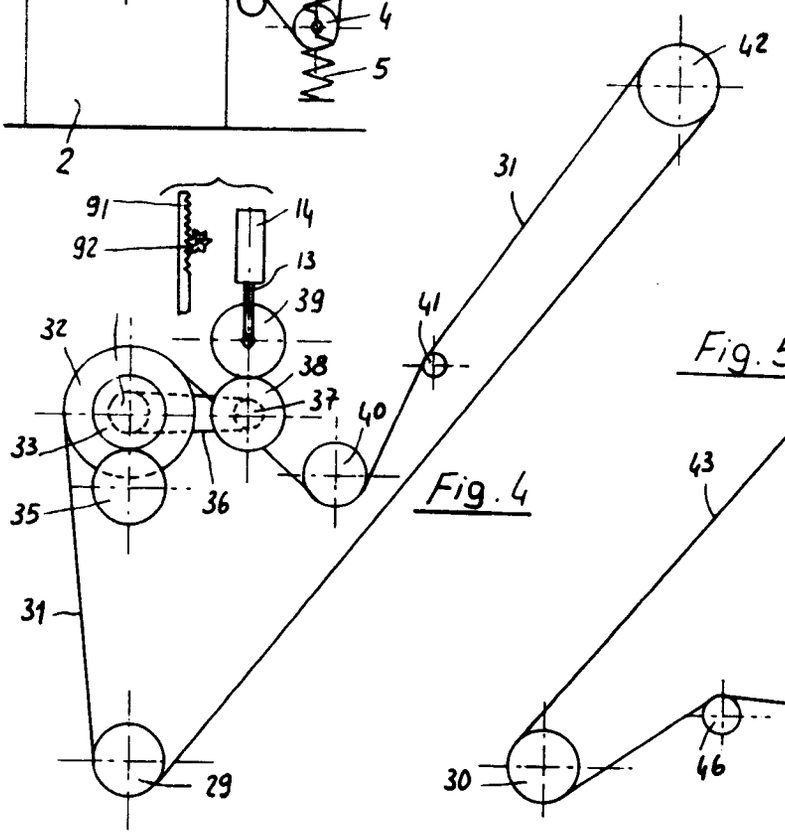


Fig. 4

Fig. 5

Fig. 7

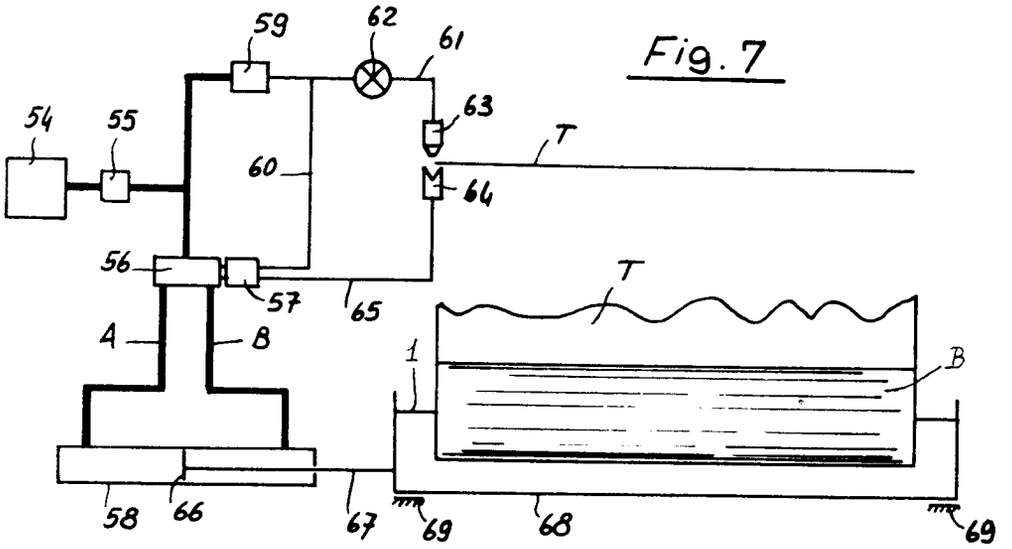


Fig. 5 A

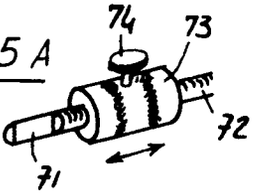


Fig. 9

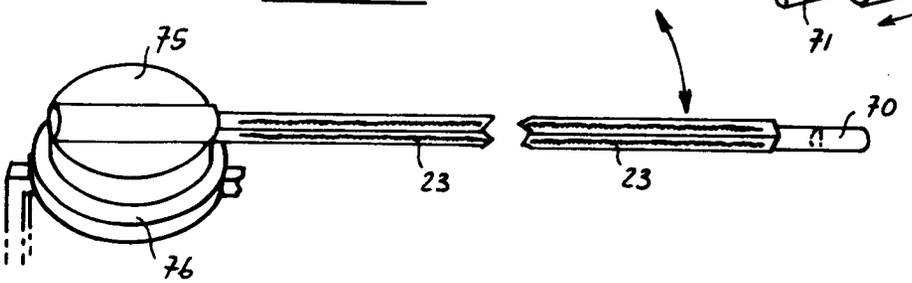


Fig. 10

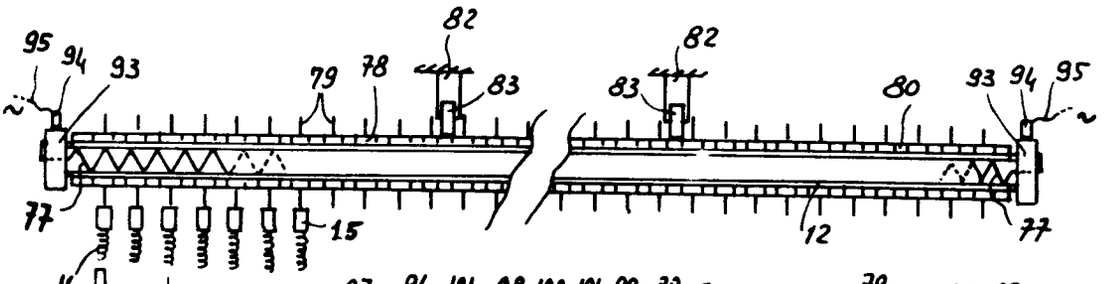
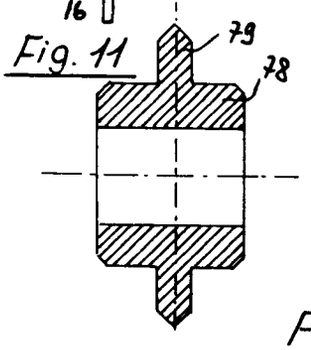


Fig. 11



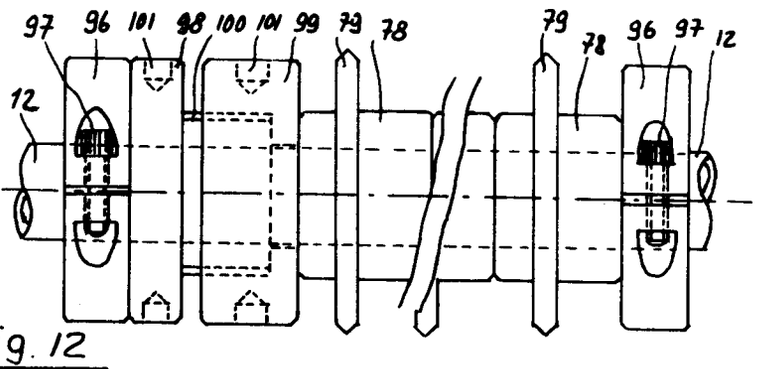
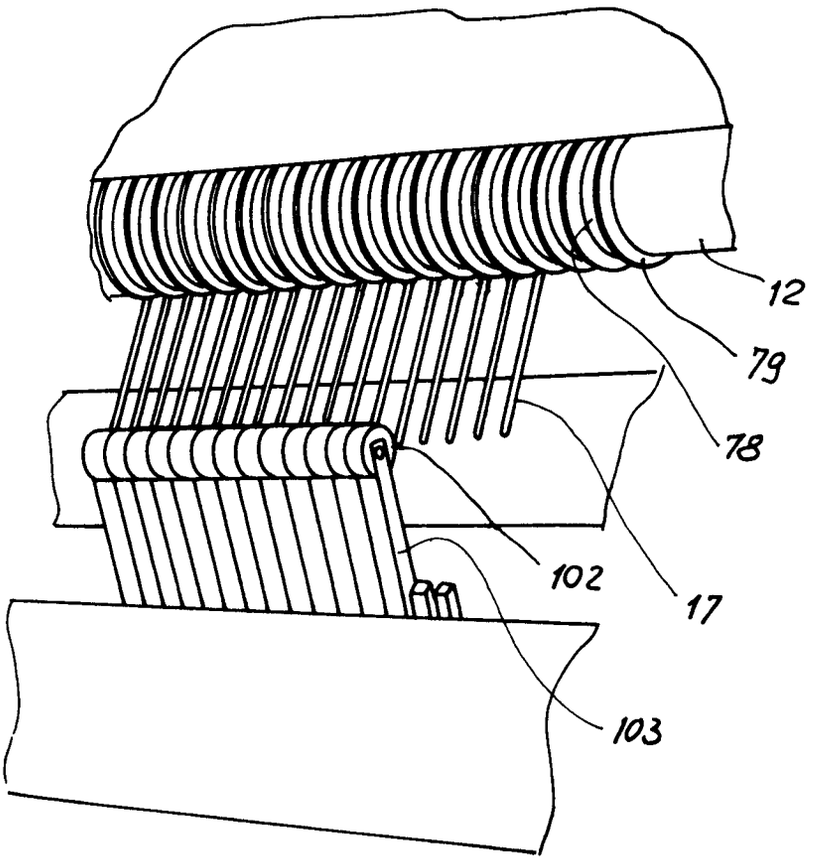


Fig. 12

Fig. 13



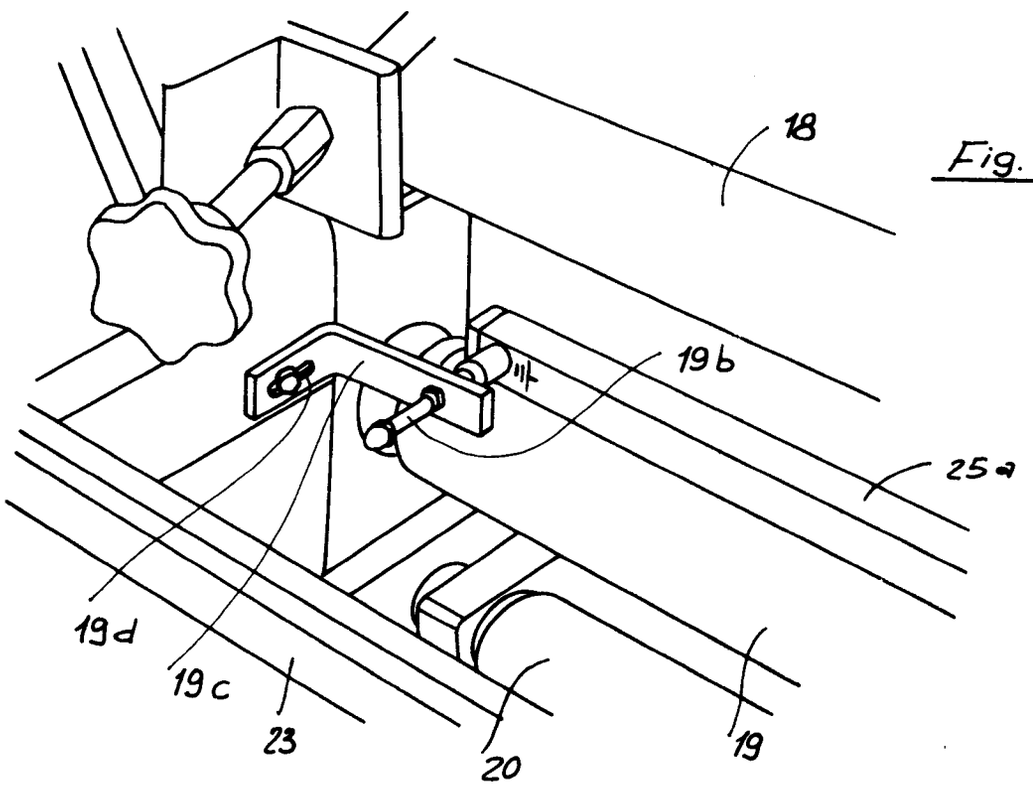


Fig. 15

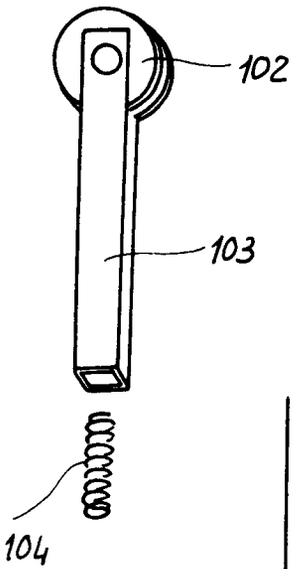


Fig. 14

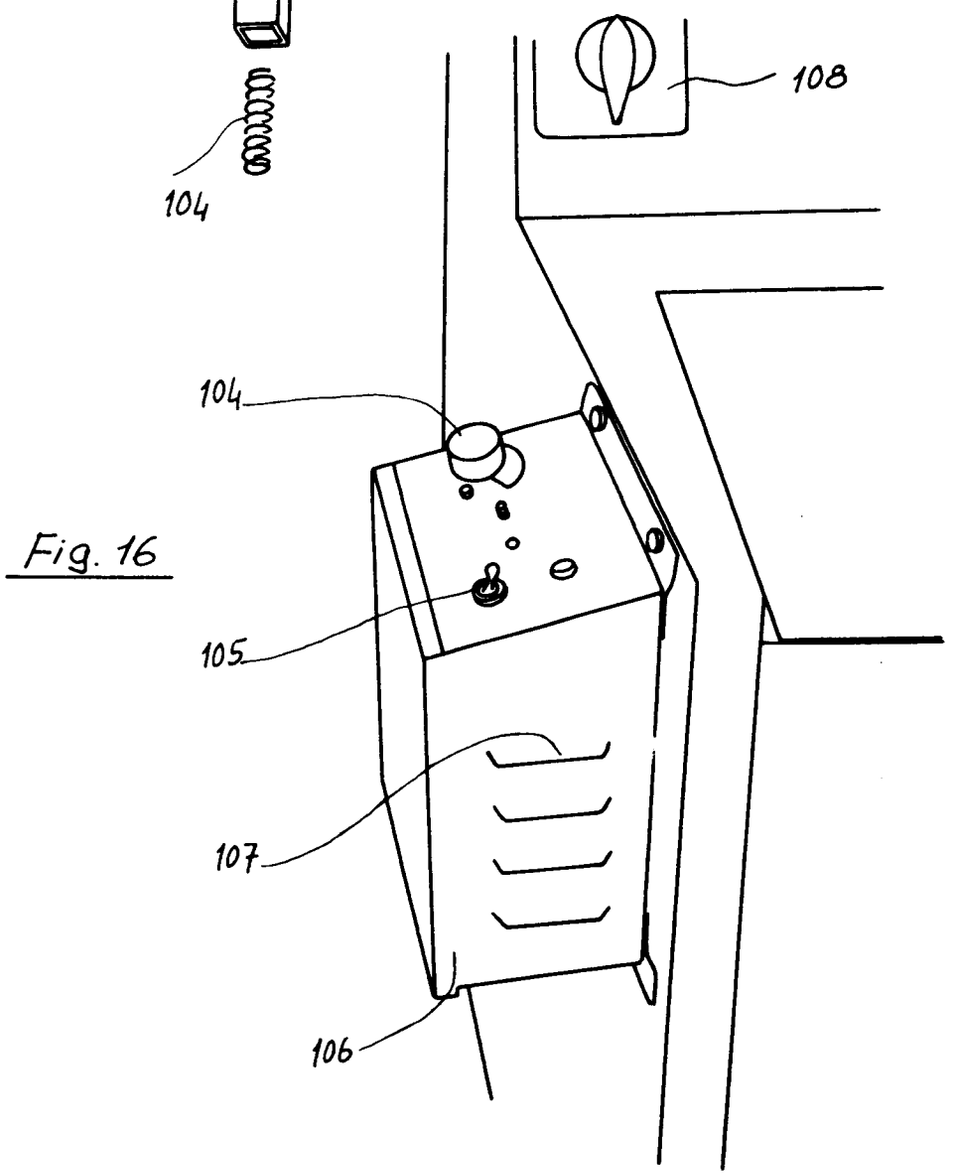


Fig. 16