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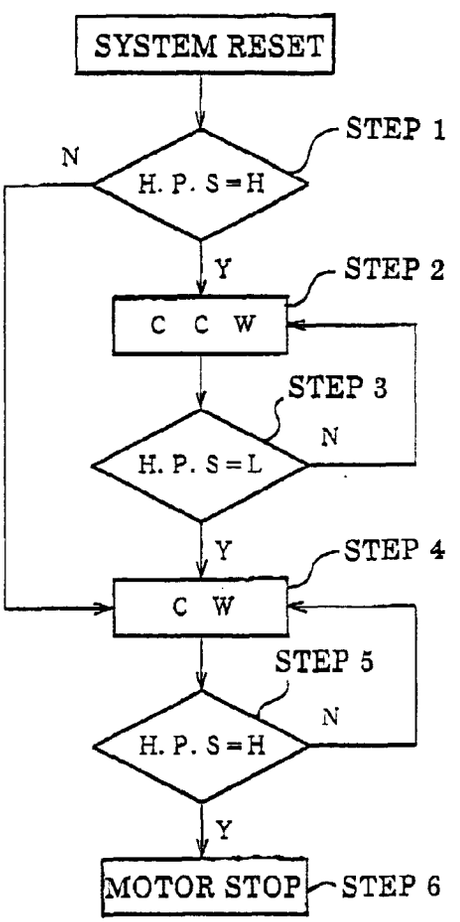
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(54) Apparatus for binding a stack of sheets

(57) A binding apparatus is provided for preventing double drive-in of a clip or a staple in a reset mode. As this binding apparatus, a clipping unit and a stapler are exemplified. Taking the clipping unit as an example, this clipping unit has the following characteristics. That is, the clipping unit has a pair of clamp members (51 and 52) for folding a clip (101) and binding a bundle of stacked sheet materials (S). The clamp members (51 and 52) have a stand-by state in which they are opened so as to hold the clip (101) and a bent state in which they are closed so that the clip (101) is bent and bind the bundle of sheet materials (S). This clipping unit (10) has a step which causes the clamp members (51 and 52) to reach the stand-by state after completion of the bent state, when the clamp members (51 and 52) are restarted again after elimination of the stop causes in the case where the clamp members (51 and 52) are stopped while bending the clip (101).

FIG. 1



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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a stacked-body binding apparatus that binds a bundle of sheet materials with a staple or a clip, and more particularly to a stacked-body binding apparatus improving the operation of a folding means which is performed after reset when the folding means for bending a staple or a clip is stopped during a bending operation.

2. Description of the Related Art

Some of the copying machines installed in offices are equipped with an electric stapler for binding a bundle of paper sheets copied and sorted at a predetermined number. However, the electric stapler cannot separate a plurality of sheet bundles from one another so that they are not mixed with one another, in order to bind them with staples.

Hence, research has been advanced on a clipping unit which is attached to an apparatus stacking a bundle of sheet materials, such as a copying machine, a facsimile, or a printing machine for business, and can automatically separate a plurality of bundles of sheet materials so that they are not mixed with one another.

A clipping unit, such as this, has a pair of clamp members for holding a clip. On the opposed surfaces of the clamp members, a pair of jaw portions are provided for holding the opposite ends of a flat clip which binds a bundle of sheet materials. First, the clip is held by the jaw portions. Then, a bundle of sheet materials is positioned near the held clip and the clamp members are closed to bend the clip so that the end portion of the bundled sheet materials is bound.

The clip is formed into the shape of a long and narrow rectangle, and a plurality of clips are connected together with the adjacent side edges contacted with each other by tape and constitute connected clips (hereinafter referred to as a connected clip body). Between a cartridge housing the connected clip body and a pair of clamp members, a slider is provided for feeding the connected clip body from the cartridge between the pair of clamp members.

The drive source for opening and closing the pair of clamp members usually employs a DC motor and the drive circuit. Also, in order to open and close the clamp members, a gear mechanism is connected to the output shaft of the DC motor, and a cam mechanism and a link mechanism are connected to the gear mechanism. The drive circuit is provided with a microcomputer and peripheral circuits. If a clip instruction signal is sent from a copying machine, a facsimile, or a printer to the microcomputer, the clamp members will be closed to fold a clip and the end portion of sheet materials will be bundled with the folded clip.

In the case of such a clipping unit with clamp members, when the clamp members are bending a clip, there is the possibility that the clamp members will stop the bending operation due to power shutdown, an error occurring in a copying machine itself, or an error occurring in the clipping unit.

In such a case, if the clamp members are returned to the initial opened state, there will be cases where a clip bent into the shape of ">" will not be separated from the connected clip body but will float in the air in the vicinity of the end portion of a sheet bundle. Also, even if a clip were separated from the connected clip body and bent into a U-shape, caulking would not be performed and therefore a clipping defect in a loosed state would arise.

In addition, if the clamp members are returned to the initial state, the slider itself will also be returned to the initial state in interlock with the clamp members and advance the next clip in the next feeding operation. As a consequence, there will arise another problem that the front clip and the next clip will interfere with each other and be jammed.

Similarly, even in electric staplers, there are cases where either a magazine for pushing out a staple or a clincher for supporting sheet materials and folding the inserted leg portions of the staple driven in the sheet materials along the sheet surface will stop operation during bending of the staple due to power shutdown or system error occurrence. In such cases, if the magazine and the clincher are returned to the opened state which is before restart of a staple drive-in operation, sheet materials will be discharged in the middle of a binding operation being performed with a staple, or a new staple will be driven onto a staple being driven and therefore the staple jam will cause an error again.

SUMMARY OF THE INVENTION

An object of the present invention is to prevent the occurrence of a new error which is caused by a binding defect of sheet materials or a reset operation, by completely bending a binding member, such as a clip or a staple bent halfway, after reset, in the case where the bending operation of a folding means is stopped while bending the clip or staple.

To achieve this end, a stacked-body binding apparatus according to an aspect of the present invention comprises: a pair of folding means for folding a linear or flat binding member and binding stacked sheet materials, the pair of folding means having a stand-by state in which they are opened and hold the binding member and a bent state in which they are closed so that the binding member is bent and bind the stacked sheet materials; wherein if the pair of folding means are stopped while bending the binding member, the pair of folding means are caused to be in the bent state and then in the stand-by state, when the pair of folding means are

restarted after elimination of stop causes.

According to the stacked-body binding apparatus of this aspect of the present invention, an error, such as a binding defect or a jam by double feed of a binding member, can be prevented, because the folding means are caused to complete the bent state after reset, in the case where the folding means are stopped while bending the binding member.

A clipping unit according to an aspect of the present invention comprises: a pair of clamp members for folding opposite ends of a flat clip which bundles end portions of stacked sheet materials, the pair of clamp members having a stand-by state in which they are opened to such a degree that they hold the opposite ends of the flat clip and a bent state in which they bend the clip and are closed to such a degree that they bind the stacked sheet materials and being caused to reach the bent state after the clip has been supplied between the pair of clamp members; wherein if the pair of clamp members are stopped while bending, the pair of clamp members are caused to be in the bent state and then in the stand-by state, when the pair of clamp members are opened or closed again after elimination of stop causes.

According to the clipping unit of this aspect of the present invention, even if a U-shaped clip were loosely attached to a paper bundle and did not completely bind the paper bundle due to power shutdown or an error during the bending operation of the clamp members, the clamp members would be completely closed. Therefore, since the paper bundle is completely bound by the clip, the occurrence of a clipping defect is prevented.

In a stacked-body binding apparatus according to another aspect of the present invention, the aforementioned pair of folding means are constituted by a magazine section for pushing out a linear staple and driving the staple into stacked sheet materials and a clincher section for supporting the stacked sheet materials and clinching end portions of the driven staple projecting from the stacked sheet materials. The magazine section and the clincher section have a stand-by state in which they are opened and hold the binding member and a bent state in which they are closed so that the staple is bent and bind the stacked sheet materials, and if the magazine section and the clincher section are stopped while bending the binding member, the magazine section and the clincher section are caused to be in the bent state and then in the stand-by state, when the magazine section and the clincher section are restarted after elimination of stop causes.

According to the stacked-body binding apparatus of this aspect of the present invention, even if the magazine section and the clincher section were stopped while bending the staple, they would be caused to first complete the bent state after reset and then return to the stand-by state. Therefore, double drive-in operation of the staple can be prevented and the end portions of the staple bent halfway will be folded. For this reason, a binding defect or a jam of the staple can be prevented.

The above and other objects and advantages of the present invention will become apparent from the following detailed description of the preferred embodiments of the invention when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a flowchart showing a slider reset operation performed by a board computer in accordance with a first embodiment of the present invention;

FIG. 2 is a corresponding diagram of the rotation of a clamp-member drive cam and the output level of a microswitch according to the first embodiment;

FIG. 3 is a flowchart showing a slider reset operation performed by a board computer in accordance with a variation of the first embodiment;

FIG. 4 is a corresponding diagram of the rotation of the clamp-member drive cam and the output level of the microswitch according to the variation;

FIG. 5 is a front view showing a clipping unit of the first embodiment of the present invention, the attached state of the cartridge, and the arranged state of the slider;

FIG. 6 is a left side view of the clipping unit, the cartridge being removed from the unit;

FIG. 7 is a schematic view showing the positional relation between the disc protruding portion of FIG. 6 and the microswitch;

FIG. 8 is a plan view showing the cartridge removed from the clipping unit of the first embodiment of the present invention;

FIG. 9 is a sectional side view showing the clipping unit of the first embodiment of the present invention;

FIG. 10 is a block diagram showing how a clipping operation is controlled by the board computer of the clipping unit according to the first embodiment of the present invention;

FIGS. 11(A) and 11(B) are flowcharts showing how a clip is fed according to the clipping unit of the first embodiment;

FIGS. 12(A)(1) through (5) are explanatory diagrams showing a feeding operation in which re-feed of the slider is not performed when feeding a connected clip body;

FIGS. 12(B)(1) through (6) are explanatory diagrams showing a feeding operation in which re-feed of the slider is performed when feeding a connected clip body;

FIG. 13 is a schematic sectional view showing the construction of an electric stapler according to a second embodiment of the present invention; and

FIG. 14 is a front view showing how the clincher arms of the electric stapler of FIG. 13 are opened or closed.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

A binding apparatus for a stacked body according to a preferred embodiment of the present invention will hereinafter be described in reference to the drawings.

Fig. 5 schematically shows the construction of a clipping unit of this embodiment. In the figure, reference numeral 10 denotes a clipping unit which is attached, for example, to a copying machine. The clipping unit 10 is constituted by a unit main body 11 and a cartridge 100 detachably attached to the unit main body 11.

The housing 12 of the unit main body 11 is provided with a slider reciprocating mechanism 30 for reciprocating a slider (feed means) 150 attached to the cartridge 100 in the longitudinal direction of the slider 150, a clamping mechanism 50 for folding a clip 101 which serves as a binding member for binding a bundle of copied paper sheets by clipping, and a drive mechanism 80 for driving the slider reciprocating mechanism 30 and the clamping mechanism 50. In Fig. 5 the clip 101 is formed into the shape of a longitudinally long rectangle, and a plurality of clips 101 are arranged widthwise at constant intervals, and are connected together by a plastic film tape easily cuttable widthwise.

(Housing)

The housing 12 is provided with a table 13 on which the cartridge 100 is placed. By the side of the table 13 a clamp chamber 14 is formed, and the clamping mechanism 50 is provided in the clamp chamber 14. The housing 12 is further formed with a cam chamber 15 under the table 13 and a gear chamber 16 under the clamp chamber 14.

The table 13 is provided with a mechanism having a pawl for locking the cartridge 100. In the upper surface of the table 13 a vertical guide rail 17 (Fig. 9) is formed and the guide rail 17 extends vertically along a side wall 14A forming the clamp chamber 14 and is formed in the upper surface of the table 13. The guide rail 17 serves as a positioning mechanism for locking the cartridge 100, and the cartridge 100 is formed with a fitting hole 104A into which the guide rail 17 is fitted.

The upper surface of the table 13 is provided with a vertical support member 18 for supporting a bundle of copied paper sheets 13. This support member 18 is provided with a photodetector 19 (Fig. 8) consisting of a light-emitting diode (not shown) and a light-receiving diode (not shown) at the surface opposed to the cartridge 100. The photodetector 19 is used to detect remaining clips.

In this photodetector 19, the light emitted by the light-emitting diode is first reflected by the tape of a connected clip body 200 drawn out from the cartridge 100 and then the reflected light is received by the light-receiving diode, thereby detecting whether or not the clip 101 is present.

The table 13 is formed with a front wall portion 21 on the side of the clamping mechanism 50, and the front end of the housing 12 is formed with a stepped portion 22 on which a sheet bundle S is placed. The upper surface of the front wall portion 21, the stepped portion 22, and the upper surface of the support member 18 are on the same level with one another for placing the sheet bundle S thereon.

At the front end portion of the table 13 (Figs. 5 and 8), the slider 150 reciprocates to feed out the connected clip body 200 in the cartridge toward the clamping mechanism 50. The slider 150 is supported by the cartridge 100 so that it can slide, and is provided with nonreturn pawls for feeding the clip 101 only in the direction in which the connected clip body 200 is drawn out.

Inside the side wall 23 of the housing 12 a stopper 24 and a microswitch M1 are provided. The stopper 24 stops the clip 101 fed by the slider 150 at a predetermined position, and the microswitch M1 abuts and detects the clip 101.

(Clamping Mechanism)

The clamping mechanism 50 is equipped with a pair of L-shaped clamp members 51 and 52, a clamp rotating member 53 for supporting the clamp members 51 and 52, and a clamp shaft 62 inserted through the clamp rotating member 53 and abutting the circumferential surface of the clamp-member drive cam 90.

(Clamp Rotating Member)

The clamp rotating member 53 is constituted by a pair of inner and outer clamp rotating members. Each clamp rotating member is constituted by a pair of opposed side plate portions and a connection plate portion connecting the upper flanges of the side plate portions together, and has a channel shape whose cross section is rectangular.

The side plate portions of the clamp rotating member 53 have a shaft 63 inserted therethrough. The shaft 63 is the rotational center of the clamp rotating member 53 and attached to the side wall forming the clamp chamber 14 of the housing 12. The clamp rotating member 53 is rotatable with the shaft 63 as a fulcrum. The clamp shaft 62 which is the cam follower of the cam 90 is attached to the side plate portions of the clamp rotating member 53 so that it is freely rotatable.

A nut 65A is provided on the clamp rotating member 53 through a spring 67. The spring 67 urges the connecting plate portions (not shown) of the inner and outer clamp rotating members of the clamp rotating member 53 in a direction where the connecting plate portions approach each other, and a pair of side plate portions of the outer clamp rotating member and a pair of side plate portions of the inner clamp rotating member are integrally rotated on the shaft 63. Reference numeral 69 denotes a washer, which is interposed between the spring

67 and the nut 65A. The washer 69 is connected to one end of a spring 70, and the other end of the spring 70 is connected to a stopper portion 12K of the housing 12.

The outer and inner pairs of side plate portions of the clamp rotating member 53 are relatively rotatable only by a predetermined angle on the shaft 63 against the urging force of the spring 67, and rotation of the clamp-member drive cam 90 is smoothly performed regardless of the thickness of a sheet bundle S.

The clamp rotating member 53 is urged in a counterclockwise direction of Fig. 6 by the spring 70 with the shaft 63 as a fulcrum. This urging causes the clamp shaft 62 of the clamp rotating member 53 to abut the circumferential surface of the clamp-member drive cam 90 at all times, and the clamp members 51 and 52 are urged in an opening direction at all times. When the clamp rotating member 53 constituted by inner and outer clamp rotating members closes the clamp members 51 and 52 and binds the sheet bundle S, the inner and outer clamp rotating members are slightly shifted from each other so that the angles of the clamp members 51 and 52 can be adjusted according to the thickness of the bundle S.

(Clamp Member)

The clamp members 51 and 52 have a flat L-shaped arm, and are rotatable on the shafts 63 and 78, respectively. The clamp members 51 and 52 have generally U-shaped press members 280 attached thereto, respectively. If the clamp members 51 and 52 are rotated on the shafts 63 and 78, the clamp portions 73B and 77B of the clamp members 51 and 52 will be closed, thereby folding the clip 101. Then, the folded portions of the clip 101 are caulked by the press members 280 of the clamp members 51 and 52.

(Drive Mechanism)

The drive mechanism 80 is equipped with a drive motor 81 (Fig. 5) attached to the side wall 12A of the housing 12, a gear 83 (Fig. 9) mounted on the drive shaft 82 of the drive motor 81, a speed reduction gear train 84 having speed reduction gears 84A through 84D and engaging the gear 83, and a link-member drive cam 85 with gear teeth engaging the speed reduction gear 84D of the speed reduction gear train 84. The gear 83 and the gears 84A through 84D are arranged in the gear chamber 15 of the housing 12, and the link-member drive cam 85 is arranged in the cam chamber 16.

The drive motor 81 is controlled by a control circuit 300 to be described later. This control circuit 300 controls the drive motor 81, based on a clip signal output from the main body of the copying machine and a detection signal output from the photodetector 19, for example.

The link-member drive cam 85 controls the reciprocating motion of the slider 150 and is normally rotated in a direction of arrow CW shown in Fig. 9 by the drive motor 81 through the gear 83 and the gears 84A through 84D.

One side surface of the link-member drive cam 85 has an annular cam groove 86 for pivoting a slider actuating arm portion 85. This cam groove 86 has a valley-shaped small-diameter portion whose distance from the center of a rotational shaft 87 is reduced and a large-diameter portion 86B whose distance from the center is constant.

The link-member drive cam 85 is provided integrally with the clamp-member drive cam 90 which rotates with the link-member drive cam 85. In the cam groove 86 of the drive cam 85 an arm portion 33 is inserted for reciprocating the slider 150.

The clamp-member drive cam 90 for opening and closing the clamp members 51 and 52 is provided with a disc protruding portion 90B on the side surface thereof, as shown in Fig. 7. This disc protruding portion 90B detects whether or not the clamp members 51 and 52 are in a position which can receive the clip 101. The disc protruding portion 90B is formed with a circular arc-shaped recess 90A. In the vicinity of the rotational area of the disc protruding portion 90B, a microswitch M2 which is a home position sensor is arranged. This microswitch M2 is attached to a side wall portion opposite to the disc protruding portion 90B of the clamp-member drive cam 90. The output of the microswitch M2 is input to the control circuit 300 through an interface. The front edge α in the rotational direction of the recess 90A is a home position at which the microswitch M2 goes from an OFF state to an ON state, while the rear edge β in the rotational direction of the recess 90A is a clip feed completion position at which the microswitch M2 goes from an ON state to an OFF state.

An area, covered until the rear edge β of the recess 90A goes beyond the microswitch M2 since the front edge α of the recess 90A faces the microswitch M2, is an area for possible reverse rotation. If the rear edge β of the recess 90A of the clamp-member drive cam 90 goes beyond the microswitch M2, the rear edge β will be a feed completion position at which the clip 101 is set in the clamp members 51 and 52 and will be an area for impossible reverse rotation.

(Slider Reciprocating Mechanism)

The slider reciprocating mechanism 30, as shown in Fig. 9, is constituted by a shaft J (Fig. 5) supported by the support portions 12B and 12C of the housing 12 so as to be freely rotatable and first and second link members 31 and 32 mounted on the shaft J so as to be freely rotatable.

The first link member 31 has a pivotal arm portion 33 slidably inserted in the cam groove 86 of the link-member drive cam 85. If the link-member drive cam 85 is rotated, the arm portion 33 will be moved up and down by the cam groove 86 and therefore the first link member

31 will be pivoted on the shaft J.

The second link member 32 has a cylindrical portion 34, which is in turn connected to the first link member 31 so that it is freely rotatable. The cylindrical portion 34 is provided with a slider actuating arm portion 35 for reciprocating the slider 150 in the longitudinal direction of the slider 150.

The cylindrical portion 34 of the second link member 32 has a coil spring 36 attached to the exterior surface. One end of the coil spring 36 is anchored to a stopper portion 31A provided on the first link member 31, while the other end is anchored to the slider actuating arm portion 35 of the second link member 32. This coil spring 36 causes the second link member 32 to rotate with the first link member 31, and if rotation of the first link member 31 is stopped, only the second link member 32 will rotate with respect to the first link member 31.

The slider actuating arm portion 35 of the second link member 32 is interposed between the guide portions 157 and 157 of the slider 150 so that the pivotal portion of the slider actuating arm portion 35 causes the slider 150 to reciprocate in the longitudinal direction thereof.

(Cartridge)

The cartridge 100, as shown in Fig. 8, is constituted by a cartridge main body 103 forming a generally circular housing chamber 102 and a lid body 120 attached to the cartridge main body 103 so that it can be opened and closed. The cartridge 100 is made so that the housing of the connected clip body 200 wound in roll form into the housing 102 can be easily performed. The bottom plate and the upper plate of the cartridge main body 103 are formed with a guide recess 104A into which the guide rail 17 of the unit main body 11 is fitted.

On the front side of the cartridge main body 103 a flat guide plate portion 130 is continuously formed for clamping and guiding the upper and lower edges of the slider 150 and also for guiding the clip 101. This guide plate portion 130 has the slider 150 attached thereto so that the slider 150 is movable in the longitudinal direction thereof. The guide plate portion 130 is formed with lower and upper guide portions for guiding the upper and lower ends of the clip 101. The guide plate portion 130 is provided with nonreturn pawls (not shown) for catching the clip 101, and the nonreturn pawls can be projected from the guide plate portion 130 and retracted into the guide plate portion 130. The nonreturn pawls allow the clip 101 to move forward when the slider 150 feeds the clip 101 toward the clamp members 51 and 52, and prevents the clip 101 from moving backward when the slider 150 moves away from the clamp members 51 and 52.

(Slider)

The slider 150 is formed from a rectangular plate member 151, as shown in Fig. 5. The upper and lower ends of the plate member 151 are formed with grooves which are engaged by the guide plate portion 130. The exterior surface of the plate member 151 is provided with the aforementioned guide portions 157 for holding the slider actuating arm portion 35 of the second link member 32. Therefore, if the slider actuating arm portion 35 of the second link member 32 is pivoted on the shaft J, the slider 150 will be reciprocated in the longitudinal direction. The rear end portion of the plate member 151 of the slider 150 is formed with a rectangular cutout 163 so that the photodetector can detect the tape 201 of the connected clip body 200.

As shown in Fig. 5, a forward-feed pawl 180 is attached to the front end portion of the plate member 151. This forward-feed pawl 180 projects toward the guide plate portion 130 and catches the clip 101. The clip 101 can be fed forward by this catching.

Similarly, backward-feed pawl plates 195 are attached to the rear end portion of the plate member 151. The backward-feed pawls (not shown) of the backward-feed pawl plates 195 catch the clip 101 in the same way as the aforementioned. The four feed pawls before and after are shifted from each other in longitudinal and vertical directions so that they do not interfere with the aforementioned nonreturn pawls attached on the side of the cartridge main body. The nonreturn pawls comprising four pawls in the longitudinal and vertical directions of the slider 150 can be projected or retracted by the elastic force so that they do not interfere with the backward movement of the slider 150.

(Connected Clip Body)

The connected clip body 200 is one in which a plurality of clips 101 are bonded to a ribbon tape 201, connected together, and wound in roll form. The clip 101 is formed from metal, and the tape 201 has the orientation property that it tears easily in the width direction thereof. Therefore, if the clip 101 is bent, it is separated from the tape 201 when bent.

(Control Circuit)

Fig. 10 shows the board computer 300 serving as a control circuit which controls the rotational angle and rotational quantity of the drive motor 81. This board computer 300 comprises a board having a microcomputer and the peripheral circuits, such as connection circuits, mounted thereon and controls the drive motor 81. The drive motor 81 comprising a DC motor is driven through the interface of the board computer 300. The output of the microswitch M2, the output of the photodetector 19, the output of the microswitch M1 which is a clip detection sensor on the clamping side, the clip mode signal and clip instruction signal from the copying machine, and the sheet material detection signal provided in the copied paper stacking tray of the copying machine are input to the data input of the board computer 300.

The board computer 300 outputs a control signal for controlling the rotational angle and rotational direction of the drive motor 81, a clipping completion signal representative of the state of the clipping unit 10, a clip jam signal, a clip supply request signal, and a motor lock display signal. When clip set detection means detects that the clip 101 has not been set in the clamp members 51 and 52, the board computer 300 functions as output means for displaying the state in which the clip 101 has not been set in the clamp members 51 and 52. The board computer 300 receives power from the copying machine when power to the copying machine is applied, and based on the clipping instruction signal from the copying machine, a start flag rises in a clipping mode.

Fig. 11(A) shows a flowchart of the operation performed by the board computer 300. Describing the flowchart of the board computer 300 along with the clip feed operation of the slider in reference to Fig. 11(A) and Figs. 12(A)(1) through (5) and 12(B)(1) through (6), the microswitches M1 and M2 and the photodetector 19 are turned on along with the rise of the start flag, and in step S1 it is judged whether the recess 90A of the disc protruding portion 90B of the clamp-member drive cam 90 is located at the position of the microswitch M2. If the recess 90A is present at the position of the microswitch M2, no initialization will be required. If, on the other hand, the recess 90A is not present at the position of the microswitch M2, the drive motor 81 will be controlled and initialization will be performed so that the recess 90A of the clamp-member drive cam 90 will be located at the position of the microswitch M2 (step S2).

At this time, the slider 150 is in a stand-by position shown in Fig. 12(A)(1) or 12(B)(1) and the clip 101 is near the clamp members 51 and 52.

If the microswitch M2 goes from the OFF state to the ON state and the recess 90A is positioned at the home position HP, then a positive rotation signal CW(1) will be sent to the interface of the drive motor 81 so that the slider 150 is moved from the vicinity of the photodetector 19 (see Fig. 8) toward the vicinity of the microswitch M1 (see Fig. 9) (step S3). This positive rotation signal CW causes the drive motor 81 to rotate the clamp-member drive cam 90. If the clamp-member drive cam 90 is rotated, the first link member 31 will be pivoted by the link-member drive cam 85 through the arm portion 33 of the first link member 31, and the slider actuating arm portion 35 of the second link member 32 will be pivoted on the shaft J through the arm portion 31A of the first link member 31. This pivotal motion of the slider actuating arm portion 35 causes the slider 150 to move from the photodetector 19 toward the microswitch M1.

If the drive motor 81 causes the clamp-member drive cam 90 to rotate, the time T α that elapsed since the microswitch M2 has gone to the ON state will be compared with a predetermined time T0 (step S4).

If the elapsed time Tα after the ON state of the microswitch M2 is longer than the predetermined time T0, the on-off judgment of the microswitch M2 will be performed (step S5). If the microswitch M2 is not off but remains on, a display of motor lock will be performed (step S6).

If the microswitch M2 goes to the OFF state, the next time T β that elapsed until the clip 101 is detected by the microswitch M1 will be compared with a predetermined time T1 (step S7). If the elapsed time T β exceeds the predetermined time T1, it will be judged whether the microswitch M1 is on or off (step S8). If the microswitch M1 is on, it will mean that the clip 101 has been set in the clamp members 51 and 52 and therefore the slider 150 will be moved from the clamp members 51 and 52 to the photodetector 19.

In this way, the clip 101 is fed between the clamp members 51 and 52, as shown in Fig. 12(A)(2). Thereafter, the drive motor 81 is rotated to close the clamp members 51 and 52 (Fig. 12(A)(3)), and the sheet materials S are clipped with the clip 101 (Fig. 12(A)(4)).

The elapsed time Tγ between the detection of the clip 101 by the microswitch M1 and the return of the slider 150 to the stand-by position of the photodetector 19 is compared with a predetermined time T2 (step S9).

In step S9, if the elapsed time Tγ is longer than the predetermined time T2, it will be judged whether the microswitch M2 is on or off (step S10). If the microswitch M2 is not on, motor lock will be displayed (step S11). In step S10, if the microswitch M2 is on, the numeric value N of the reverse rotation number register of the drive motor 81 will be set to 0 (step S12) and this control operation will end. In this way, the clamp members 51 and 52 are opened as shown in Fig. 12(A)(5).

In step S8, if the microswitch M1 remains off, a value of 1 will be added to the numeric value N of the reverse rotation number register of the drive motor 81 (step S13) and it will be judged whether the photodetector 19 is on or off (step S14), because the clip 101 has not reached the microswitch M1, as shown in Fig. 12(B)(2).

If the photodetector 19 is on, the reverse rotation number N will be compared with a set value of 10 (step S15). If the reverse rotation number N is less than 10, a reverse rotation instruction CCW will be transmitted to the interface of the drive motor 81 (step S16).

Based on this reverse rotation instruction CCW of the drive motor 81, the slider 150 is returned to the side of the photodetector 19, as shown in Fig. 12(B)(3). If the reverse rotation number N exceeds 10, it means that the slider 150 has reciprocated ten times, and a signal indicating that clips 101 have been jammed is output (step S17).

In the on-off judgment of the photodetector 19 (step S14), if the photodetector 19 is off, the reverse rotation number N of the drive motor 81 will be compared with a numeric value of 2 (step S18). If the reverse rotation number N is greater than 2, a signal indicating that the connected clip body 200 has been used up will be output (step S19). If the reverse rotation number N is 2 or less, the stage returns to step S16.

The time T δ that elapsed after a signal for reversely

rotating the drive motor 81 has been set is measured, and is compared with a predetermined time T3 (step S20). If the elapsed time T δ exceeds the predetermined time T3, it will be judged whether the drive motor 81 has been returned to the home position HP by the reverse rotation thereof and also the microswitch M2 has been on or remains off (step S21). If the microswitch M2 remains off, motor lock will be displayed (step S22). If the microswitch M2 has been on, the drive motor 81 will be returned until the microswitch M2 goes to the OFF state and step S21 will return to step S1. In step S1 the drive motor 81 is rotated in the positive rotational direction. In this way, the clip 101 being stopped halfway is held between the stepped portions of the press members 280 of the clamp members 51 and 52, as shown in Fig. 12 (B)(4).

After the clip 101 has been set in the clamp members 51 and 52, step S4 and the steps thereafter are performed. Figs. 12(B)(4) through (6) show the state when the clip 101 is set in the clamp members 51 and 52 only by re-sending and is bent in the same way as Figs. 12(A)(3) through (5).

The initialization in step S2 is shown in Fig. 11(B). After the initialization flag rises, the on-off judgment of the microswitch M2 is performed (step S201). If the microswitch M2 is on, the drive motor 81 will be reversely rotated (step S202) and the elapsed time $T_{on\text{-}off}$ that the microswitch M2 goes to the ON state from the OFF state will be compared with a predetermined time T η (approximately 600 ms) (step S203). When the elapsed time $T_{on\text{-}off}$ is not within the predetermined time T η, motor lock or sensor failure is displayed (step S204). If the elapsed time $T_{on\text{-}off}$ is within the predetermined time T η, the drive motor will be rotated in the positive direction CW shown in Fig. 9 (step S205). After the positive rotation of the drive motor 81, the $T_{on\text{-}off}$ is compared with a predetermined time T ζ (approximately 600 ms) (step S206). If the elapsed time $T_{on\text{-}off}$ is within the predetermined time Tζ , the initialization will be ended. If the elapsed time $T_{on\text{-}off}$ is not within the predetermined time T ζ, motor lock or sensor failure will be displayed (step S204).

In the initialization step S2, if the recess 90A of the clamp-member drive cam 90 is in an area for possible reverse rotation which faces the microswitch M2, as shown in Fig. 7, the drive motor 81 will be rotated reversely in the direction of arrow CCW until the front edge α abuts the microswitch M2. If the microswitch M2 is contacted by the front edge α and goes to the OFF state, the drive motor 81 will again be rotated in the positive direction of arrow CW until the microswitch M2 goes to the ON state again. On the other hand, in the initialization step S2 in Fig. 11(A), when the circumferential portion of the clamp-member drive cam 90 other than the recess 90A, i.e., area for impossible reverse rotation comes in contact with the microswitch M2 and thereby the microswitch M2 is in an OFF state, the drive motor 81 is rotated in the positive direction until the front edge α reaches the position of the microswitch M2. Thereafter, steps S201 to S206 are taken.

Even in the reverse rotation step S16, the drive motor 81 is rotated in the reverse direction (arrow CCW), until the front edge α abuts the microswitch M2, and if the microswitch M2 is contacted by the front edge α and goes to the OFF state, in step S3 the drive motor 81 will be rotated in the positive direction (arrow CW).

(Control of a Reset Mode)

The microswitch M2 is used to detect whether or not the clamp members 51 and 52 have been opened, when clamp-member drive cam 90 has returned to the initial position (home position). When the microswitch M2 goes to the ON state and outputs a logic high level signal to the control circuit of the drive motor 81, the clamp members 51 and 52 have been opened and the slider 150 can hold the upper and lower ends of the clip 101, and also the control circuit 300 of the drive motor 81 can select both the positive rotation in the CW direction and the reverse rotation in the CCW direction.

In the case where power supply from the copying machine or power of the clipping unit itself is cut off or a system error occurs in the copying machine or clipping unit itself, if the clipping unit is again supplied with power or turned on or the system error is eliminated, the system of the clipping unit will be reset. If the clipping unit is reset, the operation of the clamp members 51 and 52 will vary, depending upon the opened or closed state (stand-by state or bent state) of the clamping members 51 and 52.

In the system reset mode, as shown in Fig. 1, if the microswitch M2 is on (high) (step 1), the clamp-member drive cam 90 will be rotated once in the reverse direction CCW (step 2). If the microswitch M2 goes to the OFF state (low level) (step 3), the clamp-member drive cam 90 will be rotated in the positive direction CW (step 4). If the microswitch M2 goes to the ON state (high level) again (step 5), power supply to the drive motor 81 will be stopped (step 6).

When the microswitch M2 contacts the largest radial edge of the disc protruding portion 90B of the clamp-member drive cam 90, then goes to the OFF state, and outputs a low level signal, the rotation of the drive motor 81 in the reverse direction CCW is prohibited and in step 4 the drive motor 81 is rotated in the positive direction CW. If the microswitch M2 faces the recess 90A of the clamp-member drive cam 90 and goes to the ON state again (step 5), the driving of the drive motor 81 will be stopped (step 6).

That is, when the clamp members 51 and 52 remain at stand-by in the opened state, the recess 90A of the clamp-member drive cam 90 is in a position facing the microswitch M2, and as shown in Fig. 2, the microswitch M2 is on (high). Based on the ON state of the microswitch M2, the drive motor 81 is rotated in the reverse direction CCW. If this reverse rotation causes the edge

α of the recess 90A on the home position side to turn off the microswitch M2, the drive motor 81 will be rotated in the positive direction CW, based on the OFF state of the microswitch M2.

After the positive rotation of the drive motor 81, if the microswitch M2 goes to the ON state again by the edge α of the recess 90A, the drive motor 81 will be stopped and the clamp members 51 and 52 will return to the opened stand-by state which is before receiving the clip 101.

When the clamp members 51 and 52 are in the closed state, the microswitch M2 goes to the OFF state by the circumferential edge of the disc protruding portion 90B of the clamp-member drive cam 90. At this time, the clamp members 51 and 52 are either before the clipping completion of the clip 101 or after the clipping completion, or although not detected with the microswitch M2, after interruption the clamp members 51 and 52 will continue the stopped operation, as it is, like a normal operation, because the drive motor 81, as it is, is rotated in the positive direction. Therefore, if the clamp members 51 and 52 are before binding the sheet material bundle S with the clip 101, the clamp members 51 and 52 will be closed (bent state) to bind the sheet material bundle S with the clip 101 and then they will be opened and return to the stand-by state.

If the clamp members 51 and 52 are stopped in the state when they are being opened after the sheet material bundle S has been bound with the clip 101, the clamp members 51 and 52 will be opened as they are, and immediately after the microswitch M2 has reached the ON state by the recess 90A, the drive motor 81 will be stopped. At this time, the front edge α of the recess 90A is positioned near the microswitch M2.

Note that the front edge α of the recess 90A may also be one whose angle is narrow. In this case, as shown in Fig. 4, since the area where the microswitch goes to the ON state is narrow, in system reset after stop, the drive motor 81 will be stopped as it is, if the microswitch M2 is on, as shown in Fig. 3. On the other hand, if the microswitch M2 is off, the drive motor 81 will be rotated in the positive direction, and then, if the microswitch M2 goes to the ON state again, the drive motor 81 will be stopped.

Even in either embodiment, if the sheet material bundle S is present between the clamp members 51 and 52, the bundle S will be bound with the clip 101, and if there are no sheet materials, the clip 101 will fall out of between the clamp members 51 and 52 in a bent state.

In this embodiment, while the stand-by state and bent state of the clamp members 51 and 52 have been detected with the disc protruding portion 90B, recess 90A, and the microswitch M2, the states of the clamp members 51 and 52 may be detected by an interrupter and a photodetector provided across a disk formed with a cutout corresponding to the recess 90A.

In addition, the opened and closed states of the clamp members and the clip feed motion of the slider 150 are related with each other, but since the microswitch M1 has been provided between the clamp members 51 and 52, the microswitch M1 can detect whether or not the clip 101 is present, by power reset.

Even if the microswitch M1 were on at the time. of power reset, the microswitch M2 would go to the OFF state (low level) because the rear edge β on the feed completion side of the disc protruding portion 90B has gone beyond the microswitch. Therefore, in the area for impossible reverse rotation of the disc protruding portion 90B, the drive motor 81, as it is, is rotated in the positive direction. At this time, the slider actuating arm portion 35 of the second link member 32 has completed the pivotal motion in the clip feed direction. As previously described, the slider actuating arm portion 35 of the second link member 32 is rotatable with respect to the first link member 31 through the cylindrical portion 34 of the second link member 32 and is rotatable integrally with the first link member 31 through the spring 36. Therefore, when the clip 101 is in contact with the stopper 24 and the microswitch M1, even if the first link member 31 were rotated so that the slider actuating arm portion 35 slides the slider 150, the rotation of the first link member 31 would be absorbed by the spring 36 and therefore the arm portion 35 would not be rotated. That is, when the clip 101 (slider 150) is stopped by the stopper and also the first link member 31 is rotated, the slider actuating arm portion 35 is stopped by the slider 150 but the first link member 31 is rotated against the spring force of the spring 36.

As a countermeasure to reduce inertia during motor rotation and eliminate overrun of the clamp operation, at the time of positive rotation the drive motor is driven with a voltage of 12 V between the home position and the feed completion of the clip 101 (between the front edge α and the rear edge β of the recess 90A) and is driven with a voltage of 24 V after the clip feed completion position β. On the other hand, during the passage of the recess 90A at the time of reverse rotation, the drive motor 81 is driven with a voltage of 6 V. In this way, voltage control is performed, thereby controlling the overrun of the clamp operation which is caused by an increase in inertia.

(Operation)

Now, a description will be provided of the mechanism operation of the clipping unit constructed as described above.

First, the lid body 120 of the cartridge 120 is opened and the connected clip body 200 is put into the housing chamber 102.

Then, the leading end portion of the connected clip body 200 is positioned outside the cartridge 100. The leading end portion is guided between the slider 150 and the cartridge main body 103, and the lid body 120 is closed. The cartridge 100 is placed on the table 13 of the unit main body 11.

Before the drive motor 81 is driven, the link-member drive cam 85 and the clamp-member drive cam 90 are in the stand-by position shown in Fig. 6, and the slider 150 is in the home position shown in Fig. 5. The photodetector 19 (Fig. 8) has detected the tape 201 of the connected clip body 200 of the cartridge 100, thereby detecting that clips 101 are present. Also, the microswitch M2 has detected the recess 90A of the clamp-member drive cam 90. The clamp members 51 and 52 have been opened at the home position shown in Fig. 6.

In this state, if a clip signal is output from the main body of a copying machine (not shown) and also a sheet bundle S is placed on the upper surfaces of the stepped portion 22 of the housing 12 and the front wall portion 21 of the table 13, the board computer 300 will drive the drive motor 81, based on the clip signal, because the photodetector 19 has detected that clips 101 are present. If the drive motor 81 is driven, the link-member drive cam 85 will be rotated in the counterclockwise direction (indicated by arrow A in Fig. 6).

If the point end portion of the arm portion 33 of the first link member 31 reaches the small-diameter portion of the cam groove 86 of the link-member drive cam 85 by the rotation of the link-member drive cam 85, then the arm portion 33 of the first link member 31 and the second link member 32 will be rotated. The slider actuating arm portion 35 of the second link member 32 is rotated in the CW direction of Fig. 5. The rotation of the slider actuating arm portion 35 causes the slider 150 to move from the side of the photodetector 19 toward the microswitch M1.

With the forward movement of the slider 150, the point end portion of the forward-feed pawls 180 catches the leading clip 101, and the clip 101 is fed forward along with the movement of the slider 150. At this time, if the backward-feed pawls 195 of the slider 150 catch another clip 101, the connected clip body 200 will be fed forward by the forward-feed pawl 180 and the backward-feed pawls 195.

Since the clips 101 are interconnected by the tape 201, they are fed forward from the cartridge 100 toward the clamp members 51 and 52.

If the link-member drive cam 85 is further rotated and the arm portion 33 of the first link member 31 arrives near the smallest-diameter portion of the cam groove 86, then the slider 150 will be moved further in the longitudinal direction thereof and the clip 101 will be fed to a position which abuts the stopper 24. If the clip 101 abuts the stopper 24, the movement of the slider 150 will be stopped and the clip 101 will be held by the protrusions 73B and 77B of the clamp members 51 and 52. Then, the microswitch M1 detects the clip 101 held by the clamp members 51 and 52.

If the point end portion of the arm portion 33 of the first link member 31 reaches the smallest-diameter portion of the cam groove 86, the first link member 31 will be rotated, but since the slider 150 has been stopped by the stopper 29, only the first link member 31 will be rotated against the urging force of the spring 37 with respect to the second link member 32.

The rotational quantity of the first link member 31 is set so that the slider 150 moves for a distance greater than the width of the clip 101. Therefore, even if there were fluctuation in the gap between the clips 101, the clip 101 could be reliably fed to a predetermined position, because the first link member 31 rotates with respect to the second link member 32 and thereby absorbs that fluctuation.

If the link-member drive cam 85 is further rotated and the point end portion of the arm portion 33 of the first link member 31 goes from the smallest-diameter portion of the cam groove 86 to the large-diameter portion, the first link member 31 will be rotated to the original position. The second link member 32 rotates in the same direction along with the first link member 31, and the slider 150 returns to the home position on the side of the photodetector 19.

When the slider 150 returns to the home position, the clip 101 is prevented from going backward along with the slider 150, by the nonreturn pawls (not shown) attached to the guide wall portion 130 of the unit main body 11. Since the nonreturn pawls have been provided on the upper and lower portions of the guide wall portion 130, there is no possibility that the clip 101 will incline when the slider 150 returns.

On the other hand, the clamp-member drive cam 90 rotates with the link-member drive cam 85, and the small-diameter portion of the clamp-member drive cam 90 corresponds to the small-diameter of the cam groove 86 of the link-member drive cam 85. For this reason, at the time the slider 150 has reciprocated, the clamp shaft 62 has abutted the small-diameter portion of the clamp-member drive cam 90, so the clamp members 51 and 52 remain opened, as shown in Fig. 6.

If the link-member drive cam 85 is further rotated and the arm portion 33 of the first link member 31 moves on the large-diameter portion of the cam groove 86 of the link-member drive cam 85 and if the clamp shaft 62 of the clamp rotating member 53 abuts the circumferential surface of the increasing portion R2 of the clamp-member drive cam 90, then the clamp rotating member 53 will be rotated on the shaft 63 in the clockwise direction B shown in Fig. 6. This rotation causes the clamp members 51 and 52 to be closed. If the clamp members 51 and 52 are closed, the clip member 101 will be pushed forward and bent in the form of "<" at the central portion.

Furthermore, if the link-member drive cam 85 rotates and the clamp shaft 62 of the clamp rotating member 53 moves on the circumference of the increasing portion R2 of the clamp-member drive cam 90 toward the large-diameter portion R3, then the clamp members 51 and 52 will be rotated further in the closing direction. As a consequence, the clip 101 is folded in two by the clamp members 51 and 52.

At this time, in the state where the clip 101 is

pressed from above and below by the front end portions of the upper and lower press members 280, since the upper and lower clamp members 51 and 52 caulk the bent portion of the clip 101, the clip 101 is attached closely to the sheet bundle S and folded, thereby binding the sheet bundle S. Therefore, the clip 101 is prevented from floating off the sheet bundle S and can closely bind the sheet bundle S.

If the link-member drive cam 85 rotates and the clamp shaft 62 of the clamp rotating member 53 moves on the circumferential surface of the reducing portion R4 of the clamp-member drive cam 95, the clamp rotating member 53 will be rotated on the shaft 63 in the counterclockwise direction and the clamp members 51 and 52 will be rotated in an opening direction opposite to the aforementioned. Then, if the link-member drive cam 85 and the clamp-member drive cam 90 make one revolution, the clamp members 51 and 52 will return to the home position shown in Fig. 7. The microswitch M2 detects the recess 90A of the clamp-member drive cam 90, and the drive motor 81 is stopped.

As previously described, the clipping unit 10 of this embodiment is equipped with the clamp members 51 and 52 as a pair of folding means which bind a bundle S of stacked sheet materials, by folding the clip 101 which is a linear or flat binding member. Furthermore, the clamp members 51 and 52 are a unit for binding a stacked body, which has a stand-by state in which they are opened so as to hold the clip 101 and a bent state in which they are closed so that the clip 101 is bent and bind a bundle S of sheet materials. This clipping unit 10 is characterized by having a step which causes the clamp members 51 and 51 to reach the stand-by state after the bent state has been completed once, when the unit is restarted after elimination of the stopping causes of the case where the clamp members 51 and 52 are stopped while bending the clip 101.

According to this clipping unit 10, in the case where the clamp members 51 and 52 are stopped during the bending operation of the clip 101, error occurrence, such as the binding defect of the sheet material bundle S or a jam of the clip 100 by double feed, is prevented, because the bent state of the clamp members 51 and 52 being stopped in the bent state is completed after reset.

Particularly, in this embodiment, in the case where the clamp members 51 and 52 are still present immediately after start of the bending operation and also the bent state of the clip 101 is weak and remains connected to the tape, the clip 101 is prevented from floating in the air. Even in the case where the clip 101 bent in the form of a U letter is attached loosely to the sheet material bundle S and therefore the bundle S is not completely bound, the clamp members 51 and 52 are completely closed once, so the bundle S is completely bound with the clip 101 and the occurrence of a clipping defect is prevented.

In addition, according to the clipping unit 10 of this embodiment, in the case where the clip 101 has not been set in the clamp members 51 and 52, the board computer 300 causes the slider 150 to feed the clip 101 a predetermined number of times, and in the case where the clip 101 is not set in the clamp members 51 and 52 within a predetermined number of times, the bending operation of the clamp members 51 and 52 can be prevented. Therefore, scratches by lost drive-in of the sheet bundle S or damage to the clamping members 51 and 52 can be prevented.

Furthermore, in the case where the number of feed operations of the connected clip body 200 of the slider 150 is counted and the clip 101 is not set in the clamp members 51 and 52 within this counted number, the state in which the clip 101 has not been set can be displayed, for example, on the control panel of the copying machine and informed to an operator. When the photodetector 19 detects that there is no connected clip body 200 in the cartridge 100 and the microswitch M1 on the side of the clamp members 51 and 52 detects that there is no clip 101, it is displayed, by output from the board computer 300, that there is no connected clip body 200 in the cartridge, thereby enabling a display of clip supply. When there is the clip 101 in the cartridge 100 and there is no clip 101 on the side of the clamp members 51 and 52, in the case where the clip 101 is not detected on the side of the clamp members 51 and 52 after the slider 150 has been fed a predetermined number of times, it can be displayed that clips 101 have been jammed in the moving area of the slider 150, by output from the board computer 300.

In the aforementioned embodiment, while a description has been given of the cartridge 100 of the clipping unit 10, it is a matter of course. that the present invention is not limited to this but is applicable, for example, to the cartridge of an electric stapler.

Fig. 13 shows a schematic view of an electric stapler to which the present invention was applied. This electric stapler 400 roughly comprises a magazine section 410 and a clincher section 420. The base 411 of the magazine section 410 is provided with a cartridge 412 stacked with sheet staple (i.e., sheets of staples) 402 each consists of a plurality of straight staples 401 arranged parallel and interconnected with an adhesive agent. On both sides of the cartridge 412 a pair of links 430 are arranged. The links 430 are rotatable on a fulcrum shaft 431 provided near the central portion of the cartridge 412. On the rear end portions of the links 430 a roller 432 which becomes a cam follower is provided. The links 430 are urged by a tension spring 435 so that the rear end portions thereof are positioned downward, and are supported by a stopper 436.

The front end portions of the links 430 support a flat driver 433 for pushing out the staple 401 bent in the form of a rectangular gate toward the clincher section 420. The driver 433 is provided with a flange having an elongated hole into which the shaft 430A of the links 430 is inserted, and up-and-down movement of the shaft 430A

causes the driver 433 to move up and down.

In the base 411 near the driver 433, a guide plate 413 is stood up for guiding the staple 401, and the driver 433 moves up and down along the guide plate 413. On the surface of the driver 433 remote from the guide plate 413, a forming plate 434 is arranged for separating the foremost staple 401 from the sheet staple 402 and bending the opposite ends of the separated staple 401 into the shape of a rectangular gate.

The forming plate 434 is also supported by the shaft 430A, and the lower opposite side portions of the forming plate 434 project downward beyond the lower central portion so that the staple can be bent into the shape of a rectangular gate. The portion of the base 411 positioned under the forming plate 434 is formed with a protruding portion 416 for supporting the central portion of the staple 401. The lower opposite side portions of the forming plate 434 enter on both sides of the protruding portion 416, and both sides of the protruding portion 416 are formed into a taper surface 417 which causes the staple 401 bent in the form of a gate to move under the driver 433. A staple guide plate 414 is stood up next to the forming plate 434 and supports the front end of the sheet staple 402.

The driver 433 and the forming plate 434 move up and down at the same time, and the lower end portion of the driver 433 projects downward beyond the lower end portion of the forming plate 434. When the driver 433 and the forming plate 434 are lowered by the links 430, the front end of the sheet staple 402 strikes on the side surface of the driver 433, the advancement is stopped, and the front staple is bent into the shape of a gate by the downward movement of the forming plate 434.

Then, if the driver 433 and the forming plate 434 rise, the staple 401 bent in the form of a gate will be moved under the lower end of the driver 433 and the next staple will be positioned under the forming plate 434.

Therefore, in the very initial state immediately after the sheet staple 402 has been set in the cartridge 412, the front staple 401 is not present under the lower end of the driver 433, but the front end of the sheet staple 402 is pushed by a flat hook member (not shown) arranged under the cartridge 412 and strikes on the side surface of the driver 433.

For this reason, in the first forming operation, the foremost staple is bent into the form of a gate by the forming plate 434 and is separated from the sheet staple 402. If the driver 433 and the forming plate 434 rise, the staple 401 bent in the form of a gate will fall along the taper surface 417, and will stop in the gap between the guide plate 413 and the side surface of the protruding portion 416 due to frictional force. In the second forming operation, if the driver 433 is lowered, the staple 401 being stopped in the gap between the side surface of the protruding portion 416 and the guide plate 413 will be pushed by the driver 433 and will project to the side of the clincher section 420.

On the side of the roller 432 of the links 430 of the base 411, a rotational shaft 440 is supported by side wall portions stood up in the base 411. The rotational shaft 440 has a cam 441 mounted thereon. The cam 441 is rotated by a gear 442 coaxially mounted on the rotational shaft 440. The gear 442 is driven by a motor 450 through gears 443, 444, and 445.

The rotation of the motor 450 is controlled by a drive circuit (not shown). More specifically, if a bundle of copied paper sheets T is placed on the table 421 of the clincher section 420, the motor 450 will rotate and the cam 441 will be rotated. Then, the cam follower 432 is pushed up and the driver 433 is lowered. As previously described, the driver 433 is lowered and staple 401 is projected from the end of the base 411.

The table 421 of the clincher section 420 is formed with a slit 421A at a position to which the driver 433 is lowered. Under this slit 421A, a pair of clincher arms 422 are provided for bending the opposite leg portions 401A of the gate-shaped staple 401 inside. The clincher arm 422 is held by a shaft 422A, which is in turn held by a clincher frame 423 so that it is freely rotatable. The clincher arm 422 is urged downward by a tension spring (not shown). The clincher arm 422 is rotated upward by a link 424.

One end of the link 424 is formed with a horizontal flange portion 424A, while the other end is provided with a cam follower 425. The link 424 is rotatably supported by a shaft 424B held by the side wall portions of the clincher frame 423. The link 424 is urged upward on the side of the cam follower 425 by a spring (not shown), and the cam follower 425 is moved up and down by a cam 426. The cam 426 is driven by a motor 428 through gears 427A, 427B, and 427C. The motor 428 is controlled by a control circuit (not shown). When the driver 43 is lowered and the cam follower 432 strikes on the same radius portion 441A of the cam 441, the link 424 is moved up and down, thereby bending the opposite leg portions 401A of the staple 401 along the paper surface of the sheet bundle T.

In this electric stapler 400, in the case where the front end of the sheet staple 402 strikes only on the side surface of the driver 433 and the lower end of the forming plate 434 is above the front end of the sheet staple 402, it is possible to slightly pivot the link 434 under the state where the lower end of the forming plate 434 does not contact the front end of the sheet staple 402. That is, it is possible to rotate the drive motor 450 in positive and reverse directions.

Therefore, in the case where the electric stapler 400 is stopped under the state where the lower end of the forming plate 434 does not contact the front end of the sheet staple 402, the rotation of the drive motor 450 is adjusted in positive and reverse directions, thereby being able to position the link 433 at a normal stand-by position. Also, since an area at which the forming plate 434 contacts the front end of the sheet staple 402 is con-

stant by the angle of the cam 441, in the case where the electric stapler 400 is stopped with the forming plate 434 in contact with the sheet staple 402, the driver 433 and the forming plate 434 are lowered as they are and the leg portions 401A of the staple 401 bent in the form of a gate are folded by the clincher section 420. If a disk having cutouts at predetermined angles is attached to the rotational shaft 440, the positions of the stand-by state and the bent state of the link 430 can be provided at the rotational angles of the cam 441. Therefore, it is detected whether the link 430 is in the stand-by state or the bent state, by providing an interrupter and a photodetector across the disk formed with cutouts.

If constructed in this way, when the link 30 is stopped by system failure during the stand-by state or bent state and is reset after elimination of the causes, double drive-in of the staple 401 and discharging of the sheet bundle T incompletely bound with the staple 401 can be prevented.

According to the clipping unit of the present invention, during the bending operation of the clamp members 51 and 52, the bending operation is interrupted as the result of interruption causes, such as power cut-off to the clamp members or errors, and the clamp members 51 and 52 hold the position taken during the bending operation. In the case where the clamp members 51 and 52 again perform the opening and closing operation after elimination of interruption causes, if the clamp members 51 and 52 are returned to the initial opened state, there will be the possibility that an incompletely bent U-shaped clip will be attached loosely to the end of a paper bundle and therefore the paper bundle will not be completely bound, depending upon the stopped state of the bending operation. However, in the present invention, even in the case where the clamp members 51 and 52 are stopped with the state in which an incompletely bent U-shaped clip is attached loosely to the end of a paper bundle, the paper bundle is completely bound with the clip, because the clamp members 51 and 52 are completely closed once, and the occurrence of a clipping defect can be prevented.

While the present invention has been described with reference to preferred embodiments thereof, the invention is not to be limited to the details given herein, but may be modified within the scope of the appended claims.

Claims

1. A stacked-body binding apparatus comprising:

   a pair of folding means for folding a linear or flat binding member and binding stacked sheet materials, the pair of folding means having a stand-by state in which they are opened and hold said binding member and a bent state in which they are dosed so that said binding member is bent and bind said stacked sheet materials;

   wherein if said pair of folding means are stopped while bending said binding member, said pair of folding means are caused to be in said bent state and then in said stand-by state, when said pair of folding means are restarted after elimination of stop causes.

2. A clipping unit comprising:

   a pair of clamp members for folding opposite ends of a flat clip which bundles end portions of stacked sheet materials, the pair of clamp members having a stand-by state in which they are opened to such a degree that they hold said opposite ends of the flat clip and a bent state in which they bend said clip and are closed to such a degree that they bind said stacked sheet materials and being caused to reach said bent state after said clip has been supplied between said pair of clamp members;

   wherein if said pair of clamp members are stopped while bending, said pair of clamp members are caused to be in said bent state and then in said stand-by state, when said pair of clamp members are opened or closed again after elimination of stop causes.

3. The stacked-body binding apparatus as set forth in claim 1, wherein said pair of folding means are constituted by a magazine section for pushing out a linear staple and driving said staple into stacked sheet materials and a clincher section for supporting said stacked sheet materials and clinching end portions of said staple projecting from said stacked sheet materials and wherein said magazine section and said clincher section have a stand-by state in which they are opened and hold said binding member and a bent state in which they are closed so that said staple is bent and bind said stacked sheet materials, and if said magazine section and said clincher section are stopped while bending said binding member, said magazine section and said clincher section are caused to be in said bent state and then in said stand-by state, when said magazine section and said clincher section are restarted after elimination of stop causes.

FIG. 1

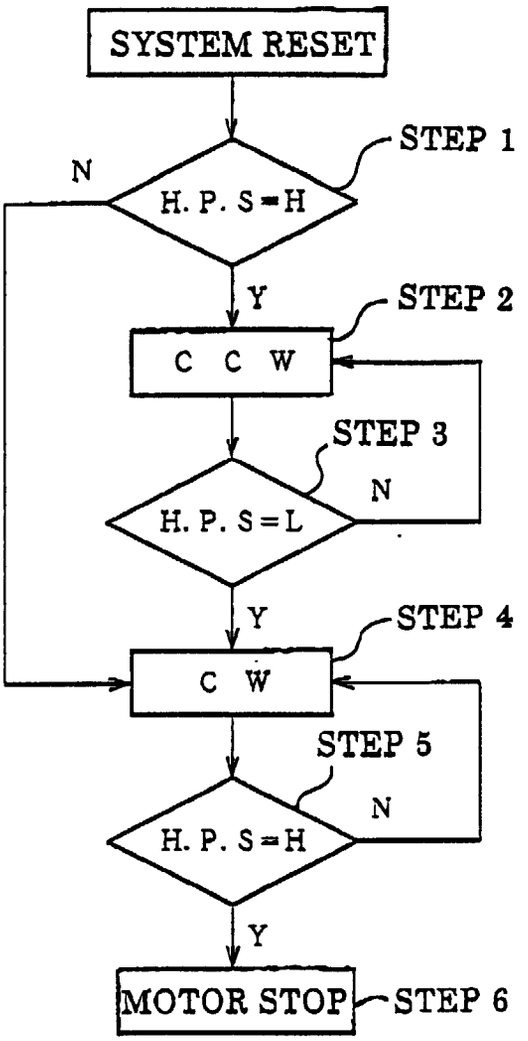

SYSTEM RESET
STEP 1
N
H. P. S=H
Y
STEP 2
C C W
STEP 3
N
H. P. S=L
Y
STEP 4
C W
STEP 5
N
H. P. S=H
Y
MOTOR STOP
STEP 6

FIG. 2

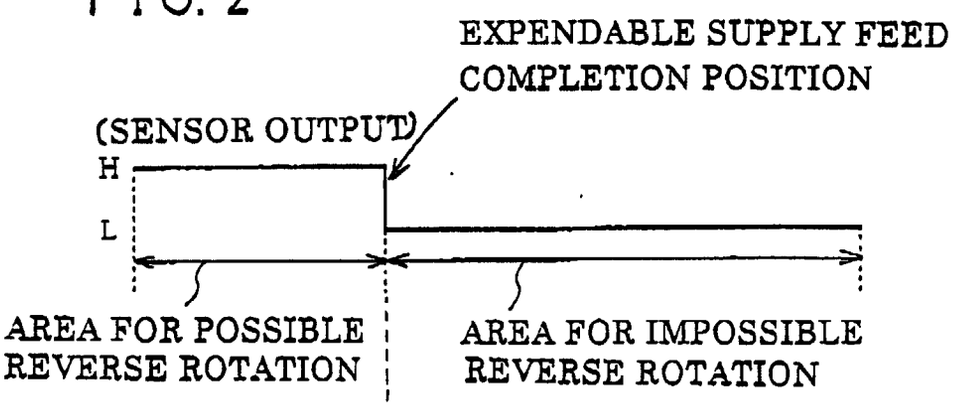

EXPENDABLE SUPPLY FEED
COMPLETION POSITION
(SENSOR OUTPUT)
H
L
AREA FOR POSSIBLE
REVERSE ROTATION
AREA FOR IMPOSSIBLE
REVERSE ROTATION

FIG. 3

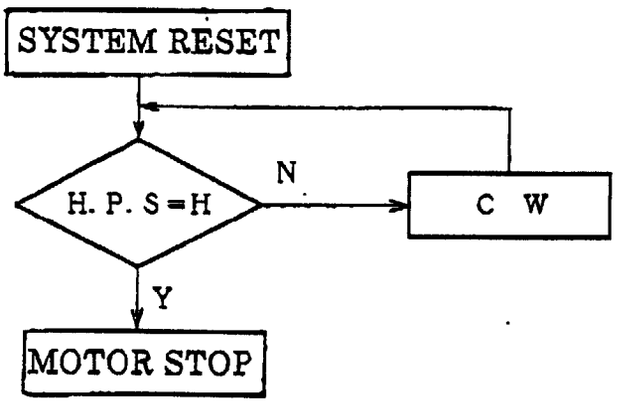

SYSTEM RESET
H. P. S = H
N
C W
Y
MOTOR STOP

FIG. 4

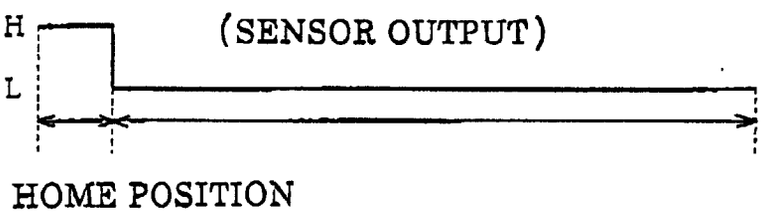

H
L
(SENSOR OUTPUT)
HOME POSITION

FIG. 5

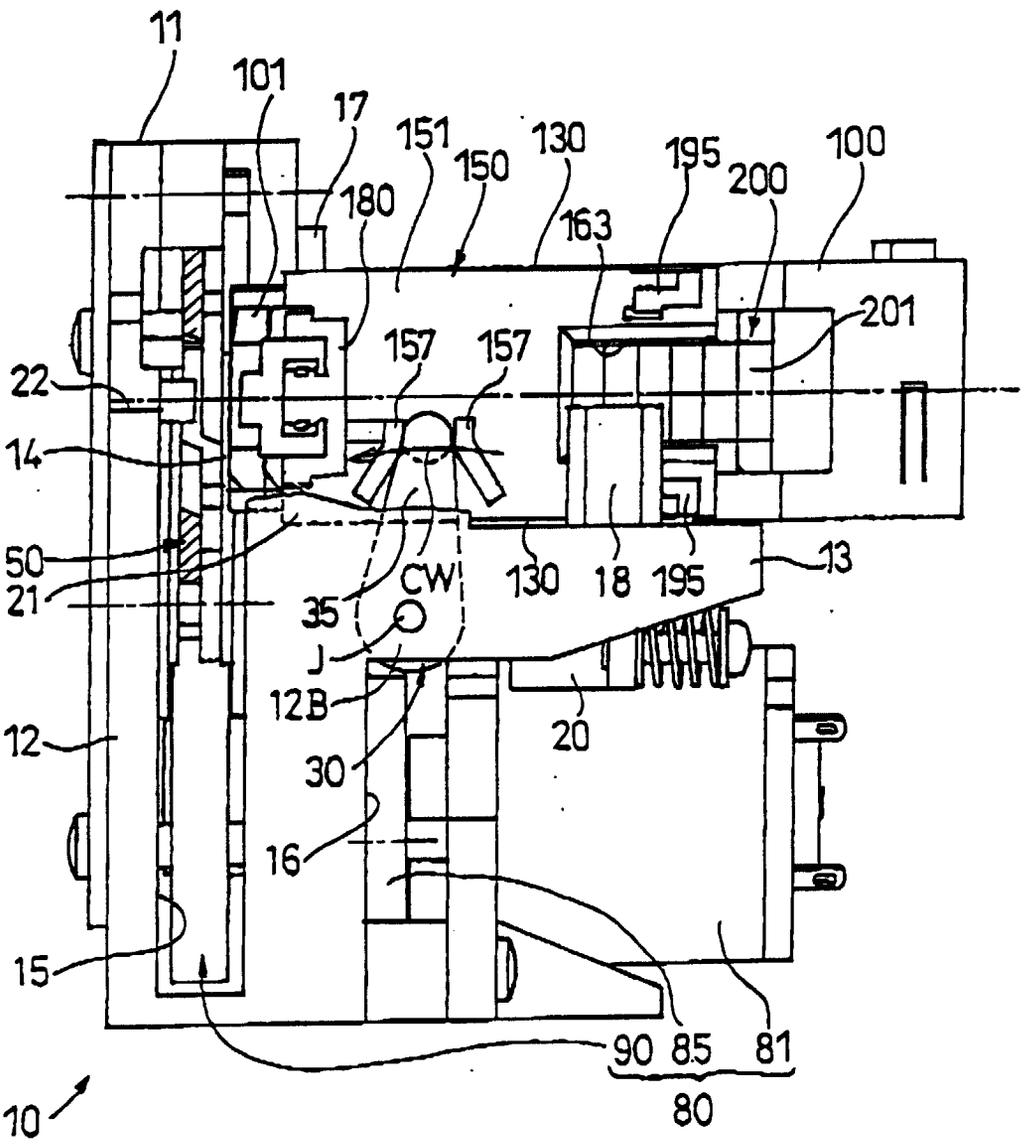

11
101
17
151
150
130
195
200
100
180
163
201
157
157
22
14
50
21
35
CW
130
18
195
13
J
12B
20
12
30
16
15
90
85
81
80
10

FIG. 6

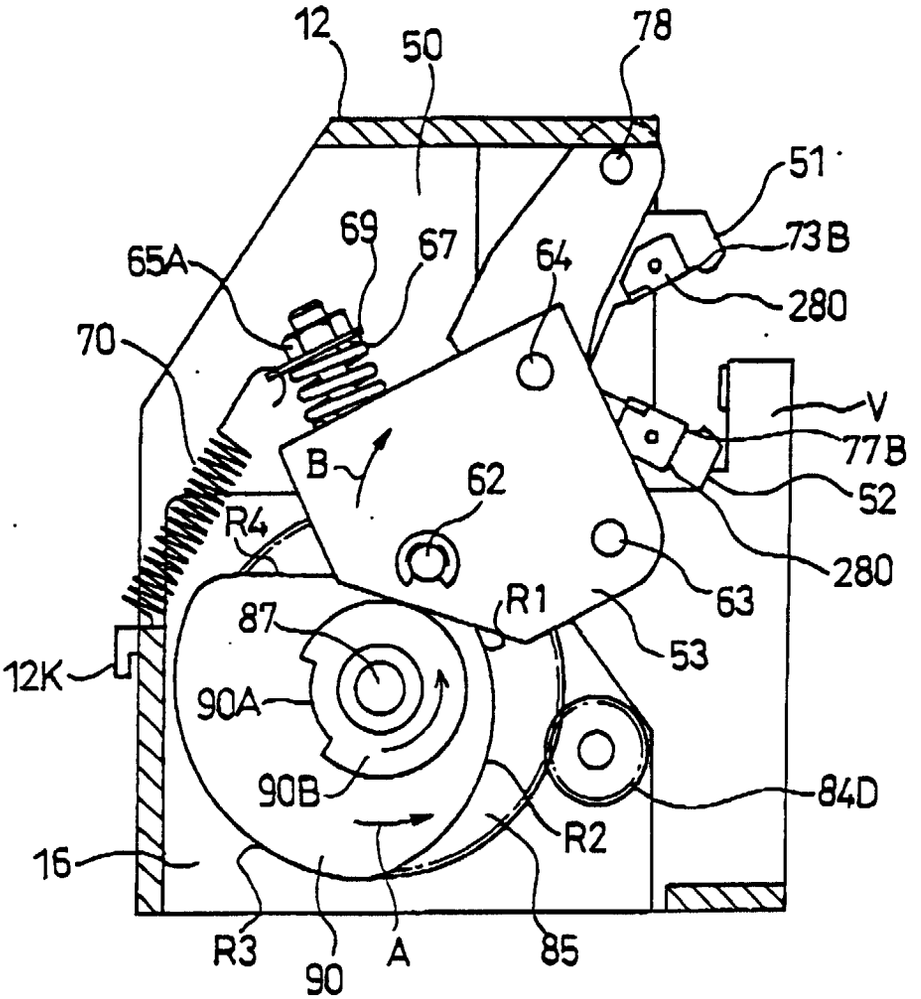

12
50
78
51
73B
280
V
77B
52
280
63
53
84D
R2
85
A
90
R3
16
12K
90B
90A
87
R1
62
R4
B
64
67
69
65A
70

FIG. 7

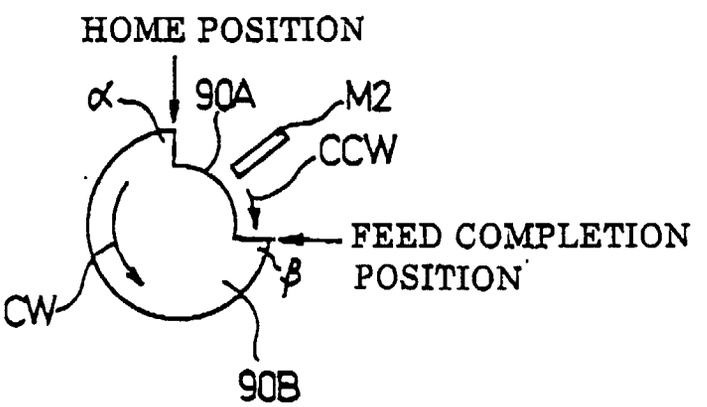

HOME POSITION
α
90A
M2
CCW
FEED COMPLETION POSITION
β
CW
90B

FIG. 8

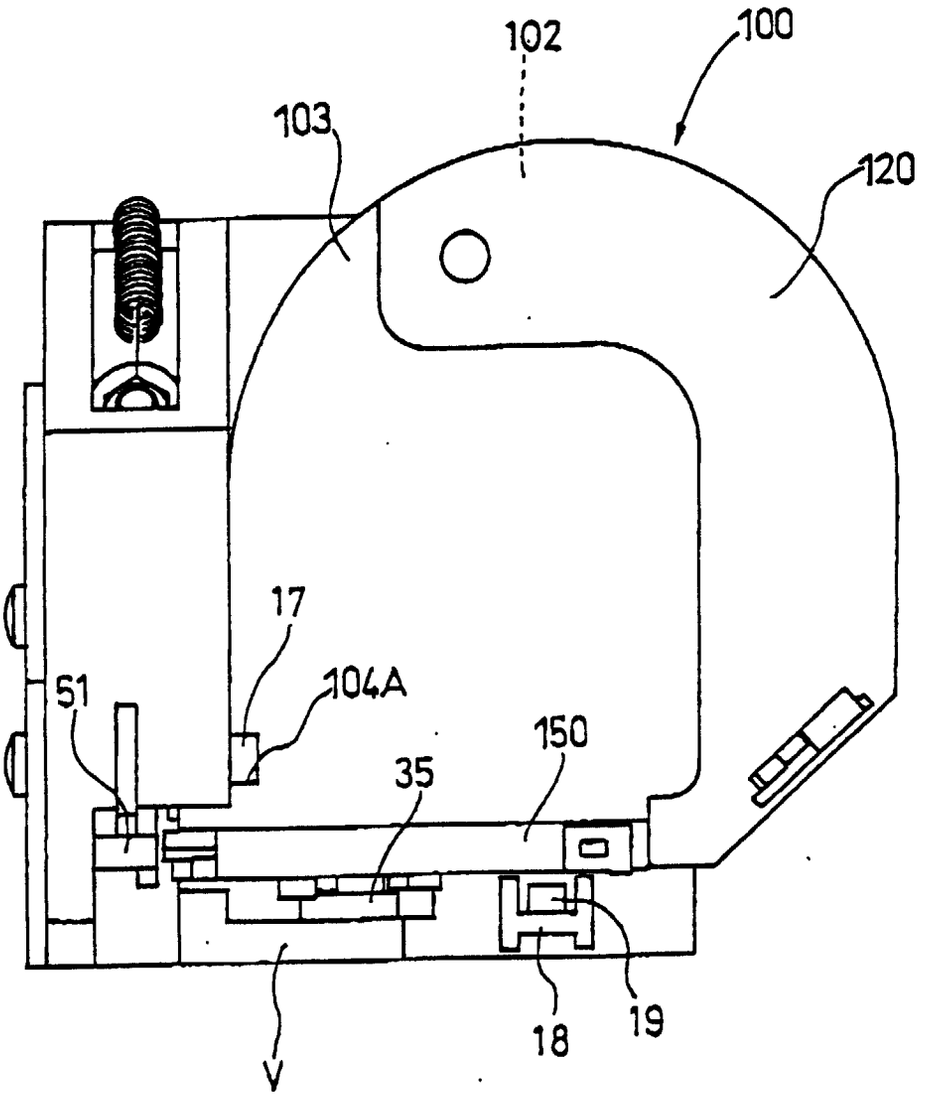


FIG. 9

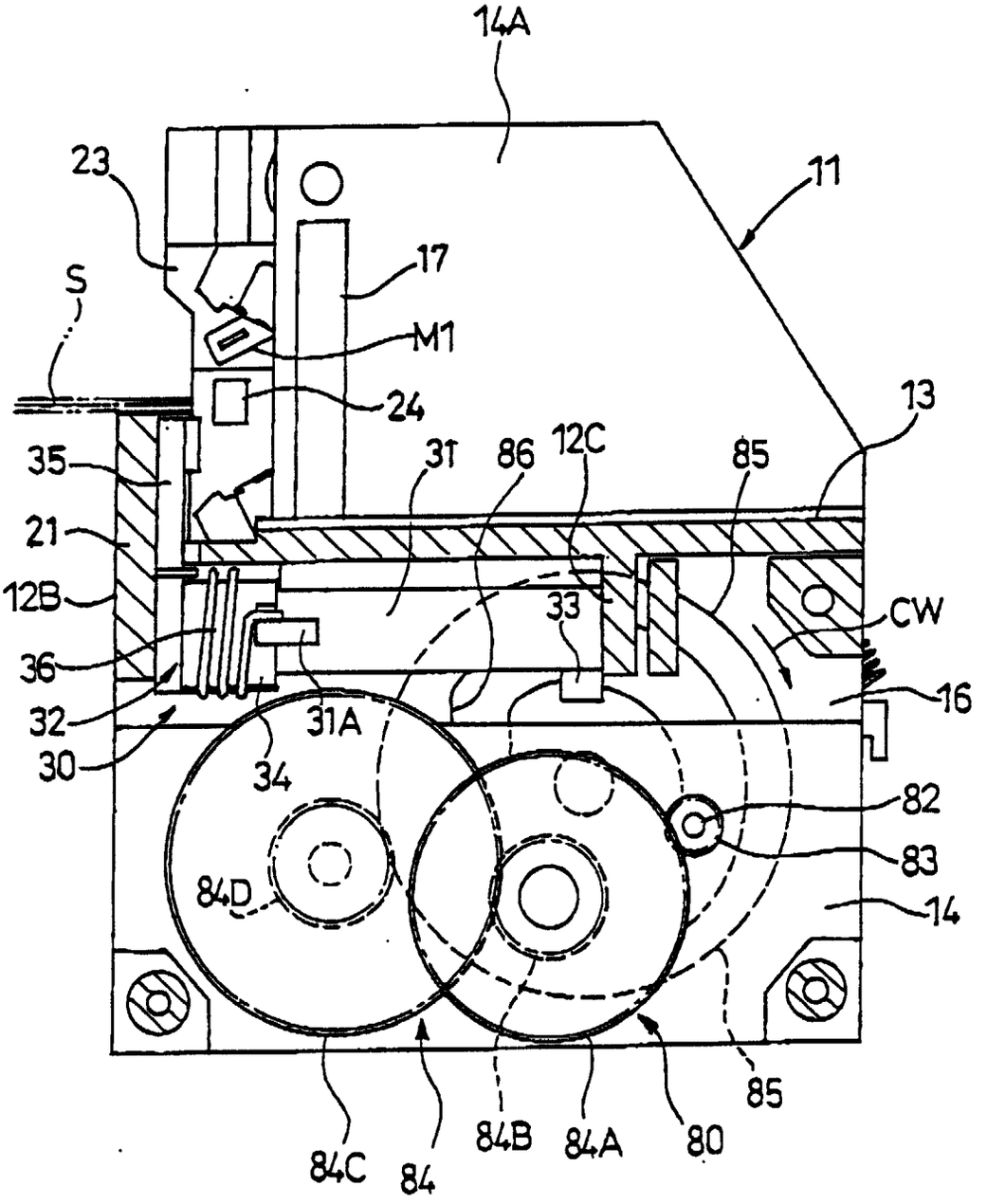

14A
23
11
17
S
M1
24
13
35
31
86
12C
85
21
12B
33
CW
36
16
32
31A
30
34
82
83
84D
14
85
84C
84
84B
84A
80

FIG. 10

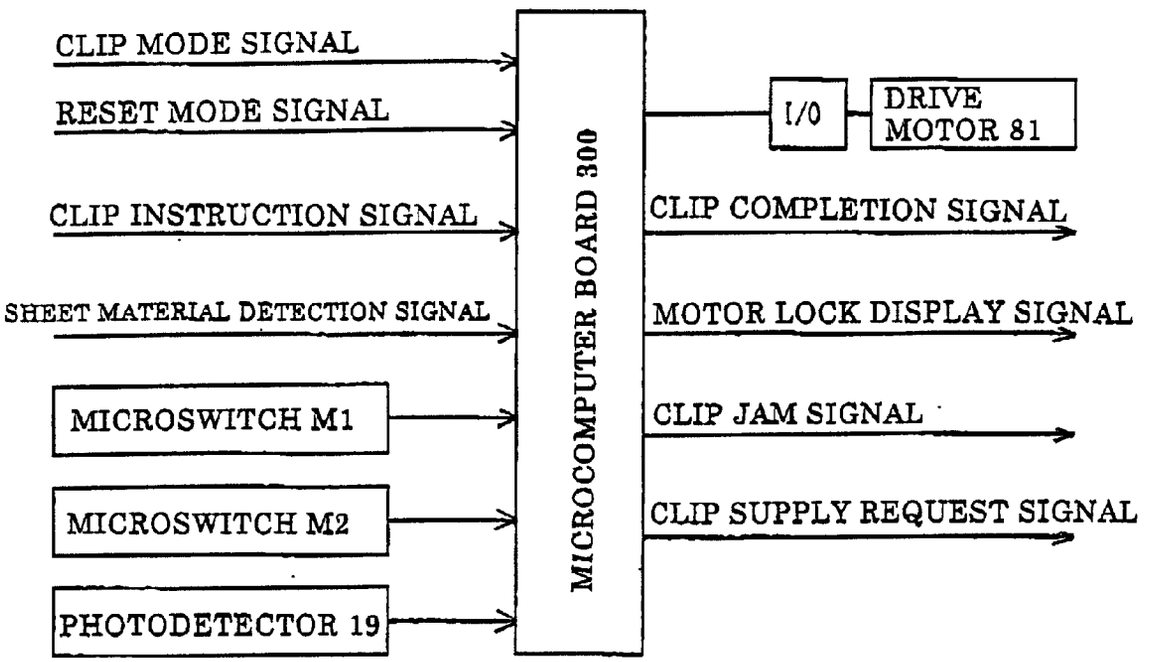

CLIP MODE SIGNAL
RESET MODE SIGNAL
CLIP INSTRUCTION SIGNAL
SHEET MATERIAL DETECTION SIGNAL
MICROSWITCH M1
MICROSWITCH M2
PHOTODETECTOR 19
MICROCOMPUTER BOARD 300
I/O
DRIVE MOTOR 81
CLIP COMPLETION SIGNAL
MOTOR LOCK DISPLAY SIGNAL
CLIP JAM SIGNAL
CLIP SUPPLY REQUEST SIGNAL

FIG. 11(A)

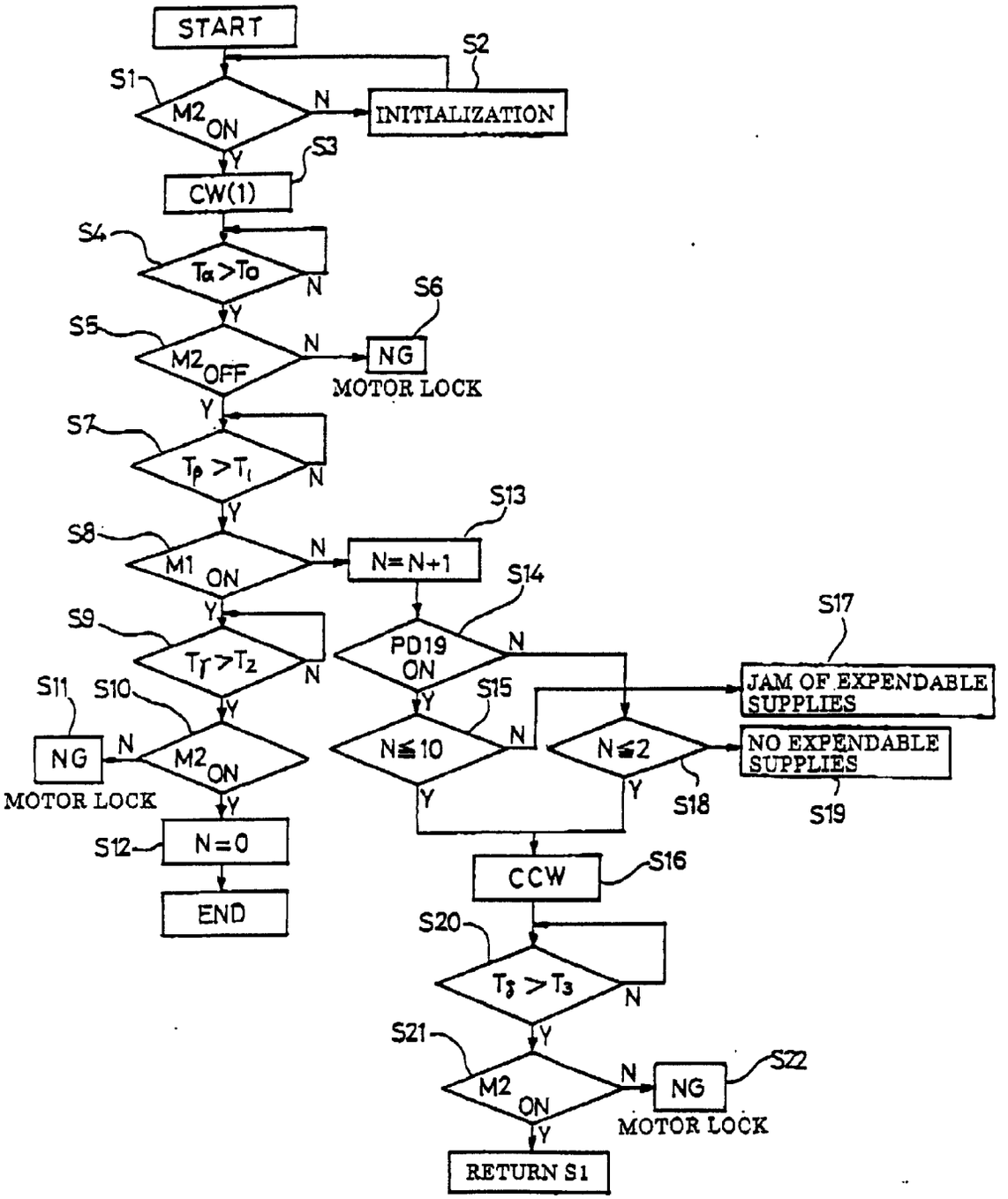

START
S1
M2 ON
N
S2
INITIALIZATION
Y
S3
CW(1)
S4
Tα > To
N
Y
S5
M2 OFF
N
S6
NG
MOTOR LOCK
Y
S7
Tp > T1
N
Y
S8
M1 ON
N
S13
N=N+1
Y
S9
T1 > T2
N
S14
PD19 ON
N
S17
JAM OF EXPENDABLE SUPPLIES
Y
S10
S11
S15
N≦10
N
N≦2
NO EXPENDABLE SUPPLIES
S19
NG
N
M2 ON
MOTOR LOCK
Y
Y
Y
S18
S12
N=0
S16
CCW
END
S20
T3 > T3
N
Y
S21
M2 ON
N
S22
NG
MOTOR LOCK
Y
RETURN S1

FIG. 11(B)

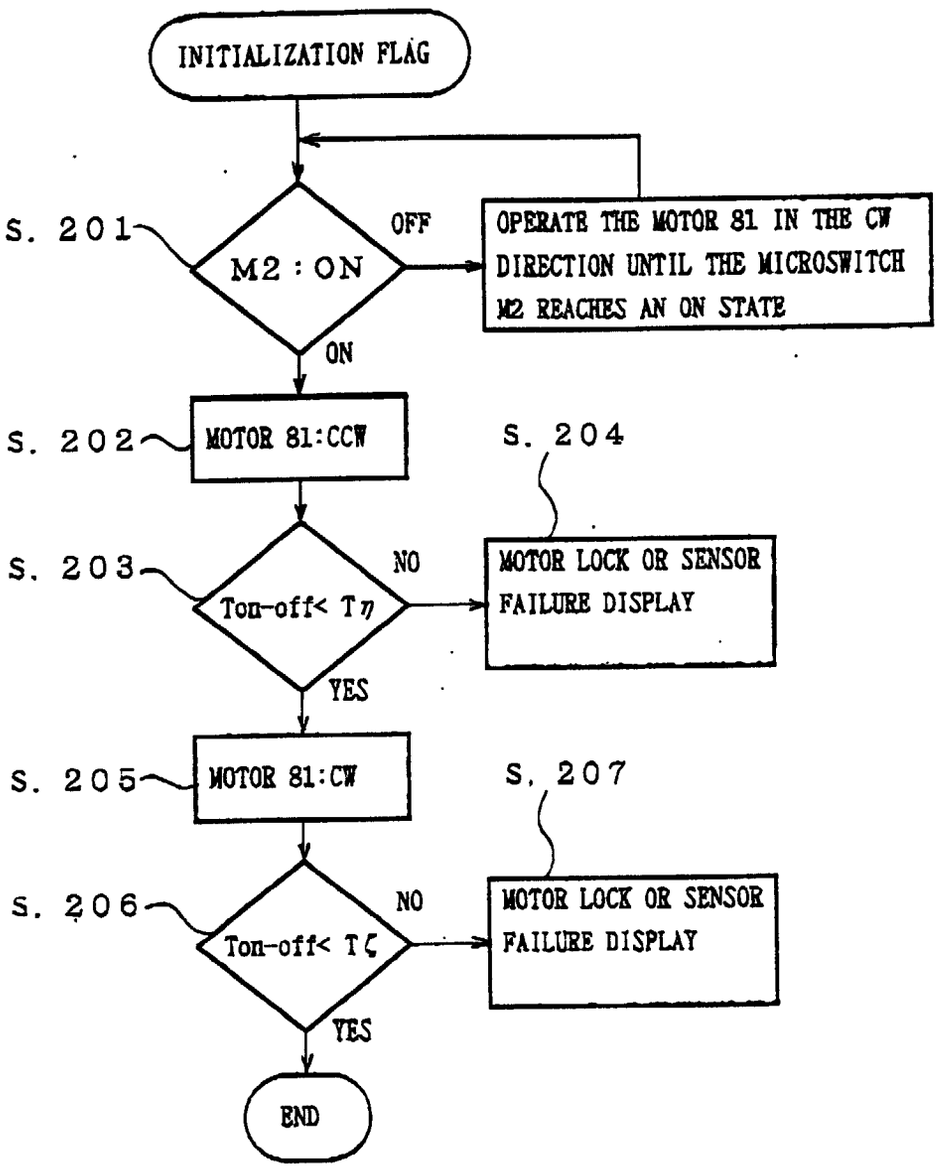

INITIALIZATION FLAG
S. 201
M2 : ON
OFF
OPERATE THE MOTOR 81 IN THE CW DIRECTION UNTIL THE MICROSWITCH M2 REACHES AN ON STATE
ON
S. 202
MOTOR 81:CCW
S. 204
S. 203
Ton-off< Tη
NO
MOTOR LOCK OR SENSOR FAILURE DISPLAY
YES
S. 205
MOTOR 81:CW
S. 207
S. 206
Ton-off< Tζ
NO
MOTOR LOCK OR SENSOR FAILURE DISPLAY
YES
END

FIG. 12(A)

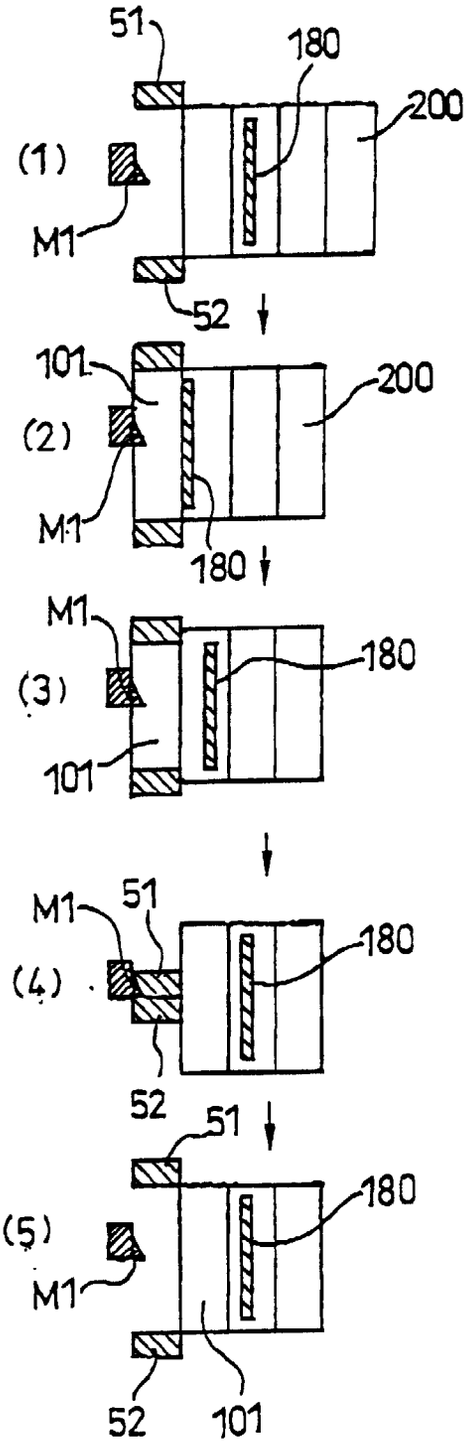


FIG. 12(B)

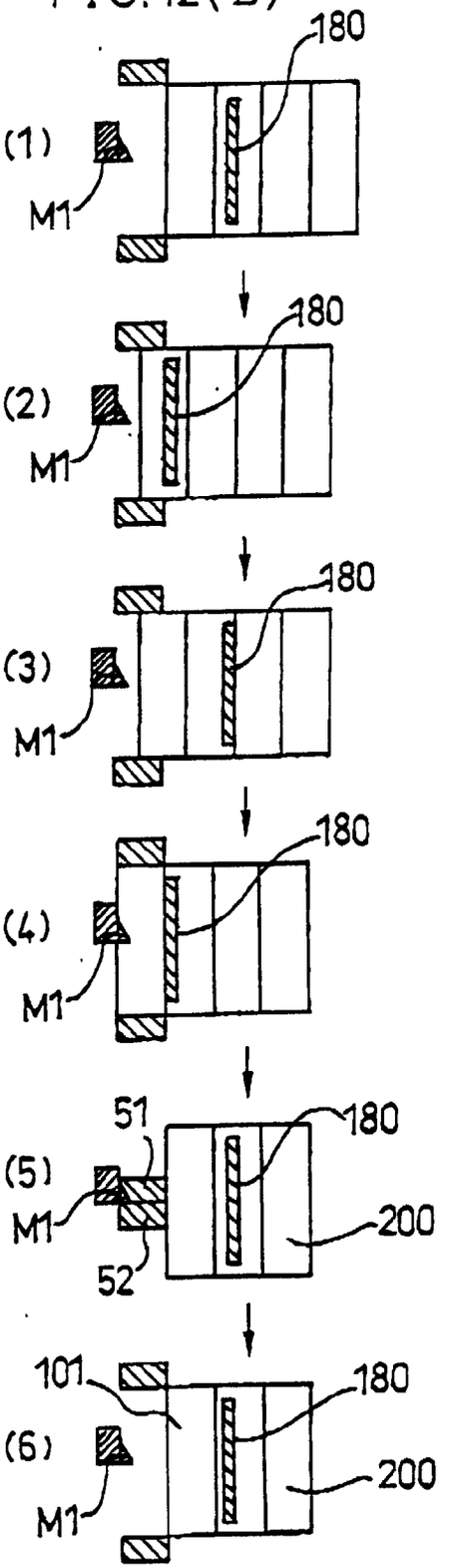


FIG. 13

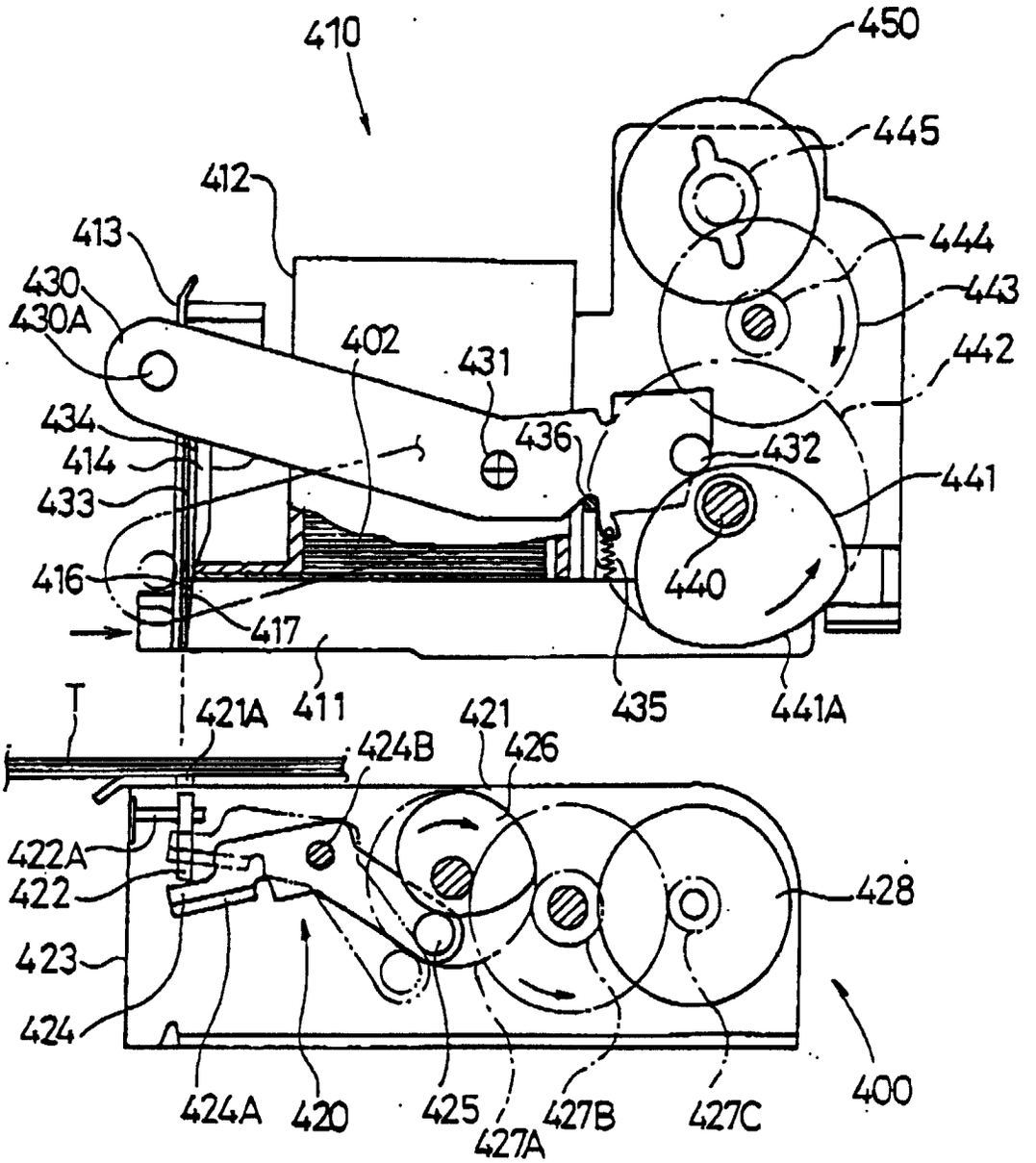
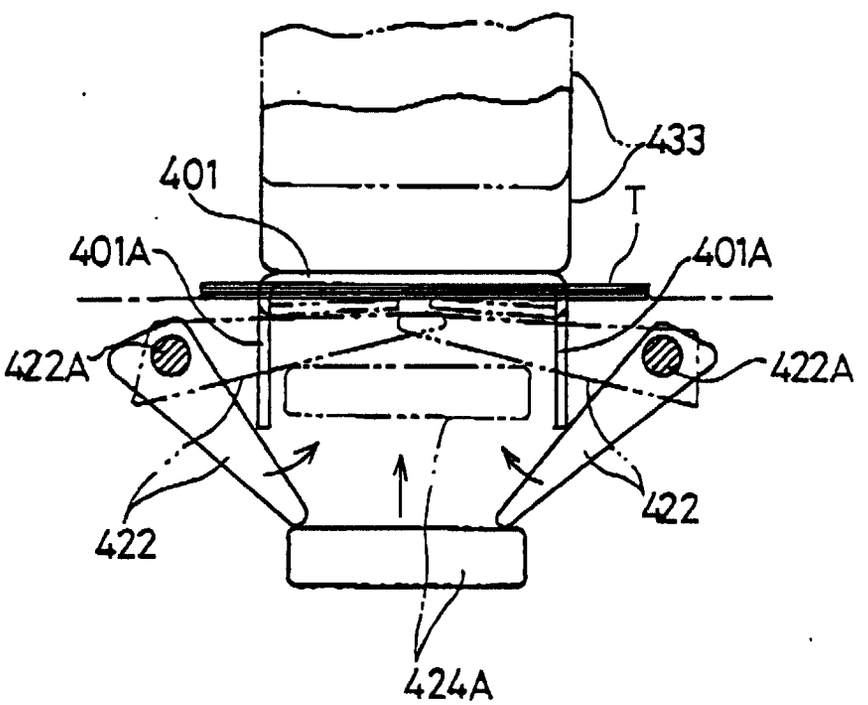

410
450
445
412
444
413
443
430
430A
402
431
442
434
436
432
414
441
433
440
416
417
411
435
441A
421A
421
424B
426
422A
428
422
423
424
424A
420
425
427A
427B
427C
400

FIG. 14



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 98 25 0063

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	US 5 195 671 A (SHIMOMRA ET AL) 23 March 1993 * column 2, line 65 - column 3, line 5; figure 1 *	1-3	B42B4/00 B27F7/36
A	EP 0 637 486 A (MAX) 8 February 1995 * the whole document *	1-3	
A	WO 94 27788 A (MAGNUSSON) 8 December 1994 * the whole document *	1-3	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B42B
B27F
B42C
B25C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 July 1998	Evans, A

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