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(54) Printer with a static electricity eliminator and a taking-up means for an ink ribbon slack.

(57) A printer which performs printing by abutting a printer head against a paper behind an ink ribbon while allowing the paper to pass between the ink ribbon and a platen roller and which moves said printer head backward when not performing printing , comprising a static eliminator means for eliminating a static electricity developing on the ink ribbon or the paper , and reel drive means for driving a take-up reel for taking up slack of ink ribbon when printer starts to operate.

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BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a printer which is provided in copying machines, facsimiles, printing equipment, and the like, and more particularly to a printer which performs printing by abutting a printer head against a paper behind an ink ribbon while allowing the paper to pass between the ink ribbon and a platen roller and which moves said printer head backward when not performing printing.

2. Description of the Related Art

As such printers, an unknown printer has been invented as shown in Figs. 1 and 2 (see specifications, U.S. Pat. No. 07/569019 and E.P. Pat. No. 90 115 818.8, in connection with prior application of the present applicant).

That is, Fig. 1 shows the printer when not performing printing. In a body 242 of an ink ribbon cassette 204 are provided members such as an ink ribbon 241, a rotatable thermal head 205, a supply reel 243 and a take-up reel 244.

Fig. 2 is a view of the ink ribbon cassette 204 when the printer is performing printing. A paper P has been supplied onto a platen roller 290, while the thermal head 205 has rotated downward to cause the ink ribbon 241 to project beyond the cassette 204, thereby pressing the ink ribbon 241 against the paper P. In that condition, a heating element of the thermal head 205 is energized to effect printing.

However, there has been a problem that, since the ink ribbon 241 uses the PET film as a base, a static electricity due to friction develops on the ink ribbon 241 and the paper P when printing is performed in such a manner as described above, whereby the ink ribbon 241 and the paper P after printed are conveyed while they adhere to each other, causing the ink ribbon 241 to move toward a discharge exit while being dragged by the paper P shown as Fig. 3.

Then when the printing is finished after the heating element of the thermal head 205 has been properly energized to effect printing as described above, as shown in Fig. 4, the thermal head 205 is moved upward, and the ink ribbon 241 having a slack is taken up by rotating the take-up reel 244 to eliminate the slack, thereby preparing the printing for the next paper P.

There is a case, however, where, before the ink ribbon 241 is taken up by the take-up reel 244 after the thermal head 205 has been moved upward, a trouble such as paper clogging(jam) may occur in a copying machine, causing the operation of the machine to be stopped while the ink ribbon 241 remains slack. In such a case, there is a problem that, if the copying machine starts to operate again, the copied and conveyed paper P will come in contact with the slack ink ribbon 241, causing the ink ribbon 241 to be damaged and the paper P to be stained with ink.

SUMMARY OF THE INVENTION

The present invention is a printer which performs printing by abutting a printer head against a paper behind an ink ribbon while allowing the paper to pass between the ink ribbon and a platen roller and which moves said printer head backward when not performing printing, wherein

static eliminator means for eliminating a static electricity developing on the ink ribbon or the paper is located near the place where the ink ribbon is in contact with the paper.

And the present invention is a printer which performs printing by abutting a printer head against a paper behind an ink ribbon while allowing the paper to pass between said ink ribbon and a platen roller and which moves the printer head backward when not performing printing, comprising;

start-possibility detection means for detecting the start-possibility of the operation of the printer assembly,

a take-up reel for taking up the ink ribbon,

reel drive means for driving the take-up reel, and

control means for driving the reel drive means based on the result detected by the start-possibility detection means to allow the reel to take up the ink ribbon.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1 through 4 are schematic sectional views of a printer of prior application to help explain the operation ;

Fig. 5 is a schematic sectional view of a copying machine in which one embodiment according to the present invention is used;

Fig. 6 is a perspective view of the embodiment;

Fig. 7 is a schematic sectional view showing mainly the embodiment;

Fig. 8 is a schematic perspective view of the embodiment;

Fig. 9 is a sectional view to help explain the operation of the embodiment;

Fig. 10 is a schematic sectional view showing mainly an embodiment the printer of another present invention;

Fig. 11 is a schematic perspective view of the embodiment;

Fig. 12 is a plan view of an ink ribbon cassette

of the embodiment;

Figs. 13 and 14 are schematic sectional views to help explain the operation of the embodiment; and

Fig. 15 is a flowchart showing the operation of the embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Fig. 5 is a schematic side view showing a condition that a printer as one embodiment of the present invention is used in a copying machine, where in a housing 1 as a body of the copying machine are provided an optical system 11 for forming an electrostatic latent image corresponding to a manuscript image on a photosensitive material 12a, an image processing section 12 for developing said electrostatic latent image to a toner image and transferring the toner image onto a paper supplied from a manual paper-feeding section 14, a paper-feeding cassette 15a or a paper-feeding cassette 15b, a fixing device 17 for heating and fixing the image on the copying paper, a printer 2 , a punching device 18 , and a paper conveying section 13 to convey a paper to a discharge tray 19.

The printer 2 described above will be explained in detail hereinafter.

Fig. 6 is a schematic perspective view of the printer 2, and Fig. 7 is a schematic sectional view of the inside of the copying machine showing mainly the printer 2. The printer 2 has a casing 3, an ink ribbon cassette 4 which is mounted removably to the casing 3 and houses a belt-like ink ribbon 41 described later, and a head supporting member 6 which is mounted rotatably to the casing 3 and supports a thermal head 5 as an example of printer heads. The supporting member 6 is fixed to a spindle 61, and is rotatable through an operating strip 86 mounted on one end of the spindle 61 by the rotation of a cam 82.

The casing 3 is equipped with a box 31 whose top side is released, and side plates 32a and 32b which are fixedly secured to the both ends of the box 31. The side plates 32a and 32b have a substantially triangular shape, and are mounted by a spindle 34 at the lower end thereof directly or indirectly to the housing 1 of the copying machine assembly. Thus, the casing 3 is pivotally moved with the spindle 34 as a center.

The ink ribbon cassette 4 is equipped with the ink ribbon 41, a body 42, and a supply reel 43 and a take-up reel the both of which are mounted parallel to the body 42, so that the ink ribbon 41 supplied from the supply reel 43 is taken up by the take-up reel 44. An opening 42b is formed in a bottom wall 49 of the cassette, and a bottom plate 31a of the casing 3 has an opening 33. Said print head 5 and part of the ink ribbon 41 can project through the openings 42a and 33 beyond the cassette, thereby abutting against a paper P on a platen roller 90.

In the box 31 of the casing 3 are provided said ink ribbon cassette 4, drive means 7 for driving the take-up reel 44 of the ink ribbon cassette 4 to allow the reel to take up the ink ribbon 41, and a lock member 9 for holding a condition that the ink ribbon cassette 4 is mounted to the casing 3.

The thermal head 5 heats a plurality of micro resistors by being energized, forming a print pattern on the paper P. The thermal head 5 can be raised by a spring 88 mounted to the housing of the fixing device 17.

Fig. 8 is a perspective view showing a condition that the ink ribbon cassette 4 is removed from the box 31 of the casing 3. Static eliminator means 200 is mounted to the front (based on the conveyance direction of the paper P, and in the lower left direction on Fig. 8) edge of said opening 33 in the bottom plate 31a of said casing 3. The mounting position of the static eliminator means 200 is not particularly limited to the position of the embodiment shown, provided that the mounting position is near the place where said ink ribbon 41 is in contact with said paper P. For example, the position may be beneath the paper P. The static eliminator means 200 may be any means utilizing an electrically-conductive material capable of eliminating static electricity such as metal material including SUS-based stainless steel, and carbon-based material. The shape of the means may be an arbitrary shape such as plate and comb, without being limited to brush shown in the embodiment.

In Fig. 7, the paper P, after having been fixed by fixing rollers 171 and 172 of the fixing device 17, is adapted to be fed in such a manner that it passes through conveyance rollers 100 and 101, passes over the platen roller 90, and is discharged from a discharge guide 102 to the outside of the copying machine.

The operation of the above-mentioned embodiment will be explained hereinafter.

As shown in Fig. 7, when no printing is performed, the thermal head 5 is housed in the ink ribbon cassette 4. The ink ribbon 41 is also housed in the ink ribbon cassette 4 after having been taken up by the take-up reel 44.

During printing , When the paper P is supplied after having been transferred and fixed , as shown in Fig. 9, the paper P brings down a limit switch 17b at the exit of the fixing device 17, and is fed through the conveyance rollers 100 and 101 onto the platen roller 90. Based on a signal from the limit switch 17b, discharge rollers 48 and the platen roller 90 reduce the conveyance speed of the paper P to an extent that the printer can perform

printing. On the other hand, the thermal head 5 is rotated downward through the operating strip 86 and the support member 6 by the rotation of the cam 82. The ink ribbon 41 is pulled downward accordingly, as shown in Fig. 9. Then, the ink ribbon 41 is pressed through the paper P against the platen roller 90 by the force of the thermal head 5. In that condition, the thermal head 5 is energized to effect printing. Then, the paper P and the ink ribbon 41 thus pressed leave the place of the platen roller 90. At that time, even if a static electricity develops, the static electricity will be eliminated through the brush of the static eliminator 200 which is located near the contact place. Accordingly, even if a static electricity develops, it is immediately eliminated, whereby the paper P and the ink ribbon 41 are immediately separated from each other, and the ink ribbon 41 is taken up by the take-up reel 44, without such a misgiving that the paper P and the ink ribbon 41 are discharged while adhering to each other because of the action of the static electricity. The paper P is also smoothly discharged. Even where the brush of the static eliminator 200 is out of contact directly with the ink ribbon 41 or the paper P, the brush can eliminate sufficiently the static electricity because the brush is located near the ribbon or the paper. Where the brush is in directly contact with them, in addition to the effect of static elimination, the brush can prevent physically the paper P from floating or the ink ribbon 41 from being pulled by the paper P.

The ink ribbon and the printer head of a printer according to the present invention may be of an arbitrary type such as impact type, without being limited to heat transfer type.

The printer according to the present invention can be applied to any printer of facsimiles, computer printers and the like, without being limited to copying machines.

As explained previously, the printer according to the present invention is equipped with static eliminator means to eliminate static electricity, whereby an ink ribbon and a paper are separated smoothly from each other. Accordingly, the printer can prevent such an inconvenience that an ink ribbon is pulled toward the discharging exit while adhering to a paper.

Next, with reference to drawings, an embodiment of another present invention will be explained hereinafter.

Fig. 10 is a schematic sectional view showing the inside of a copying machine mainly concerning the printer 2, and Fig. 11 is a perspective view of the printer 2. The printer 2 is similar in construction to that described in Fig. 6. That is, the numeral 92 indicates start-possibility detection means for detecting the start-possibility of the operation of the printer assembly. For example, the means 92 is such that it detects the on/off of a main power switch of the copying machine, or detects the on/off of a safety switch. The safety switch is such that it detects the open/close condition of the front cover plate which is opened if paper clogging occurs, or the open/close condition of the discharge cover plate on the discharge side of the copying machine, and a condition that an optical system such as reflecting mirrors and lenses is rotated upward beyond and pulled out of the upper part of the copying machine. The start-possibility detection means 92 is usually implemented by utilizing a microcomputer and sensor. The numeral 91 indicates control means for controlling the drive means 7 to rotate the take-up reel 44 based on a signal from the start-possibility detection means 92.

The drive mechanism of the ink ribbon cassette 41 will be explained more specifically. As shown in Fig. 12, a gear 75 is mounted to the motor shaft of the drive means 7, while a connecting shaft 74 is mounted at one end of the take-up reel 44, and a torque limiter 79 is connected between the connecting shaft 74 and said gear 75. The torque limiter 79 is equipped with a disk 72 urged by a spring 73 and with a friction gear 71 adhering to the disk 72 and engaged with the gear 75. The disk 72 is always pressed against the friction gear 71 by the spring 73, so that the disk 72 rotates following the rotation of the friction gear 71 by the friction force. Accordingly, a rotation torque is transmitted from the drive means 7 through the gear 75, the friction gear 71, the disk 72 and the connecting shaft 74 to the take-up reel 44. At that time, when a large rotation counter-torque exceeding the friction force between the disk 72 and the friction gear 71 is applied to the take-up reel 44, the disk 72 and the friction gear 71 begin to slide to cause the rotation torque of the drive means 7 not to be transmitted to the take-up reel 44, whereby the gear 75 rotates idly and the take-up reel 44 fails to rotate. On the other hand, the supply reel 43 is rotatably supported in a condition that it is pressed against the ink ribbon body 42 with a proper force by a spring 431 as an example of restraint means for restraining the rotation of the reel. Accordingly, in a condition that the take-up reel 44 stretches fully the ink ribbon 41 after having taken up the loosened ribbon, when the supply reel 43 begins to rotate by being pulled by the ink ribbon 41, said pressing force causes a counter torque against the take-up reel 44, whereby the drive means 7 begins to rotate idly and the take-up reel 44 takes up no more ink ribbon 41.

The thermal head 5 heats a plurality of micro-resistors by being energized, thereby forming a print pattern on the paper P. The thermal head 5, as shown in Fig. 10, can be raised by the spring 88 mounted to the fixing device 17. The head may be

arranged in a manner to be always urged upward and raised by the spring 88 mounted on the shaft member located in the housing 1 of the copying machine assembly.

The paper, after having been fixed by the fixing rollers 171 and 172 of the fixing device 17, is adapted to be fed in such a manner that it passes through the conveyance rollers 100 and 101, passes over the platen roller 90, and is discharged from the discharge guide 102 to the outside of the copying machine.

The operation of the above-mentioned embodiment will be explained hereinafter.

As shown in Fig. 10, when no printing is performed, the thermal head 5 is housed in the ink ribbon cassette 4. The ink ribbon 41 is also housed in the ink ribbon cassette 4 after having been taken up by the take-up reel 44.

During printing, when the paper P is supplied after having been transferred and fixed during printing, as shown in Fig. 13, the paper P brings down the limit switch 17b at the exit of the fixing device 17, and is fed through the conveyance rollers 100 and 101 onto the platen roller 90. Based on a signal from the limit switch 17b, discharge rollers 48 and the platen roller 90 reduce the conveyance speed of the paper P to an extent that the printer 2 can perform printing. On the other hand, the thermal head 5 is rotated downward through the operating strip 86 and the support member 6 by the rotation of the cam 82. The ink ribbon 41 is pulled downward accordingly, as shown in Fig. Then, the ink ribbon 41 is pressed through the paper P against the platen roller 90 by the force of the thermal head 5. In that condition, the thermal head 5 is energized to effect printing. Then, the paper P and the ink ribbon 41 thus pressed leave the place of the platen roller 90.

Then, after printing has been performed, the thermal head 5 is moved upward by the urging force of the spring 88 with the rotation of the cam 82. As a result, the ink ribbon 41 remains slack temporarily as shown in Fig. 14. In that condition, the take-up slack of the ink ribbon 41 is usually eliminated by rotating the take-up reel 44 with the drive means 7 driven. However, if the operation of the copying machine is stopped because of a trouble such as paper clogging before the slack is eliminated, the initialization of a microcomputer is to be checked as shown in the flowchart of Fig. 15 (step S1). Then, the start-possibility detection means 92 checks that the main power switch has been turned on (step S2). Further, the means 92 checks that the safety switch has been turned on (step S3). When an operator settles a trouble such as paper clogging and turns on both the switches , the start-possibility detection means 92 detects such operation, and following such detection, the control means 91 drives the drive means 7, whereby the take-up reel 44 is rotated to cause the slack of the ink ribbon 41 to be eliminated (step S4). The duration of the rotation is set to a time during which the slack may be sufficiently eliminated, for example, 0.8 second (step S5). If the switch is turned off again before the time of 0.8 second lapses (steps S5 and S6), the drive means 7 is to be turned off (step S7). Then, the check operation is to be returned to step S2. Concluding that the ink ribbon 41 has been sufficiently taken up when the time of 0.8 second thus lapsed, the drive means 7 is to be stopped (step S8). There is no misgiving about the development of over take-up because, if it develops, the drive means 7 will rotate idly by the action of the torque limiter 79 as described above.

Thus, even if a trouble develops in a condition that the ink ribbon 41 slacks, starting the operation again allows the copying to be performed smoothly.

The ink ribbon and the printer head of a printer according to the present invention may be of an arbitrary type such as impact type, without being limited to heat transfer type.

The printer according to the present invention can be applied to any printer of facsimiles, computer printers and the like, without being limited to copying machines.

As explained previously, the printer according to the present invention is equipped with start-possibility detection means for detecting the start-possibility of the operation of the printer assembly, and based on the detection, the slack of an ink ribbon can be surely eliminated, thereby providing an advantage that, even if the printer assembly stops in a condition that the ink ribbon slacks, no ink ribbon will be damaged and no paper be stained when the operation is started again.

It is further understood by those skilled in the art that the foregoing description is a preferred embodiment and that various changes and modifications may be made in the invention without departing from the spirit and scope thereof.

Claims

1. A printer which performs printing by abutting a printer head against a paper behind an ink ribbon while allowing the paper to pass between said ink ribbon and a platen roller and which moves said printer head backward when not performing printing, wherein

   static eliminator means for eliminating a static electricity developing on said ink ribbon or said paper is located near the place where said ink ribbon is in contact with said paper.

2. A printer in accordance with claim 1, wherein

said static eliminator means is on the discharge side of said paper and located between said ink ribbon and said paper.

3. A printer in accordance with claim 2, wherein said static eliminator means is directly in contact with said ink ribbon or said paper.

4. A printer in accordance with claim 2, wherein said static eliminator means is provided in a printer casing.

5. A printer in accordance with claim 1, wherein said static eliminator means is a brush made of an electrically-conductive material.

6. A printer in accordance with claim 1, wherein said printer head is of thermal transfer type.

7. A printer in accordance with claim 1, wherein said printer is built in a copying machine.

8. A printer which performs printing by abutting a printer head against a paper behind an ink ribbon while allowing the paper to pass between said ink ribbon and a platen roller and which moves said printer head backward when not performing printing, comprising;

start-possibility detection means for detecting the start-possibility of the operation of the printer assembly,

a take-up reel for taking up said ink ribbon,

reel drive means for driving the take-up reel, and

control means for driving said reel drive means based on the result detected by said start-possibility detection means to allow the reel to take up said ink ribbon.

9. A printer in accordance with claim 8, wherein said start-possibility detection means detects the on/off of a main power switch.

10. A printer in accordance with claim 8, wherein said start-possibility detection means detects the on/off of a safety switch for detecting the open/close condition of a cover which is opened if paper clogging develops or of a frame which releases a conveyance path .

11. A printer in accordance with claim 8, wherein said start-possibility detection means detects the on/off of the main power switch and of the safety switch.

12. A printer in accordance with claim 8, wherein a torque limiter is provided between said reel drive means and said take-up reel.

13. A printer accordance with claim 8, wherein a supply reel for supplying said ink ribbon is provided with restraint means for restraining the rotation of the reel.

14. A printer in accordance with claim 8, wherein said control means drives said reel drive means for a time during which a slack is sufficiently eliminated.

15. A printer in accordance with claim 14, wherein said control means drives said reel drive means for a time during which a slack is sufficiently eliminated, and stops the drive of said reel drive means if the operation of the assembly stops before said time elapses.

16. A printer in accordance with claim 8, wherein said printer is built in a copying machine.

Fig. 1

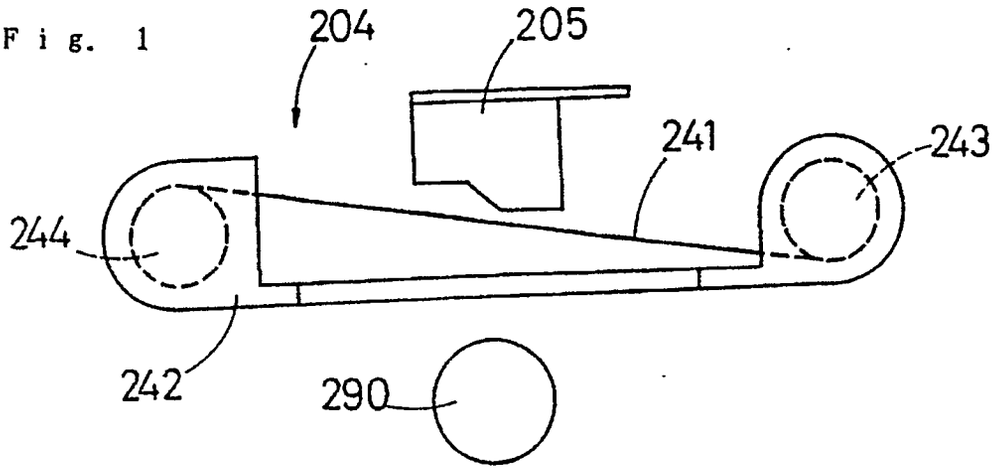


Fig. 2

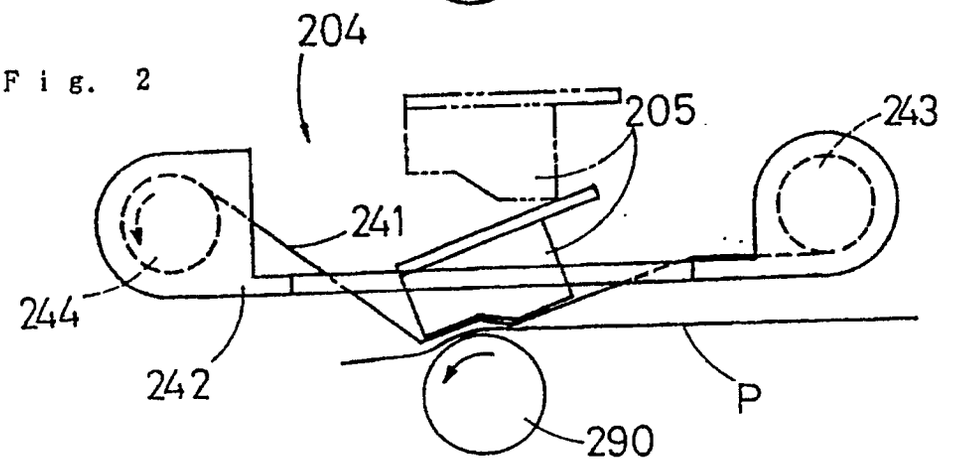


Fig. 3

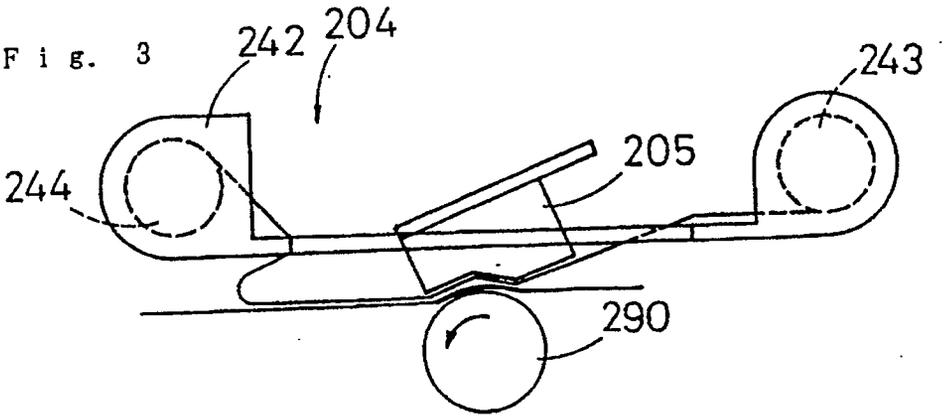
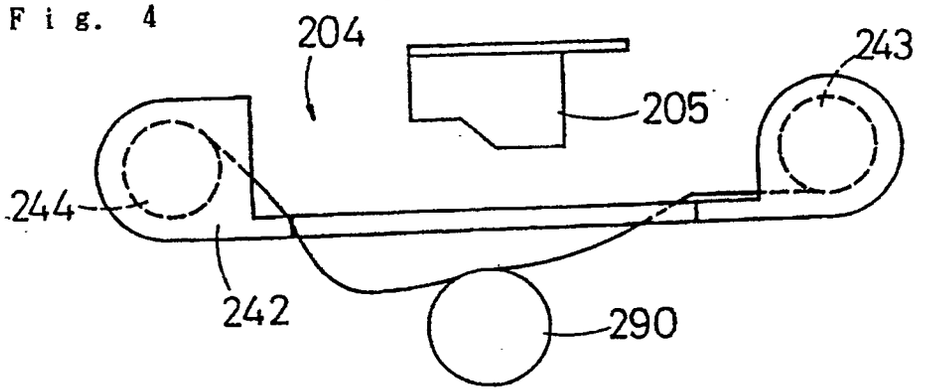


Fig. 4



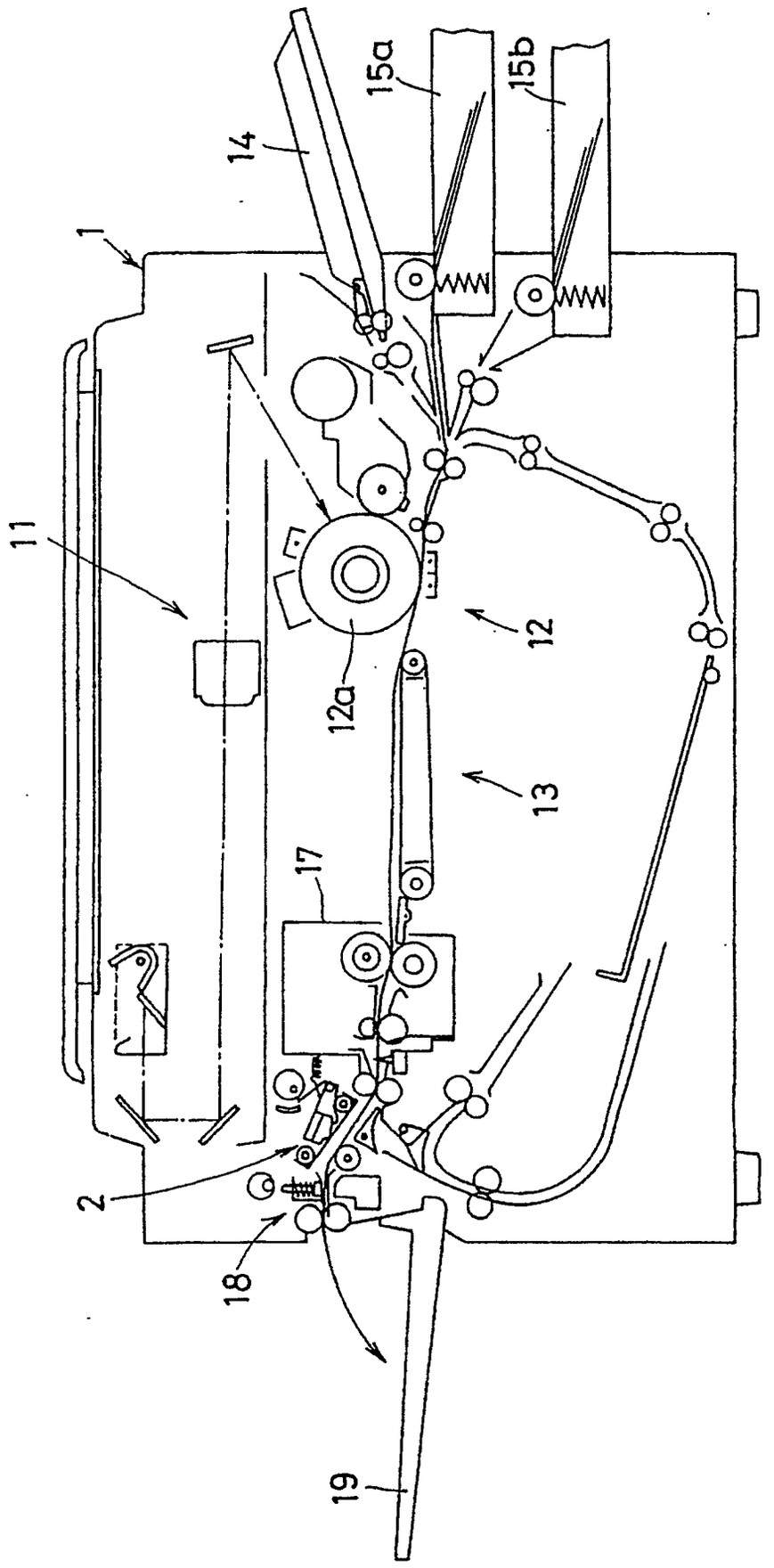


Fig. 5

Fig. 6

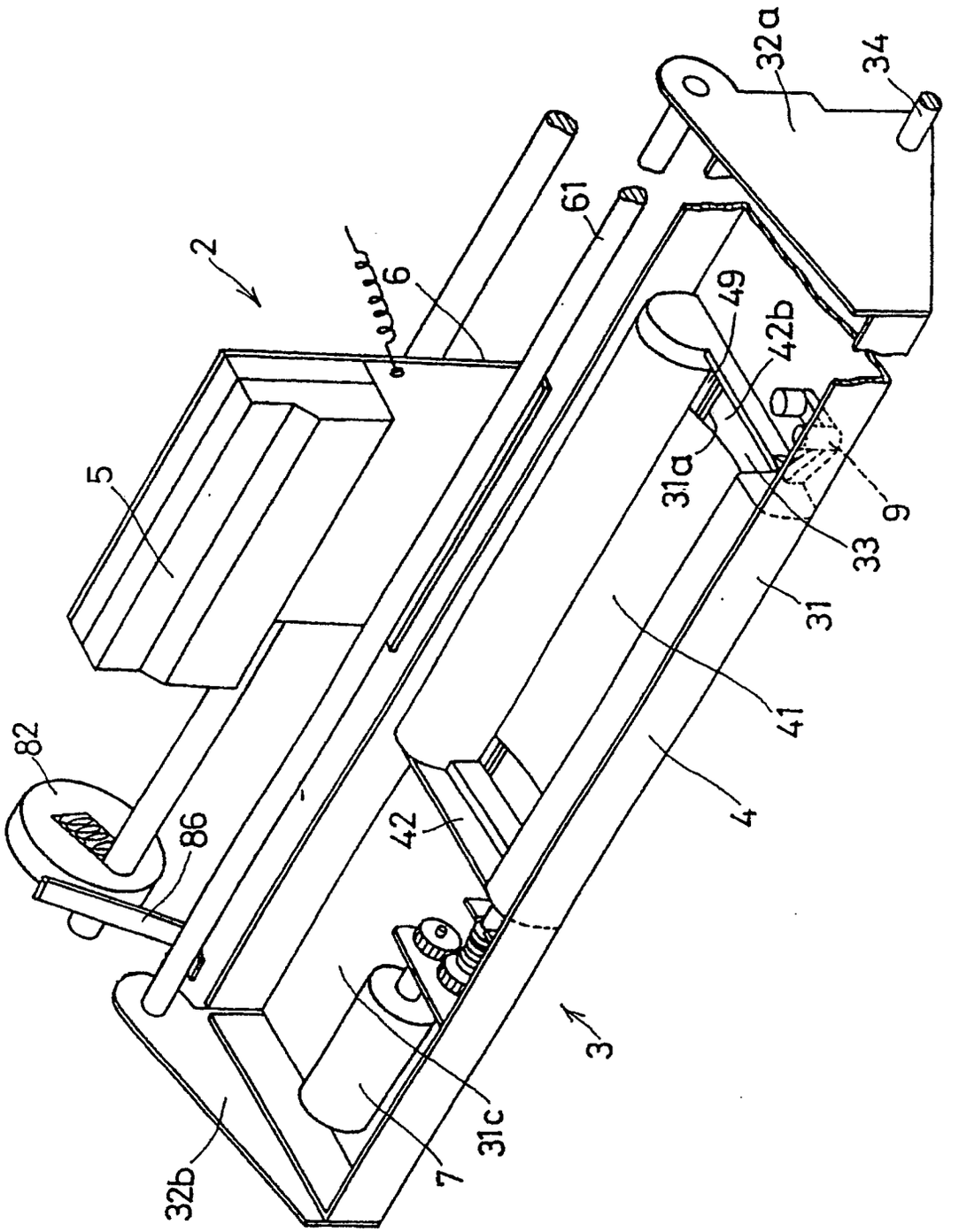


Fig. 7

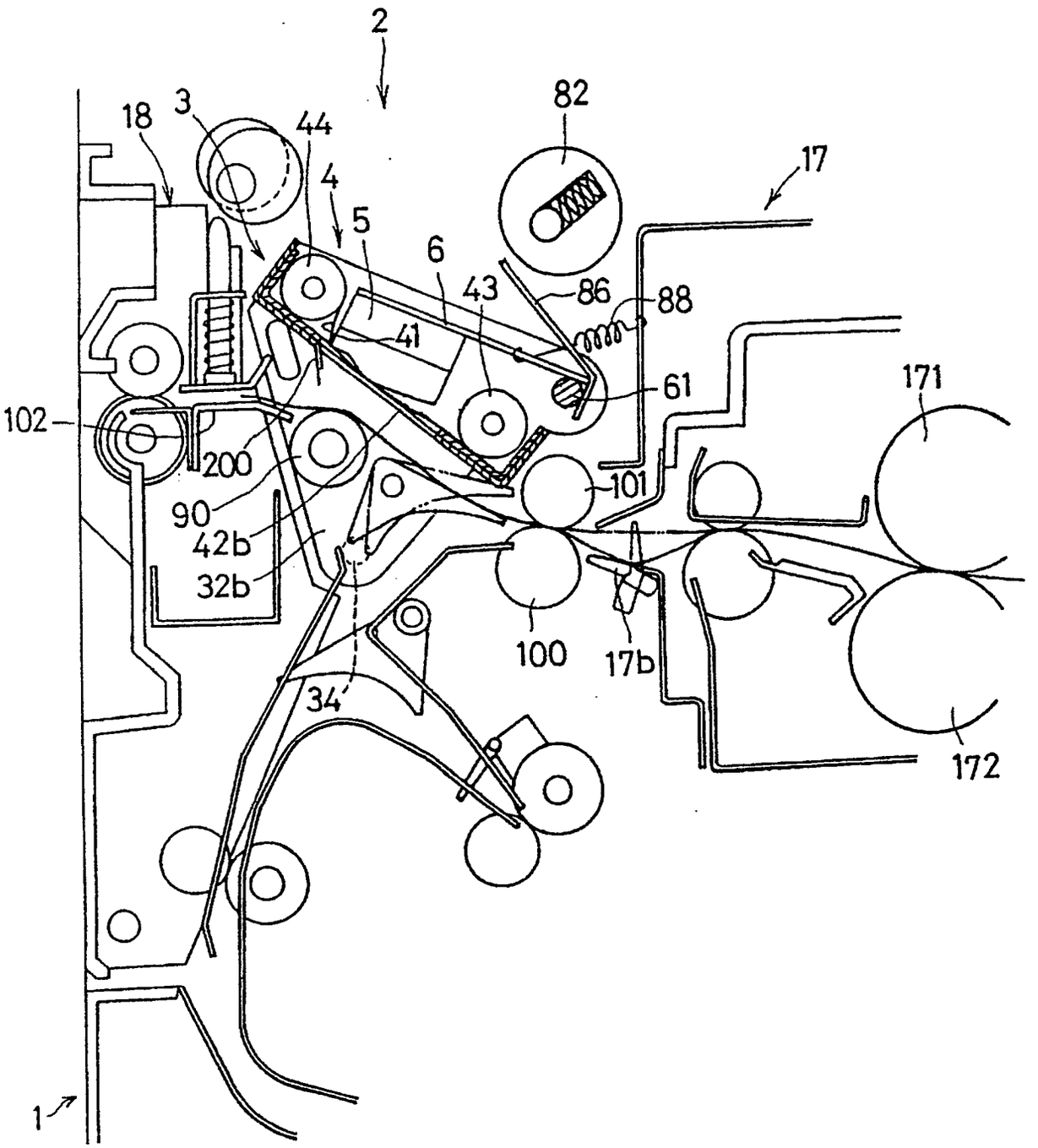

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Fig. 8

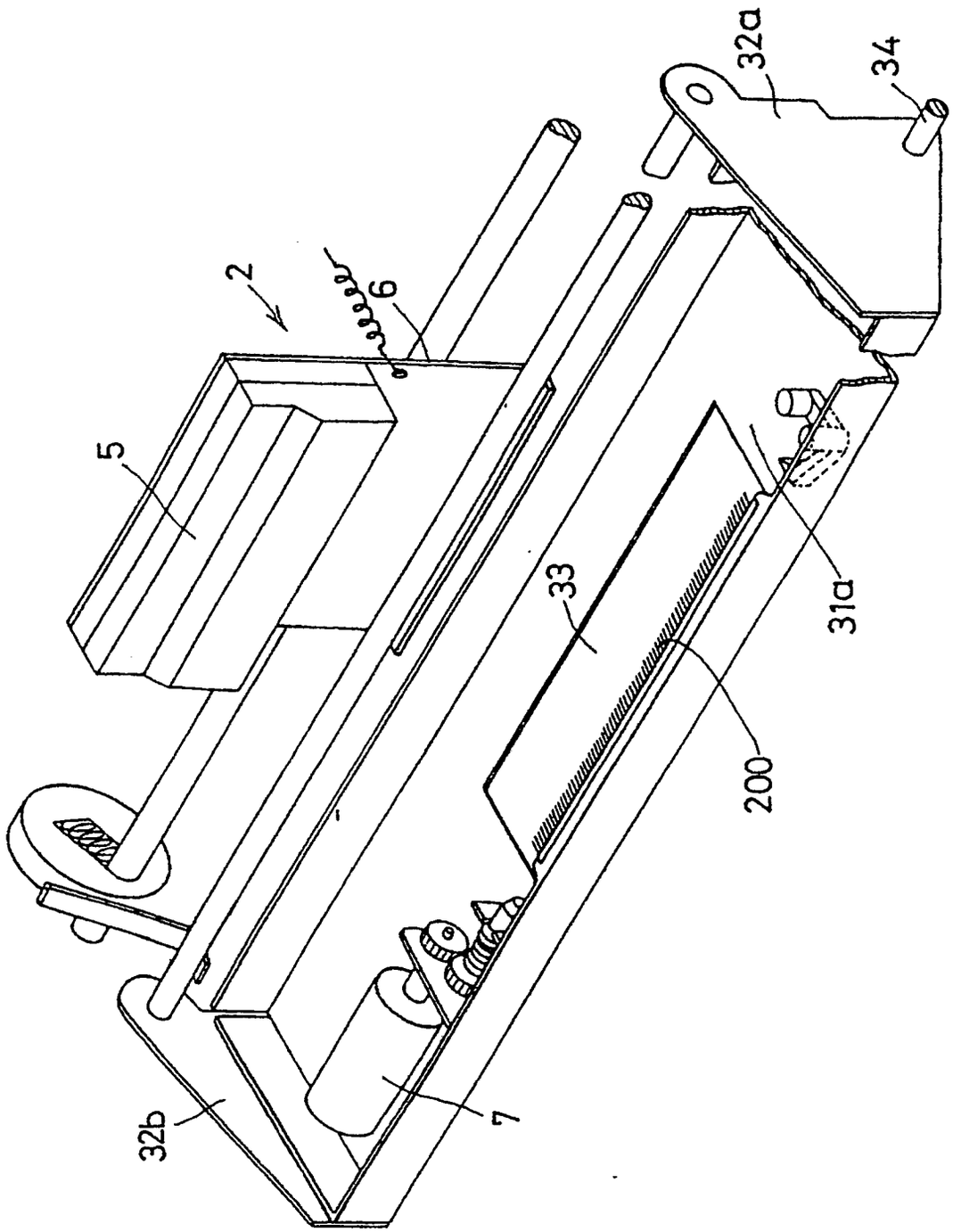

Fig. 9

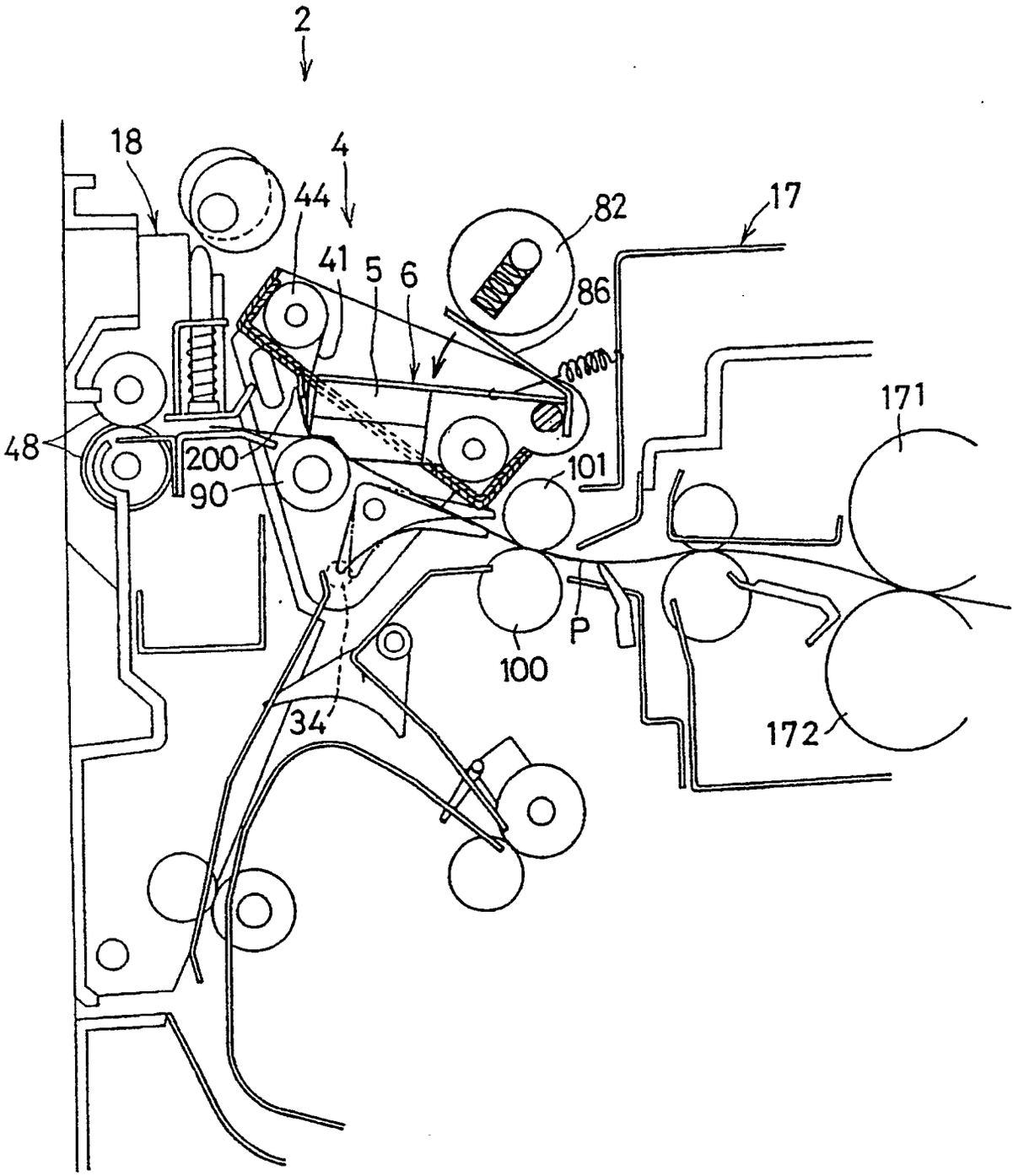

Fig. 10

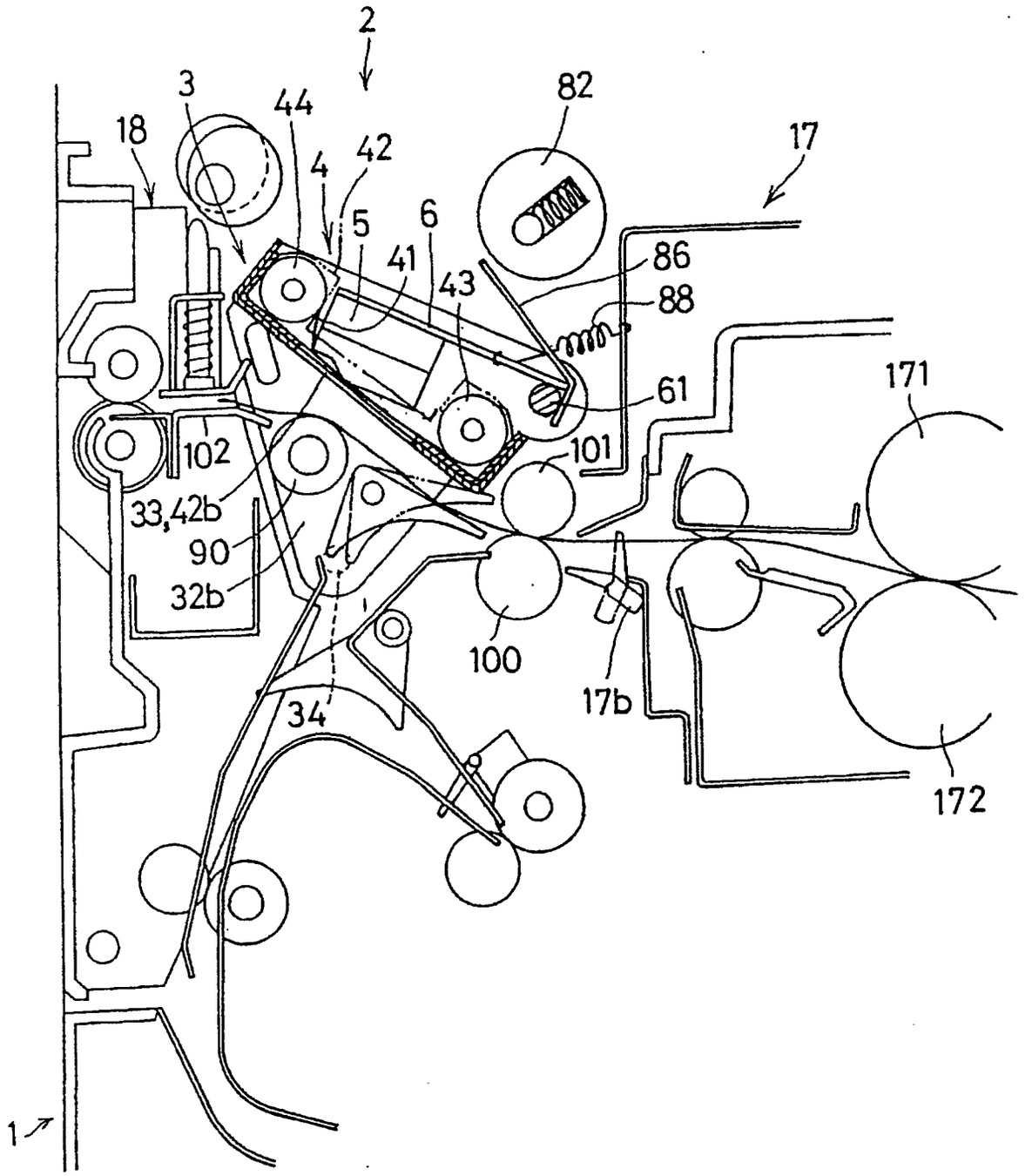
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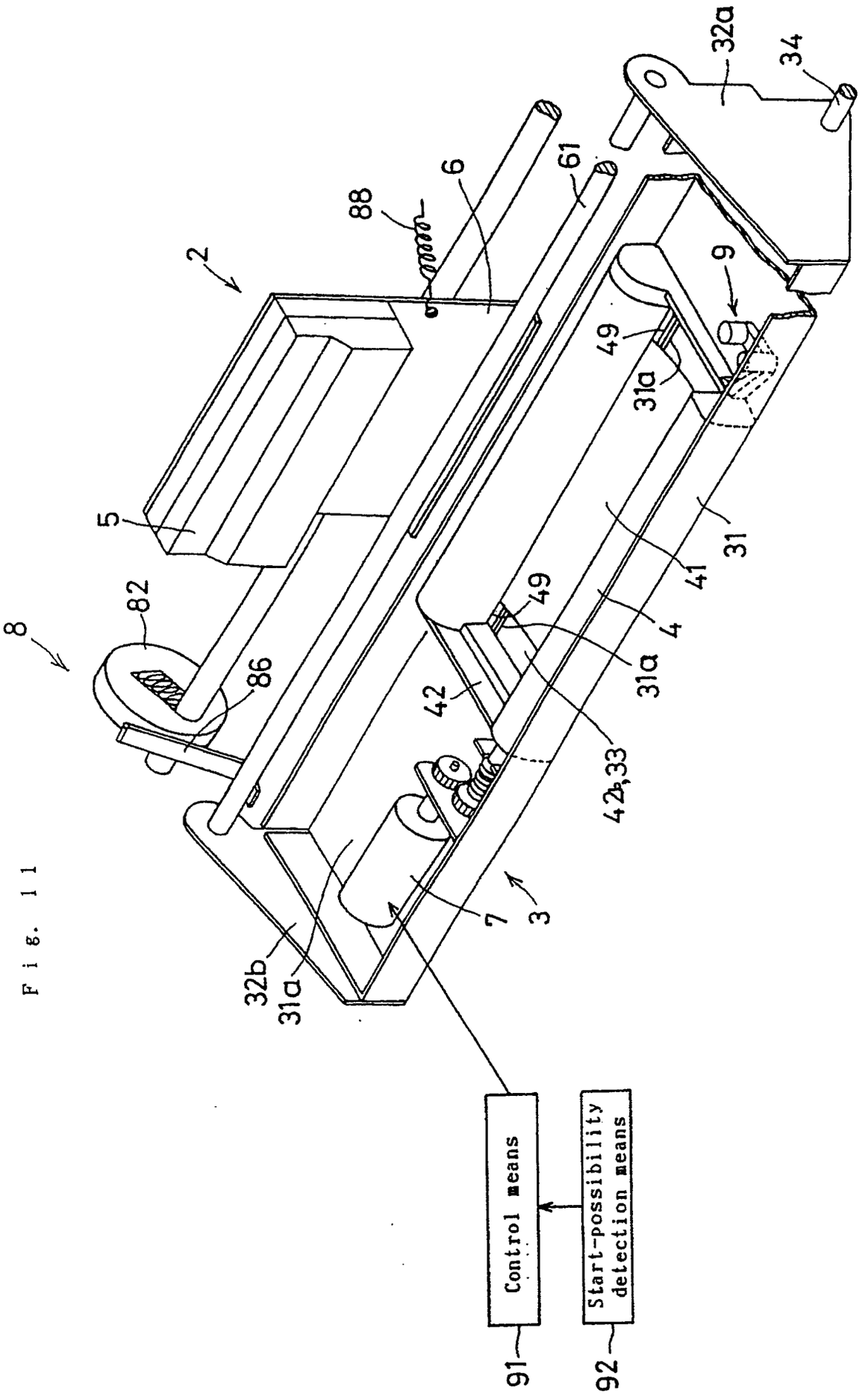
Fig. 11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32b
31a
Control means
Start-possibility detection means
91
92

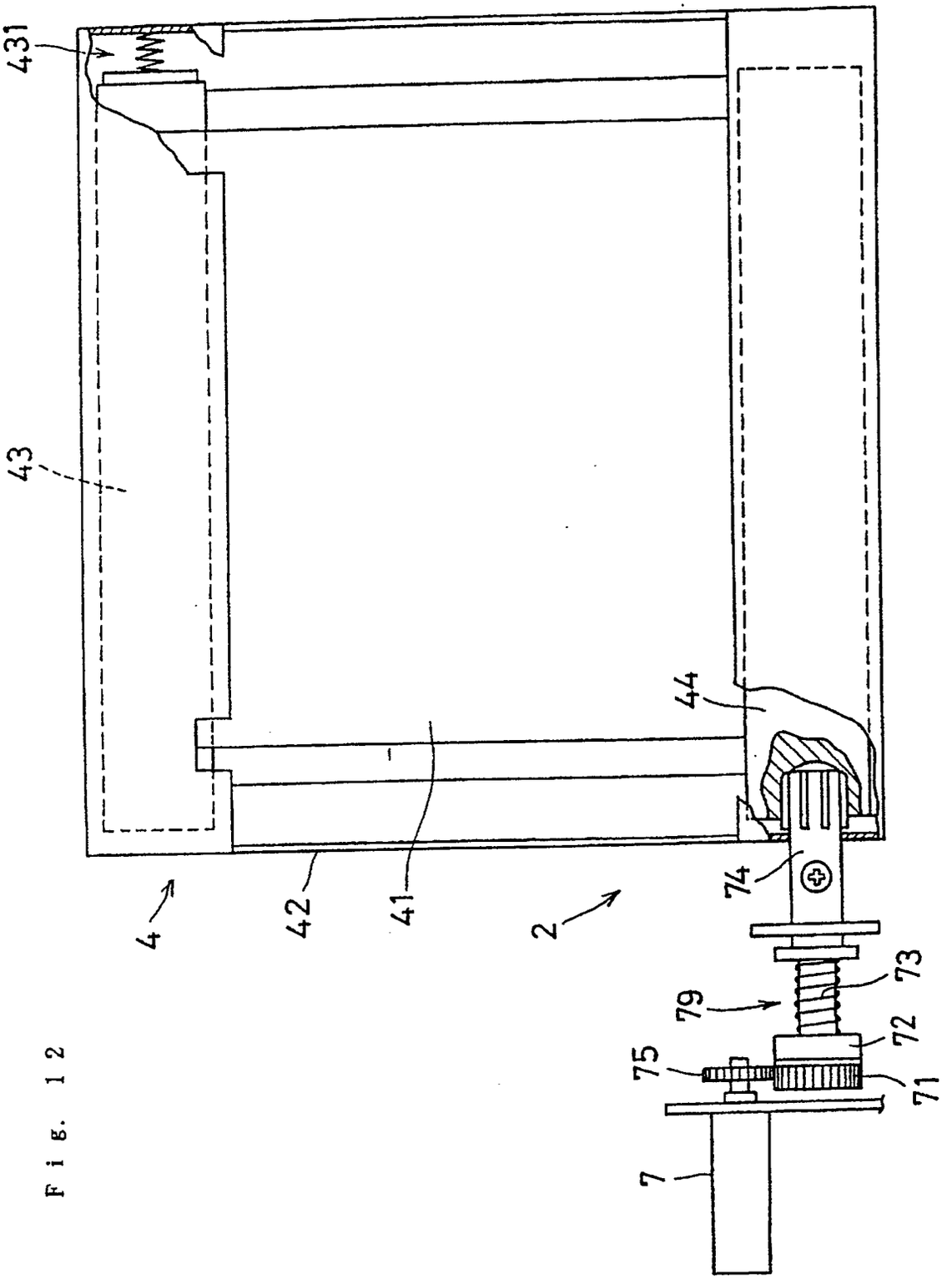


Fig. 12

Fig. 13

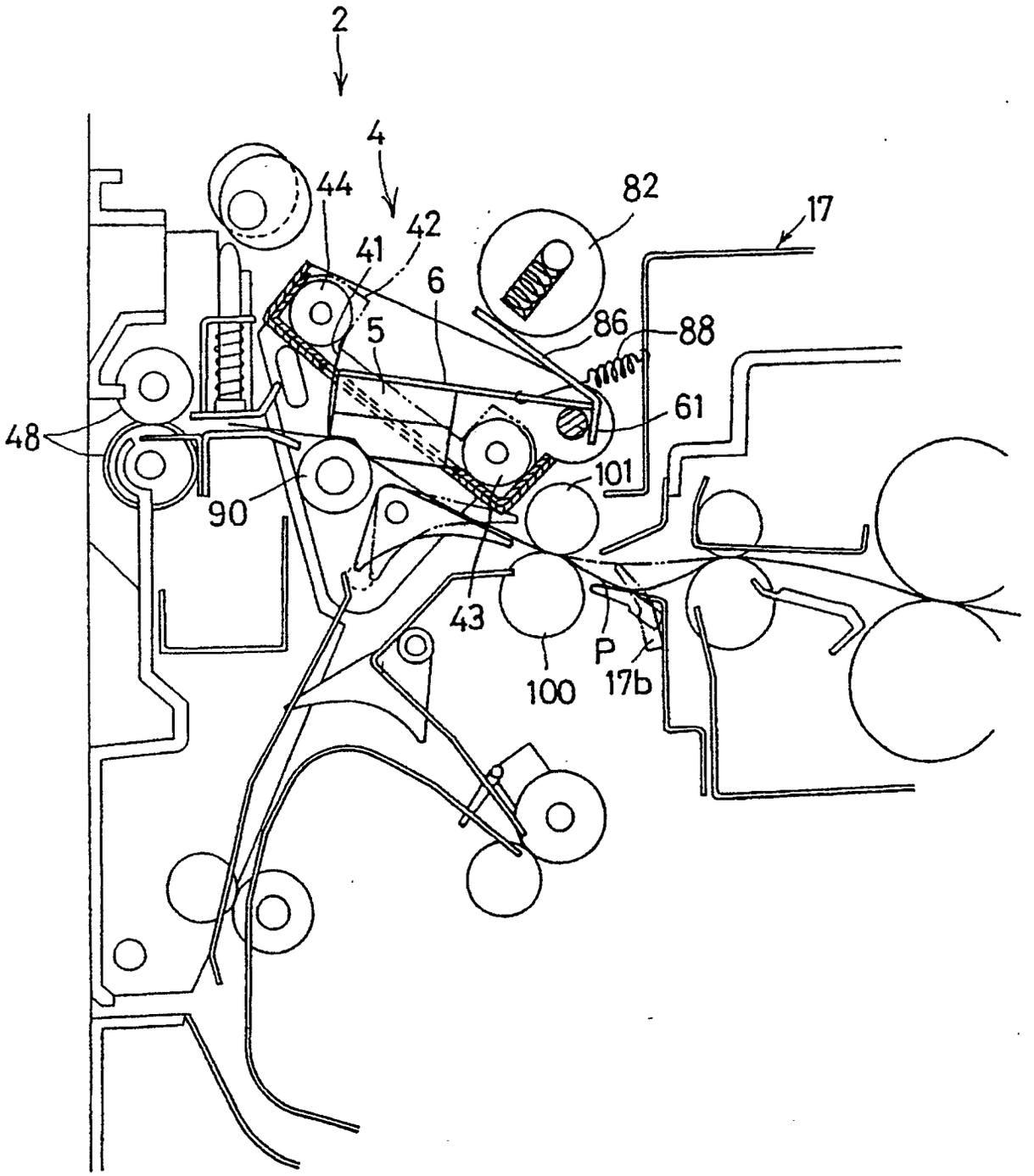
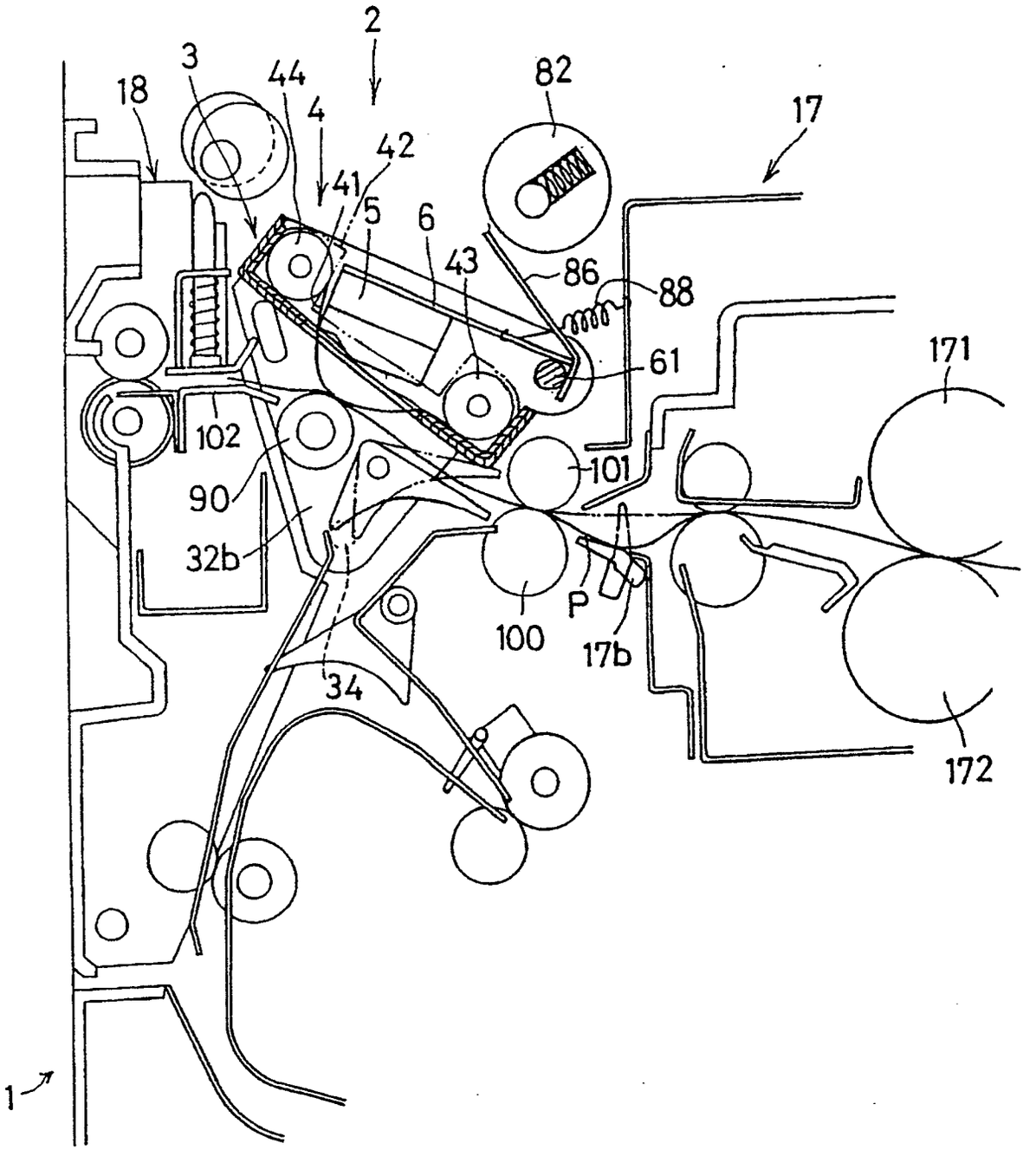


Fig. 14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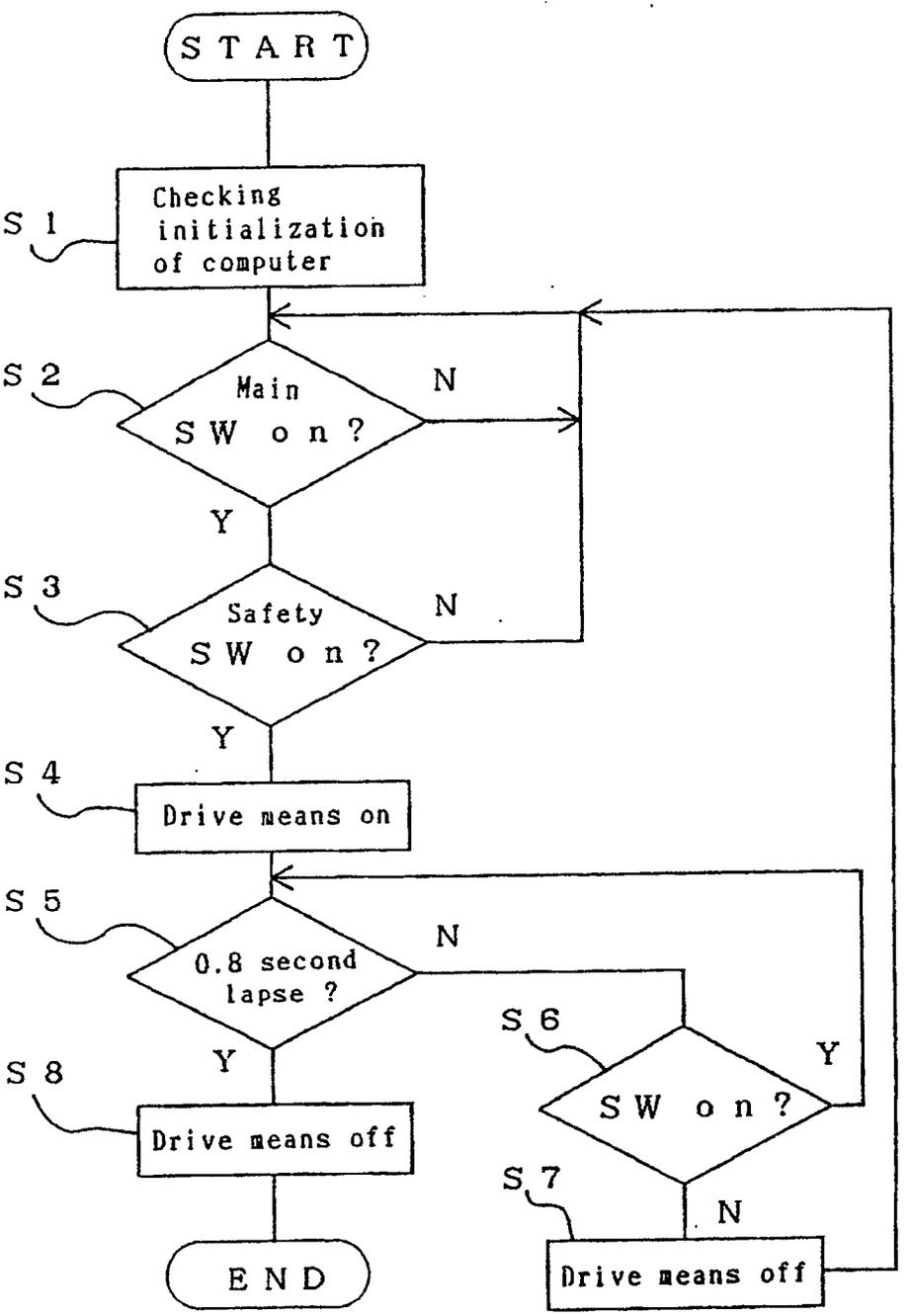
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S 2
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N
Y
S 3
Safety SW on ?
N
Y
S 4
Drive means on
S 5
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N
Y
S 6
SW on ?
Y
N
S 7
Drive means off
S 8
Drive means off
END