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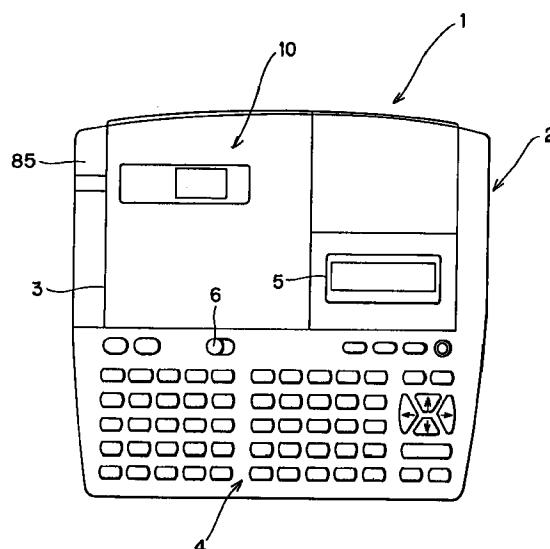
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(54) **Tape-shaped label printing device**

(57) A tape-like label printing device capable of preventing an ink ribbon from rewinding when a printing tape is rewound by a tape transfer mechanism (40). After desired text, number of printing colors, and sequence of the printing colors are inputted, and the target text for each printing color has been set, a printing key is pressed to begin printing with the first color. After the first color has been printed, a printing tape rewinding process control is executed for then performing a printing operation with a second color. To begin this process, the tape is transferred by a prescribed amount in order to separate the printing tape (22) from an ink ribbon (32) in S70. Once accomplished, a ribbon cassette (30) is removed from a tape cassette (20) (S72 and S73: Yes), and a message prompting the user not to insert another ribbon cassette is displayed. Next, printing tape rewinding operation is performed to rewind the tape until a leading edge of the tape has just passed a tape detection sensor (S75 through S77).

FIG. 1



EP 0 734 871 A2

## Description

The present invention relates to a tape-shaped label printing device, and more particularly, to a tape-shaped label printing device for preventing the ink ribbon of a ribbon cassette from rewinding when the printed tape is rewound in order to repeat printing over the same print area. The present invention also relates to such tape-shaped label printing device in which tape rewinding prevention control and tape rewinding control are performed interlockingly with a print head releasing operation provided by the relative movement between the print head and a platen.

One conventional tape-shaped label printing device is described in a U.S. Patent 5,232,297 in which characters and marks such as alphabetic characters and symbols are printed on a tape printing medium and a resultant printed tape is suitable for making labels to adhere to file tabs. This tape-shaped label printing device includes a keyboard, a display, and a printing mechanism of the thermal printing type, and is configured to print characters, marks, and the like in a variety of font styles and sizes on a printing tape medium of widths such as 6, 9, 12, 18, and 24mm.

This tape-shaped label printing device is configured to be able not only to feed the printing tape, but also to rewind the printing tape. For example, after printing characters, symbols, and the like on the printing tape, the tape can be rewound to the print start position, and a second array of characters, symbols, and the like can be printed over the first printing area. In this way, a synthesized characters, or characters decorated with designs can be produced in the tape-shaped label.

Further, the tape-shaped labels printed with character arrays are not limited to use on file tabs. These labels are also appropriate for sticking on cassettes and their cases, or video tapes and their cases, for example. In such a case, multiple colored character arrays may be intended in accordance with recorded data and kind by repeatedly performing tape rewinding and tape printing process.

The inventors of the present application conceived the idea to create a plurality of ribbon cassettes, separate from the tape cassette, with ink ribbons of not only black, but a plurality of colors such as red, green, and blue. Each of the ribbon cassettes is detachably mounted to the tape cassette, and color order for multiple color printing is set in accordance with the printing order. A color range setting process is performed with respect to the input text data so as to make correspondence with the selected character array of the input text data with the color which has been set. The ribbon cassettes having the same ribbon color as the set printing colors are exchanged in sequence during the printing process. Further, the printed tape is rewound to the print start position in each printing process. In this way, can be produced a label printed with a synthesized characters, characters with colorful designs and characters with multiple colors.

In order to repeat printing operations at the identical region of the printing tape, the printing tape must be rewound to the print start position with respect to the print head. To this effect, is required a head releasing mechanism by which a platen roller pressing against the print head through the printing tape and the ink ribbon can be released from the print head. Further, are also required a head release driving mechanism for driving the head release mechanism to perform head releasing operation in response to the completion of each printing operation, and tape rewinding control means for controlling rewinding of the tape in response to the completion of each printing operation.

The ribbon cassette is provided with an ink spool for windingly holding the ink ribbon and a take-up spool for taking up the ink ribbon. Generally, only the ribbon take-up spool is driven, in interlocking relation with the printing tape feeding movement of the printing tape, for taking up the ink ribbon used for printing.

In order to make a label that is printed with synthesized characters, characters with designs, or characters with multiple colors, printing process is performed by using a single ribbon cassette or by exchangingly using ribbon cassettes with different colored ribbons. In addition, the printing tape rewinding control is performed so as to rewind the printing tape to the print start position in each printing process. During rewinding operation of the printing tape, the ribbon take-up spool is interlockingly driven to be rotated in a direction opposite the ribbon taking-up direction. Therefore, large amount of the ink ribbon may be fed to the rewinding direction, and the paid out ink ribbon may be jammed inside the ribbon cassette. To avoid this problem, a mechanism for releasing the interlocking movement must be additionally provided for preventing the ribbon take-up spool from being driven to be rotated in synchronization with the rewinding movement of the printing tape when the printing tape is being rewound. This results in a complicated, large-sized thermal printing mechanism.

Further, the head release driving mechanism may include a large scale actuator capable of performing repeated head releasing operations for repeated printing. Accordingly, resultant tape printing device becomes bulky and costly. To avoid this problem, a head release driving mechanism may be dispensed with, and instead, the head releasing mechanism is driven manually to perform its head releasing operation. However, tape rewind control is performed immediately after completion timing of each printing process. Therefore, the tape rewinding operation may already have been started when the head releasing mechanism performs head releasing operation through the manual operation. Accordingly, the ink ribbon take-up spool which takes-up the ribbon part already used for printing may also be driven to be rotated in the rewinding direction concurrently with the rewinding movement of the printing tape. As a result, a large amount of ink ribbon may be paid out from the ribbon take-up spool and may be jammed in

the ribbon cassette. Consequently, the ribbon cassette becomes unavailable for actual use.

It is therefore, an object of the present invention to provide a tape-shaped label printing device capable of preventing the ink ribbon take up spool in the ink ribbon cassette from being driven to be rotated in a direction opposite the take-up direction when the printing tape is driven in its rewinding direction by a tape transfer mechanism without the mechanisms for releasing the interlocking movement.

Another object of the present invention is to provide such device capable of preventing the printing tape from being rewound at an instance other than the head releasing operation provided by a head releasing mechanism driven manually, to thus avoid jamming of the ink ribbon within the ink ribbon cassette.

These and other objects of the present invention will be attained by providing a tape-shaped label printing device including input means for inputting characters and symbols and various commands, data memory means for storing input text data, display means for displaying images corresponding to the input characters, symbols and various commands, a tape transfer mechanism for alternatively transferring a tape printing medium in a tape feeding direction or rewinding direction, a ribbon cassette housing an ink ribbon and mounted detachably to a portion, cassette detection means for detecting the mounting of the ribbon cassette, printing means for print an image on the tape printing medium, and control means for controlling the printing process, characterized by means for permitting the control means to rewind the tape with the tape transfer mechanism in the rewinding direction provided that the ribbon cassette has been detached from the portion as a result of a ribbon cassette detection signal transmitted from the cassette detection means.

In another aspect of the present invention, there is provided a tape-shaped label printing device including a tape transfer mechanism for alternatively feeding a tape printing medium in a tape feeding direction or a tape rewinding direction, printing means including a print head and a platen in confrontation therewith for printing an image on the tape printing medium, control means for controlling printing process, characterized by a head releasing mechanism for releasing one of the print head and the platen from remaining one of the platen and the print head, a manual operation member for manually driving the head releasing mechanism so as to perform the releasing operation, means for detecting operating state of the head releasing mechanism, the head detecting means generating a head detection signal indicative of the releasing, and means for preventing the tape transfer mechanism from performing tape rewinding operation in a state other than a state where the head detection signal is transmitted from the head detection means.

In the drawings;

Fig. 1 is a plan view of a tape-shaped label printing device;

Fig. 2 is a plan view of a thermal printing mechanism in the printing state;

Fig. 3 is a plan view of the thermal printing mechanism in the tape rewinding state;

Fig. 4 is a plan view of a tape cassette mounted with a ribbon cassette;

Fig. 5 is a plan view of the tape cassette;

Fig. 6 is a plan view showing an internal arrangement of the ribbon cassette;

Fig. 7 is a rear perspective view of the ribbon cassette and tape cassette;

Fig. 8 is a perspective view of the ribbon cassette;

Fig. 9 is a plan view of a drive system of the thermal printing mechanism in the printing state;

Fig. 10 is a vertical cross-sectional front view of an essential portions of Fig. 9 showing gear engaging relation;

Fig. 11 is a plan view of the drive system in the tape rewinding state of the thermal printing mechanism;

Fig. 12 is a vertical cross-sectional side view of an essential portion when the cassette cover is closed;

Fig. 13 is a vertical cross-sectional side view of the essential portions when the cassette cover is open;

Fig. 14 is a side view of a thermal printing mechanism, showing the tape cutting mechanism;

Fig. 15 is a plan view of the drive system of the thermal printing mechanism in the tape cutting permission state;

Fig. 16 is a block diagram of a control system of the tape-shaped label printing device;

Fig. 17 is a general flow chart of the multi-color printing control routine;

Fig. 18 is a flow chart of the process control for setting the printing color sequence routine;

Fig. 19 is a flow chart of the process control for setting the printing target range routine for each color;

Fig. 20 is a flow chart of the process control for setting the final printing color with respect to the remaining character array;

Fig. 21 is a flow chart of the print start process control routine;

Fig. 22 is a flow chart of the process for setting the color routine;

Fig. 23 is a flow chart of the printing tape rewinding process control routine;

Fig. 24 is a flow chart of the print start position alignment process control routine;

Fig. 25 is a flow chart of the final color printing process and cutting process control routine;

Fig. 26 is an explanatory diagram showing the positioning relationship between the printing position (P position), the tape cutting position (C position), and the tape detection position (S position);

Fig. 27 is an explanatory diagram showing the data configuration of the text memory;

Fig. 28(a) is an explanatory diagram of the print start point of origin on the tape;

Fig. 28(b) is an explanatory diagram showing the point at which the tape has been supplied by the length of the front margin;

Fig. 28(c) is an explanatory diagram showing the point at which the tape has been further supplied by the distance of the idle feeding; and

Fig. 29 is a plan view of the tape-shaped label printed in the three colors red, green, and black.

A tape-shaped label printing device according to one embodiment of the present invention will be described with reference to Figs. 1 through 29. The device is particularly available for printing characters, symbols, and the like in a plurality of colors on a printing tape which is a printing medium by exchanging a plurality of ribbon cassettes each with a different ribbon color.

As shown in Fig. 1, a keyboard 4 is arranged on the front portion of the main cover 2 of a tape-shaped label printing device 1. The keyboard 4 is provided with various function keys and includes keys such as character keys, symbol keys, and numeric keys. Immediately behind the keyboard 4, a liquid crystal display 5 capable of displaying the input characters, symbols, and the like is provided. A thermal printing mechanism 10 containing a thermal head 12 is provided within the main cover 2. The thermal head 12 is provided at a position corresponding to a cassette cover 3, which is opened and closed to allow exchanging of ribbon cassettes 30. A slide knob 6 is provided slidably for opening the cassette cover 3. A cutting knob 85 is also provided, which is pressed down for manually cutting a printing tape 22 which has been printed on.

Next, a tape cassette 20 will be described with reference to Figs. 2 through 7 and Fig. 7. The tape cassette 20 is detachably mounted on the thermal printing mechanism 10 which will be described later with reference to Figs. 2 through 8.

A tape spool 23 is rotatably provided on the inside of a tape case 21 of the tape cassette 20. A printing tape 22 formed of a thin film is wound around the tape spool 23. The printing tape 22 supplied from the tape spool 23 is moved in the tape feeding direction by a tape feeding roller 24 while being guided in a curved passage by a plurality of guides, passing directly in front of the thermal head 12, and discharged out of the tape cassette 20.

As shown in Fig. 7, a pair of guide shafts 21a and 21b are provided at positions spaced away from each other for supporting a ribbon cassette 30. Each lower end portion of the guide shaft 21a, 21b is provided integrally with an outer peripheral wall of the tape cassette 20. The ribbon cassette 30 is slidably movable in a vertical direction along the guide shafts 21a, 21b and is supported thereby for exchanging the ribbon cassette 30 with a new ribbon cassette. Further, a pair of lower end walls 21c and 21d (Fig. 5) are formed on the tape case 21 for supporting the lower surface of the ribbon cassette 30. A notch 21e is formed at a corner portion of the tape case 21.

Next, the ribbon cassette 30, which is removably mounted on the tape cassette 20, will be described with reference to Figs. 2 through 8. The ribbon cassette 30 includes a ribbon case 31 which is integrally provided with an upper wall 31a extending horizontally and adapted to contact with the top wall of the tape case 21. A pair of engaging feet 31b and 31c, each having a through-hole running through its entire length, extend integrally from the lower surface of the upper wall 31a and at edge portions thereof to fit around the pair of guide shafts 21a and 21b of the tape case 21. A vertical wall 31d is integrally suspended from the upper wall 31a. The vertical wall 31d is in contact with the notch 21e of the tape case 21. A head accommodating portion 37 (Fig. 6) is formed on the ribbon cassette 30 to accommodate the thermal head 12, which is inserted from below and passed through the tape cassette 20 when the tape cassette is mounted on the printing device 1.

In addition, the inner portion of the ribbon case 31 is rotatably provided with a ribbon spool 33 around which the ink ribbon 32 is wound, and a take-up spool 34 for taking up the ink ribbon 32. Through an ink ribbon passage provided in the ribbon cartridge 30, the ink ribbon 32 winding over the ribbon spool 33 extends in parallel with and in the vicinity of the printing tape 22 when the ink ribbon 32 is placed against the thermal head 12, and the ink ribbon is bent in an approximate acute angle at a separation portion 35a of a separation member 35 provided integrally with the ribbon case 31. Thus the ink ribbon 32 is separated from the printing tape 22 and taken up by the ribbon take-up spool 34. The separation member 35 of the ribbon case 31 is positioned on the downstream side of the thermal head 12 in the tape feeding direction. A lid 31e is provided on the ribbon case 31 to support the ribbon spool 33, the take-up spool 34, and the separation member 35, etc.

A ribbon cassette accommodating portion 21f for accommodating the ribbon cassette 30 is formed in the tape case 21 as shown in Fig. 7. Tabs 31f and 31g are provided on the upper surface of the lid 31e and upper wall 31a of the ribbon case 31, respectively. When printing, the tape case 21 is first mounted in a recessed portion (not shown) formed in the main cover 2, and then, the ribbon cassette 30 having the desired color of ink ribbon 32 can be mounted in the ribbon cassette accommodating portion 21f of the tape case 21. In mounting the ribbon cassette 30 in the ribbon cassette accommodating portion 21f, while grasping each of the tabs 31f and 31g with two fingers, the engaging legs 31b and 31c are fitted around their corresponding guide shafts 21a and 21b via the holes running through the engaging legs 31b and 31c, and the ribbon cassette 30 is moved downward so that it is received in the ribbon cassette accommodating portion 21f. At this time, the upper wall 31a of the ribbon case 31 is resting on the top surface of the tape cassette 20, while the lower end of the ribbon cassette 30 is brought into abutment with the pair of lower end walls 21c and 21d of the tape case

21 from above, and the ribbon cassette 30 is held in a desirable position relative to the tape case 21.

With colors such as red, green, yellow, and black and ribbon widths such as 12, 18, 24, and 32mm, a plurality of varieties of ink ribbons 32 have been prepared for the ribbon cassette 30. A group of detection holes 36 made up of a maximum of six detection holes 36a (the ribbon cassette of Fig. 6 only shows one detection hole 36a for simplicity) are formed on a lower horizontal end portion of the vertical wall 31d on the ribbon case 31 for allowing detection of any one of these plurality of varieties of ribbon cassettes 30.

Next, a tape/ribbon transfer mechanism 40 will be described with reference to Fig. 9. The tape/ribbon transfer mechanism 40 can move the printing tape 22 and the ink ribbon 32 in the feeding direction, i.e., the printing direction, and in the rewinding direction, i.e., the direction opposite to the printing direction.

Supported rotatably on the main frame 11 are a tape take-up cam 41 engageable with the center portion of the tape spool 23, a ribbon take-up cam 42 engageable with the center portion of the ribbon take-up spool 34, and a tape drive cam 43 engageable with the center portion of the tape feed roller 24. The main frame 11 is provided with the thermal head 12, and also with a group of ribbon detection switches 103, including detection switches No. 1 through No. 6, for detecting the existence of the six detection holes 36a in the previously mentioned group of detection holes 36. A ribbon detection signal RS is adapted to be output according to the combination of switch signals from these six detection switches. The cassette detection means is thus constructed by the group of ribbon detection switches 103 and the group of detection holes 36.

Further, a tape drive motor 44 such as a stepper motor is installed on the right front end portion of the main frame 11. Gears 46 through 53, each rotatably supported on the main frame 11 are interlocked sequentially with a drive gear 45 of the tape drive motor 44. A gear 55 and a tape drive gear 54 coupled to the tape drive cam 43 are meshedly engaged with the gear 53. Among these gears, gears 48 and 49 are provided integrally and are fixed to the lower end portion of the ribbon take-up cam 42. Gears 50 and 51 are provided integrally. Additionally, tape take-up gear 52 is fixed to the lower end portion of the tape take-up cam 41. Thus, the rotation of the tape drive motor 44 is transmitted to the tape drive cam 43 fixed to the tape drive gear 54 via the gears 45 through 54. Accordingly, the printing tape 22 is fed in the feeding direction by the rotation of the tape feed roller 24.

A swing lever 56 is provided. The swing lever 56 has a base portion supported in a space between the gears 50 and 51 integral therewith. An appropriate amount of frictional resistance is provided between the swing lever 56 and the two gears. The swing lever 56 is rotatably provided with a planet gear 57 continuously engaged with the gear 51.

The gear 53 has a rotation shaft 58 to which a base end portion of a cut-restricting lever 84 is urgedly supported. That is, the cut-restricting lever 84 supports thereon a torsion spring 59, and one end of the torsion spring and the base end of the lever 84 interpose therebetween the shaft 58, so that the base end of the cut-restricting lever 84 is urgedly pressed against the shaft 58 by the biasing force of the torsion spring 59.

As shown in Fig. 9, when the tape drive motor 44 is driven in a clockwise direction for normal printing operation, the gear 50 rotates in a clockwise direction. In this case, the swing lever 56 is pivoted in a clockwise direction about an axis of the gear 51 because of the frictional force in association with the gears 50 and 51. Consequently, the planet gear 57 is disengaged from the tape take-up gear 52 to render the tape take-up cam 41 free. Accordingly, the printing tape 22 wound over the tape spool 23 can be paid out (no take-up force is imparted to the take-up cam 41). At the same time, the gear 53 is rotated in a counterclockwise direction, so that the cut restricting lever 84 is pivoted about an axis of the shaft 53 in a counterclockwise direction. Consequently, the end portion of the cut restricting lever 84 is brought into a position immediately below a cutting lever 82 described later, thus restricting cutting operations. At the same time, because of the rotation in a counterclockwise direction of the ribbon drive gear 48, the ribbon take-up cam 42 is also rotated in the counterclockwise direction, via a clutch spring 60. Therefore, the ink ribbon 32 is taken up by the ribbon take-up spool 34.

A roller holder 67 for rotatably supporting a rubber platen roller 65 and a rubber tape feeding sub-roller 66 is pivotably supported on the main frame 11 by a pivot shaft 68. A release lever 71 is provided movably in the leftward and rightward direction in interlocking relation to the opening and closing motion of the cassette cover 3. The release lever 71 changes its position between a printing position shown in Fig. 9 and a release position shown in Fig. 11. The roller holder 67 is normally biased toward its release position by a spring (not shown). A wheel roller 72 rotatably attached to the release lever 71 is in contact with an upstanding wall 11a of the main frame 11. At the same time, a free end of the release lever 71 is in contact with the roller holder 67 from the rear side.

Therefore, when the release lever 71 is moved in the left direction from a release position shown in Fig. 11 to an operating position shown in Fig. 9, the left end of the release lever 71 is wedged between the roller holder 67 and the upstanding wall 11a, so that the roller holder 67 is changed from its release position to its printing position. At this time, the platen roller 65 presses against the thermal head 12 through the printing tape 22 and the ink ribbon 32, and the tape feeding sub-roller 66 presses against the tape feeding roller 24 through the printing tape 22 as also shown in Fig. 2.

When the roller holder 67 is changed to the printing position, a platen gear (not shown) fixed to the lower

end portion of the platen roller 65 is brought into meshing engagement with the gear 55, and a subroller gear (also not shown) fixed to the lower end portion of the tape feeding sub-roller 66 is brought into meshing engagement with the tape drive gear 54.

Next, a head release mechanism 70 will be described with reference to Fig. 9 and Figs. 11 through 13. The head release mechanism is adapted to move the platen roller 65 and the sub-roller 66 away from the thermal head 12 and the tape feed roller 24 so as to allow reversal or rewinding movement of the tape 22. To this effect the head release mechanism moves the roller holder 67 to its release position with respect to the thermal head 12 by moving the release lever 71 rightwardly in accordance with the opening movement of the cassette cover 3.

As shown in Figs. 12 and 13, the rear portion of the cassette cover 3 is supported in a plurality of places by the pivotal pin 7 attached on the main cover 2, so that the cassette cover 3 can open and close. A curved, grooved cam 3b is formed on the right side wall 3a of the cassette cover 3. An operation plate 74 is positioned on the right, underside of the main frame 11, and an engaging pin 75 engageable with the grooved cam 3b is fixed to the rear end portion of the operation plate 74. The right end portion of the release lever 71 is pivotally supported on one arm of a forked lever 76. The forked lever 76 has the other arm connected to the operation plate 74 via a pin 77 fixed to the front end portion of the operation plate 74. A cover open and close detection switch 102 is provided at a position in confrontation with the operation plate 74.

In a state where the cassette cover 3 is closed as shown in Fig. 12, in other words, in a state where the roller holder 67 is in the printing position shown in Fig. 9, if the cassette cover 3 is then opened as shown in Fig. 13, the engaging pin 75 engaged with the grooved cam 3b is moved rearwardly by the movement of this grooved cam 3b. Therefore, the operation plate 74 is moved rearwardly, and the forked lever 76 is pivoted in the counterclockwise direction. As a result, the roller holder 67 is moved rightwardly so that the roller holder 67 is changed to the release position. When the operation plate 74 is moved rearwardly, a cover open and close signal VS of "H" level is output from the cover open and close detection switch 102.

Further, when the cassette cover 3 is in the open position shown in Fig. 13, in other words, when the roller holder 67 is in the release position shown in Fig. 11, and the cassette cover 3 is then closed, as shown in Fig. 12, the engaging pin 75 is moved frontwardly by the movement of the grooved cam 3b. Therefore, the operation plate 74 is moved frontwardly, and the forked lever 76 is pivoted in the clockwise direction from the position shown in Fig. 11. Thus, the roller holder 67 is changed to the printing position, or non-release condition, in response to the movement of the release lever 71 in the leftward direction.

As shown in Figs. 2 and 9, for performing printing operation, the tape cassette 20 is first mounted on the thermal printing mechanism 10. Then, the ribbon cassette 30 is mounted on the tape cassette 20. When the cassette cover 3 is closed, the roller holder 67 is shifted to the printing position. From this position, when the tape drive motor 44 is driven in its normal printing direction, i.e., in clockwise direction, each of the gears 45 through 55 is driven to rotate in its prescribed direction. The platen roller 65 and the tape feeding sub-roller 66 are each rotated in the counterclockwise direction. Further, because the tape feeding subroller 66 and the tape feeding roller 24 are in synchronous rotation, the tape passes by a tape cutting mechanism 80 and a tape detection unit 90, those described later, and is discharged outside, while the printing tape 22 is being printed on by the thermal head 12. During this time, the tape take-up cam 41 is free, and, therefore, the printing tape wound over the tape spool 23 is continually supplied in the tape feeding direction with no resistance. At the same time, and at the same pace as the printing tape 22, the ink ribbon 32 is supplied from the ribbon spool 33 by the rotating motion of the platen roller 65. The ink ribbon 32 is then taken up by the ribbon take-up spool 34 engaged with the ribbon take-up cam 42 which is rotated by the ribbon take-up gear 48.

After the printing with the first color is completed and the second color is to be printed, the cassette cover 3 is released. In a state where the ribbon cassette 30 is removed from the tape cassette 20, the roller holder 67 is changed to the release position by the head release mechanism 70. Then, when the tape drive motor 44 is driven to rotate in the counterclockwise direction, (the tape rewinding direction), each of the gears 45 through 55 is driven to rotate in its prescribed direction, as shown in Figs. 3 and 11. As a result of the gear 50 rotating in the counterclockwise direction, the swinging lever 56 is also pivoted in the counterclockwise direction to bring the planet gear 57 into meshing engagement with the tape take-up gear 52. Accordingly, the tape take-up cam 41 is rotated in the counterclockwise direction. Thus, the printing tape 22 that has been printed once is taken up by the tape spool 23. At this phase, the ribbon take-up gear 48 is driven in the clockwise direction. However, the ribbon cassette 30 has already been removed, and therefore, inadvertent reverse feeding of the ink ribbon 32 does not occur.

Next, a tape cutting mechanism 80 for cutting the printing tape 22 that has been printed will be described with reference to Figs. 9, Fig. 14 and Fig. 15.

The main frame 11 has a left end wall 11b which is provided by partially bending downwardly the left end portion of the frame 11, and a lower end of a fixed blade 81 is fixed to the left end wall 11b. A cutting lever 82, which, from the side view, looks like an abbreviated L shape, has a base end portion pivotally supported by a screw 83 to the left end wall 11b. A movable blade 82a is formed on the cutting lever 82. As shown in Fig. 9, during the printing process, gear 53 rotates in the coun-

terclockwise direction, moving the end portion of the cut restricting lever 84 to the under side of the cutting lever 82 and, thus, restricting the cutting operation.

However, when printing is completed and the tape drive motor 44 is rotated only slightly in the rewinding direction, gear 53 is rotated slightly in the clockwise direction as shown in Fig. 15, displacing the end portion of the cut restricting lever 84 from underneath the cutting lever 82 to allow cutting operations. When the cutting button 85 on the end portion of the cutting lever 82 is pushed downward as shown in Fig. 14, the movable blade 82a is pivoted to the cutting position indicated by a two dotted chain line. The printing tape 22 positioned between the fixed blade 81 and the movable blade 82a is cut through the force of these two blades. A cutting detection switch 101 installed on the main frame 11 is operated by an operation member 86 installed on the cutting lever 82 and outputs a cutting detection signal CS. After releasing pressure on the cutting lever 82, the cutting lever 82 is pivoted back to its original prescribed position indicated by the solid line, by urging force of a spring (not shown).

Next, the tape detection unit 90 will be described with reference to Fig. 2. The tape detection unit 90 is provided on the outer side of the tape cutting mechanism 80 for detecting the existence of the printing tape 22.

Guiding members 94 and 95 are provided integrally with main cover 2 at a position outside the tape cutting mechanism 90. The guiding members 94 and 95 are designed to form a tightly sealed pair of sensor accommodating chambers 96 and 97. A light emitting element 92 is installed in the sensor accommodating chamber 96, while a light receiving element 93 is installed in the sensor accommodating chamber 97. A slit 98 is formed between the pair of guiding members 94 and 95 to allow the printing tape 22 to pass therethrough. Light transmitting holes 94a and 95b having a small diameter are formed in the guide members 94, 95 in alignment with each other. The slanted guides 99 are also formed at the confronting portions between the guide members 94, 95. The slanted guide portions 99 are positioned at upstream side of the guide members 94, 95. The slanted guides 99 defines gradually narrowing passage so that the leading end of the tape 22 can easily be introduced into the slit 98. Therefore, the tape passing through the cutting mechanism 80 will reliably pass through this slit 98, so that the printing tape 22 can be accurately detected.

At this point, the light emitted from the light emitting element 92 passes through the light transmitting holes 94a and 94b formed in the sensor accommodating chambers 96 and 97, and is received on the light receiving element 93. Therefore, when the printing tape 22 proceeds into the tape detection sensor 91, and the printing tape 22 is positioned between the light emitting element 92 and the light receiving element 93, the light is interrupted by the printing tape. Thus, the tape detec-

tion sensor 91 outputs an "L" level tape detection signal TS.

The control system of the tape-shaped label printing device 1 is configured as shown in the block diagram of Fig. 16. Connected to an input/output interface 113 of a control device CD are the keyboard 4, the tape detection sensor 91, the cutting detection switch 101, the cover open and close detection switch 102, the group of ribbon detection switches 103, a display controller (LCDC) containing a video RAM for outputting display data to the liquid crystal display (LCD) 5, a driver circuit 106 for a warning buzzer 105, a driver circuit 107 for driving the thermal head 12, and a driver circuit 108 for the tape drive motor 44.

The control device CD includes a CPU 110, the input/output interface 113 connected to the CPU 110 via buses 114 including a data bus, a font ROM 111, a ROM 112, and a RAM 120. The font ROM 111 is adapted for storing dot pattern data for display, concerning all of the numerous characters, such as the alphabetic characters and symbols, and dot pattern data for printing in a plurality of printing character sizes.

The ROM 112 stores therein a display drive control program, a printing control program, a printing drive control program, and a control program. The display drive control program is adapted for controlling the display controller 104 to respond to the code data of alphabetic characters, symbols, numbers, and other characters those input from the keyboard 4. The printing control program is adapted to create dot pattern data, for printing, of the characters, symbols, and the like stored in a text memory 121. The printing drive control program is adapted for outputting the created dot pattern data for each row of dots in sequence to the thermal head 12, the tape drive motor 44, and the like for printing. The control program described later is adapted for controlling printing of multiple colors, which is a characteristic of this invention.

Incidentally, the ROM 112 stores a ribbon cassette detection table for detecting the color and width of the ink ribbon 32, based on the ribbon detection signal RS output from the group of ribbon detection switches 103, including detection switches Nos. 1 through 6.

The text memory 121 of the RAM 120 stores therein text data, such as alphabetic characters and symbols, input from the keyboard 4, in correspondence to the data for the printing color selected. A color number memory 122 stores therein data of the number of printing colors inputted. A printing color sequence memory 123 stores therein data of the printing color sequence selected. A margin memory 124 stores therein data of the size of the margin selected, where the front or top margin and rear or bottom margin are identical to each other. A printing data buffer 125 stores the developed dot pattern data corresponding to the character codes stored in the text memory 121. Further, the RAM 120 is provided with a memory for temporarily storing such data as the results of computation by the CPU 110.

Next, multi-color printing control routines carried out in the control device CD of the tape-shaped label printing device 1 will be described with reference to flow charts of Figs. 17 through 25. Incidentally, the symbols Si (i = 10, 11, 12 . . .) in the flow charts indicate steps.

Before entering into a substantive description as to the multi-color printing control, an explanation will be given based on Fig. 26, which shows the tape detecting position by the tape detection sensor 91, the tape cutting position by the tape cutting mechanism 80, and the printing position by the thermal head 12. Using the feeding direction T of the printing tape 22 and beginning on the upstream side with respect to the tape feeding direction, the positioning order is then the printing position (P position), the tape cutting position (C position), and the tape detection position (S position). The distance Dcp between the printing position P and the tape cutting position C is about 25mm. The distance Dsc between the tape cutting position C and the tape detection position S is about 15mm. Further, the separation position (B position), according to the separation portion 35a of the separation member 35, is about 6mm downstream from the printing position P in the feeding direction T.

In Fig. 17, when electrical power is supplied into the tape-shaped label printing device 1, first an initialization process is performed in step S10 to initialize the thermal printing mechanism 10 and the control device CD. Then, the text input screen is displayed on the display 5. After setting printing styles, processes such as the input process for inputting text data and the display process for displaying the input text are carried out. The input text data is stored in the text memory 121 in step S11. For example, as shown in Fig. 27 input text data of "AB" "CDE" and "FG" are stored in the text memory 121 with a space "SP" between the neighboring character arrays.

After the step S11 the routine goes into step S12 where a process for setting the printing color sequence is executed as best shown in Fig. 18. When this control begins, the message "Number of colors?" is displayed on the display 5, and the process for setting the number of colors is executed to set the number N of colors by using the numeric keys. The number N of colors set is stored in the color number memory 122 in step S30. Next, the names of a plurality of colors are displayed in the display 5, and the process for setting the color sequence is executed to set the order of the color sequence to be supplied in printing. The set color sequence data is stored in the printing color sequence memory 123 in step S31. In the illustrated embodiment, the number N is "3" and the color sequence is in order "red", "green" and "black". Control is then returned to the multi-color printing control (S13).

Next in the multi-color printing control, the process control for setting the printing range of each color is executed in step S13 as shown in Fig. 19.

When this control begins, the color number N is set in a color number counter as a count value I (S33). Then, subtraction of "1" from the color number count value I is executed and if the answer is not zero, that is,

if the character array is not the final target character array in connection with the final color (S34: No), then the process for setting the printing target character array is executed in S35 so as to make correspondence of the character array with the first color among the remaining colors based on the color sequence data. This setting is performed by indicating the characters, symbols and the like constituting the target character array, with cursor, in connection with the color.

That is, during this process for setting the printing target character array, the text data is displayed in the display 5. Therefore, by operating the four cursor movement keys provided on the right side of the keyboard 4, each characters, symbols and the like in the printing target array is indicated with the cursor with respect to the printing color but except for the last printing color. Each time the character-color setting is made by the cursor, a color set key is pressed. After completing setting of the printing target character arrays, a set key is pressed. By pressing this set key, the set color data is appended to the character data of the characters indicated by operating the cursor movement keys and pressing the color set key, and this data is stored in the text memory 121.

Then, the color number count value I is decremented by 1 (S36), and steps S34 through S36 are repeated until (I - 1) equals zero. When (I - 1) equals zero, that is, when the setting of the printing target character array with respect to all of the printing colors except the last color have been completed (S34: Yes), a process for setting a final color to the character array is executed in Step S37 in order to make correspondence of the remaining characters and symbols in the text data that have not already been set with the last printing color.

Next, the process for setting the final color to the remaining character array will be described in detail with reference to Fig. 20. First, the character data stored in the text memory 121 is retrieved from the top of the memory (S371). The data is checked to see if color data is appended or not (S372). If color data is appended to the character data read (S372: Yes) and that character data is not the last of the character data (S373: No), then the next data is retrieved (S374), and the process is repeated from S372. However, if color data is not appended to the retrieved character data (S372: No), color data corresponding to the final printing color is appended to that character data and stored in memory (S375), and the process at S373 is executed. All of the above-mentioned processes are repeated until the end of the character data stored in the text memory 121. When the data is found at S373 to be the last of the character data (S373: Yes), then control is returned to S38 of Fig. 19.

Provided that the character data "AB CDE "FG" is stored in the text memory 121, the color number N is set to "3," and the color sequence is set to "red," "green," and "black". During the process for setting the printing target character array in S35, first, the character array "AB" is set for the printing color red by operating the cur-



sor keys and the color set key. As shown in Fig. 27, the color data "red" is appended to the character data "A" and "B" of the text memory 121, and each combination of character data and color data is stored in the memory 121. Next, the character array "CDE" is set for the printing color "green," and the color data "green" is appended to the character data "C," "D" "E" of the text memory 121, and stored.

When setting of the printing color "green" is completed, the color number count value I is such that (I - 1) is zero. Therefore, in the process for setting the character array with respect to the final color in S37, the character data of the text memory 121 is read in order, beginning from the top of the memory 121. The character array "FG" of the text data, which has not been set to a printing color, is automatically set to the final printing color, "black," and the printing data "black" is then saved in the text memory 121, appended to the character data "F" and "G".

Next, the message "Margin for the printing tape?" is displayed in the display 5. The margins are set to the desirable size by operating the number keys, and the margin set is stored in the margin memory 124 in step S38. Control is then returned to S14 for continuing the multi-color printing control.

When the printing key is pressed in the multi-color printing control (S14: Yes, S15: Yes), the printing start process control (S16) is executed, as shown in Fig. 21.

When this process begins, first, the ribbon color R of the ribbon cassette 30 mounted in the tape cassette 20 is read (S40), based on ribbon detection signals RS from the group of ribbon detection switches 103. Then, the leading printing color C in the printing color sequence is read (S41). If the ribbon color R does not match the leading printing color C (S42: No), then an error message is displayed in the display 5 (S43) indicating that the ribbon color does not match the printing color.

After the cassette cover 3 is opened, the ribbon cassette 30 is replaced by another ribbon cassette 30 having an intended ribbon color R, and the cassette cover 3 is closed again. Through the cover opening movement, the cover open and close signal VS is transmitted from the cover open and close detection switch 102, so that the steps S40 and S41 are repeated. Then, if the ribbon color R matches the leading printing color C (S42: Yes), the stored character array appended with data of the leading printing color C is retrieved from the text memory 121. Further, the dot pattern data of that character array is developed in the printing data buffer 125 (S45).

Then, the tape detection signal TS is read from the tape detection sensor 91. If the tape detection signal TS is "L" level, meaning that the printing tape 22 is positioned in confrontation with the tape detection sensor 91 (S46: Yes), then a message prompting that the printing tape be cut is displayed in the display 5 (S47).

Next, the cutting button 85 is pressed for cutting the printing tape 22, and the cut detection signal CS from

the cut detection switch 101 becomes "H" level (S48: Yes). Then, the tape detection signal TS becomes "H" level, meaning the tape cutting was detected (S46: No), and the tape drive motor 44 is driven by one step only in the clockwise direction, and the printing tape 22 is moved a very small distance in the feeding direction T so as to allow the leading edge of the tape to reach the tape detection point to be detected by the tape sensor 91 (S49). As far as the tape detection signal TS maintains "H" level, steps S49 and S50 are repeated.

When the tape detection signal TS becomes "L" level, signifying that the leading edge of the printing tape 22 has reached the tape detection sensor 91 (S50: Yes) as shown in Fig. 28(a), control is returned to S17 of the multi-color printing control. At this time, that is, when the leading edge of the printing tape 22 reaches the tape detection point S, a printing position of the printing tape 22 confronting the thermal head 12 is set as a print start point of origin.

Here, during step by step movement of the printing tape 22 in the feeding direction T, the leading edge of the printing tape can be reliably guided through the slit 98 by means of the slanting guides 99 formed on the pair of guide members 94 and 95, so that the leading edge of the tape can reach the tape detecting position S, even if the leading edge portion of the printing tape 22 is curled.

It should be noted that the cutting process in step S48 is necessary so as to define the positional relationship between the printing tape 22 and the thermal head 12 in order to obtain the print start point of origin. In Fig. 28(a), the leading edge of the tape is provided by cutting the tape at the cutting position C and then, the tape is fed by the distance Dsc, so that the front cut end reaches the position S.

Next, in the multi-color printing control, when the color number N is not "1", that is, when the printing process is not on the last color (S17: No), the process for setting the color (S18) is executed to print the selected printing color, as shown in Fig. 22.

When this control begins, first, the tape drive motor 44 is driven in the clockwise direction to move the printing tape by the initial margin L corresponding to the set front margin L (S60).

If the printing start position of characters to be printed in the current printing color is still positioned upstream of the print start point of origin in the feeding direction T, even after the feeding of the printing tape by the length of the front margin L, (S61: Yes), for example, as shown in Fig. 28(c), if idle feeding (or feeding of the tape without printing) is required such that the characters "CDE" with the printing color "green" is to be printed, the tape drive motor 44 is driven in the clockwise direction, so as to move the printing tape 22 in the feeding direction T only the amount of the idle feeding (S62). However, if no idle feeding of the tape is required (S62: No) after feeding of the printing tape by the length of the front margin L, for example in case of printing of "AB", the routine is skipped into the step S63 without

executing the step S62. The dot pattern data developed in the printing data buffer 125 is retrieved, and the printing process is executed by driving the thermal head 12, the tape drive motor 44, and the like for printing (S63). Control is then returned to S19 of the multi-color printing control.

Next, in the multi-color printing control, the printing tape rewinding process control (S19) is executed as shown in Fig. 23.

When this control is begun, first, the tape driving motor 44 is driven in the clockwise direction for moving both the printing tape 22 and the ink ribbon 32 in the feeding direction T by only the separation feeding distance Dbp corresponding to the distance Dbp between the printing position (P position) and the separation position (B position) (S70). This feeding is required because the ink of the ink ribbon 32 is fused or melted to the printing tape 22 by the thermal head 12 at the final printing position. However, because the printing tape 22 and the ink ribbon 32 are moved by only the separation feeding distance Dbp, the ink ribbon 32 is forcibly pulled away from the printing tape by the separation portion 35a. Thus, the printing tape 22 and the ink ribbon 32 are separated with certainty.

Next, in order to replace the ribbon cassette 30 with one that has an ink ribbon 32 of the same color as the next printing color, a message prompting for the ribbon cassette 30 to be removed is displayed in the display 5 (S71). Then, the cassette cover 3 is opened, moving the operation plate 74 in the rearward direction, and an "H" level cover open and close signal VS is output from the cover open and close detection switch 102 (S72: Yes). In addition, all six of the detection switch signals become "H" level signals, as the ribbon detection signal RS from the group of ribbon detection switches 103. When the ribbon cassette 30 has been removed (S73: Yes), a message prompting the user not to insert another ribbon cassette 30 is displayed in the display 5 (S74).

Next, to rewind the printing tape 22, the tape drive motor 44 is driven one step only in the counterclockwise direction, moving the printing tape 22 a very slight distance in the rewinding direction (S75). During this rewinding operation, if the tape detection signal TS is "L" level (S76: No), steps S74 through S76 are repeated. Then, if the leading edge of the printing tape 22 is rewound until it is slightly on the upstream side of the tape detection sensor 91, the counterclockwise rotation of the tape drive motor 44 is stopped (S77). Control is then returned to S20 of the multi-color printing control.

Next, in the multi-color printing control, the printing start position alignment process control (S20) is executed, as shown in Fig. 24.

When this control is begun, first, an error message prompting the user to insert a ribbon cassette 30 having an ink ribbon 32 of the same color as the next printing color is displayed in the display 5 (S80). Then, if all of the six switch signals making up the ribbon detection

signal RS are not the "H" level, signifying that the ribbon cassette 30 is mounted (S81: Yes), then the ribbon color R of the mounted ribbon cassette 30 is read based on the ribbon detection signals RS (S82). Then, the next printing color C of the printing color sequence is read (S83). If the ribbon color R does not match the next printing color C (S84: No), then steps S80 through S84 are repeated.

When the ribbon color R matches the next printing color C (S84: Yes), the stored character array appended with the data for the next printing color C is read from the text memory 121. Further, dot pattern data for that character array is developed in the printing data buffer 125 (S85). When the cassette cover 3 is not closed (S86: No), a message prompting for the cassette cover 3 to be closed is displayed in the display 5 (S89). When the cassette cover 3 has been closed (S86: Yes), the tape drive motor 44 is driven one step only in the clockwise direction, until the leading edge of the printing tape 22 corresponds to the tape detection sensor 91 (S87 and S88: No). If the tape detection signal TS becomes "L" level when the leading edge of the printing tape 22 corresponds to the tape detection sensor 91, the print start point of origin for the printing tape 22 corresponds to the print position of the thermal head 12 (S88: Yes). For example, the positional relationship shown in Fig. 28(a) is again provided. Control is then returned to S21 of the multi-color printing control.

Next, in the multi-color printing control, the color number N is decremented by one (S21). If the color number is not "1," or not the final printing (S17: No), steps S18 through S21 are repeated. If the color number N becomes "1," or the final printing (S17: Yes), the final color printing process and cutting process control (S22) will be executed, as shown in Fig. 25.

This control is classified into four cases. In case 1, the front margin L is greater than the distance Dcp between cutting and printing positions. In case 2, the front margin L is smaller than the Dcp, and no idle feeding is provided. In case 3, the front margin L is smaller than the Dcp, and idle feeding is provided, and further, the total length of the front margin L and the idle feeding is equal to or greater than the distance Dcp between the printing position and the cutting position. In case 4, the front margin L is smaller than the Dcp, and idle feeding is provided, and further, the total length of the front margin L and the idle feeding is smaller than the distance Dcp between the printing position and the cutting position.

First, case 1 will be described. If the front margin L is greater than the Dcp (S90: Yes), the printing tape 22 is moved only the distance Dcp in the feeding direction T by the tape drive motor 44 being driven in the clockwise direction (S91). Then, the drive of the tape drive motor 44 is stopped, stopping the tape movement (S92). Next, the tape drive motor 44 is rotated a little in the rewinding direction. When the end portion of the cut prevention lever 84 is removed from beneath the cutting lever 82, making the cutting operation possible, as

shown in Fig. 15, a message prompting the user to cut the printing tape 22 is displayed in the display 5 (S93). Then, when the printing tape 22 is cut and the cutting detection signal CS becomes the "H" level, signifying the tape cutting has been detected (S94: Yes), the printing tape 22 is moved in the feeding direction T by the remaining distance of the front margin L (front margin L - Dcp) (S95).

If the print start position of the last printing color is upstream from the print start point of origin in the feeding direction T, and there exists an idle feeding (S96: Yes), the tape drive motor 44 is driven in the clockwise direction, moving the printing tape 22 in the feeding direction T by the length of the idle feeding (S97). Then, the characters, symbols, and the like, based on the dot image data read similar to S63 described earlier, are printed in the final printing color (S98).

Next, in order to provide the rear margin L behind the printed character array, the tape drive motor 44 is driven in the clockwise direction, moving the printing tape 22 in the feeding direction T only by the distance Dcp plus the rear margin L (S99). Then, the tape drive motor 44 is rotated slightly in the rewinding direction. When the end portion of the cut prevention lever 84 is removed from beneath the cutting lever 82, making the cutting operation possible, a message prompting the user to cut the printing tape 22 is displayed in the display 5 (S100). Then, when the printing tape 22 is cut and the cutting detection signal CS becomes the "H" level, signifying the tape cutting has been detected (S101: Yes), control is returned to S10 of the multi-color printing control.

Next, case 2 will be described. When the front margin L is less than the distance Dcp and no idle feeding exists (S90 and S102: No), the tape drive motor 44 is driven in the clockwise direction for moving the printing tape 22 in the feeding direction T by the distance of the front margin L (S103). Then, the final printing process and cutting of the printing tape 22 is performed according to the steps beginning at S104.

More specifically, one row of the dot pattern data is read from the printing data buffer 125 and printing is performed with the one row of the dot pattern (S104). The tape drive motor 44 is driven in the clockwise direction, moving the printing tape 22 only by the short distance corresponding to the one row of dots (S105). If the amount of tape movement after the final printing has begun is less than a distance given by subtracting the front margin L from the distance Dcp, that is, if the top position of the front margin has not yet reached the cutting position (C position) (S106: No), then steps S104 through S106 are repeated.

When the top position of the front margin L has reached the cutting position (S106: Yes), the printing and tape movement are stopped (S107). Then, the tape drive motor 44 is rotated slightly in the rewinding direction. When the end portion of the cut prevention lever 84 is removed from beneath the cutting lever 82, making the cutting operation possible, a message prompting

the user to cut the printing tape 22 is displayed in the display 5 (S108). Then, when the cutting button 85 is pressed, the printing tape 22 is cut, and the cutting detection signal CS becomes the "H" level, signifying the tape cutting has been detected (S109: Yes). Thereafter, printing of the remaining dot pattern data to be printed is carried out (S110). The rear margin L is provided according to the above described steps S99 through S101, and the tape is cut, and control is returned to S10.

Next, case 3 will be described. When the front margin L is smaller than the distance Dcp between the printing position P and the cutting position C, and an idle feeding exists and the total length of this idle feeding and to the front margin L is greater than the distance Dcp (S90: No; S102 and S111: Yes), the tape is moved as in the previously described steps S91 through S94, and the tape is cut (S112 through S115). Further, the printing tape 22 is moved in the feeding direction T by a distance (front margin L + idle feeding - Dcp) (S116). Then, the steps beginning from S98 are executed, so that printing in the final color is performed (S98), and the rear margin L is provided (S99), and the tape is cut (S101). Control is then returned to S10.

Finally, case 4 will be described. When the front margin L is smaller than the distance Dcp, and an idle feeding exists, and the total length of the idle feeding and the front margin L is less than the distance Dcp (S90: No; S102: Yes; S111: No), the printing tape 22 is moved in the feeding direction T by the distance of the total length of the front margin L and the idle feeding (S117). Then one row of the dot pattern data is read from the printing data buffer 125 and printing is performed (S118). The tape drive motor 44 is driven in the clockwise direction, moving the printing tape 22 only by the short distance corresponding to the one row of dots (S119).

When the amount of tape movement after the final printing has begun is less than the difference between the distance Dcp and the total length of the front margin L and the idle feeding length, that is, the top position of the front margin L has not yet reached the cutting position, (S120: No), then steps S118 through S120 are repeated.

When the top position of the front margin L has reached the cutting position (S120: Yes), the steps beginning from S107 are executed. In this way, the front margin L is provided in S109, and the rear margin L is provided in S101. Control is then returned to S10.

As in the example of the input text "AB CDE FG" shown in Fig. 29, a label was obtained with the front and rear margins L, the character array "AB" printed in the color red, the character array "CDE" printed in the color green, and the character array "FG" printed in the color black.

In the illustrated embodiment, after the text is input, the process for setting the printing color sequence is executed to set the color number N and the color sequence of the printing colors. Then, a process to set

the printing object range for each of the colors among a plurality of colors to be printed is executed. Then, after a ribbon cassette 30 with a ribbon color R that matches the first printing color C is mounted, the printing process is performed by driving and controlling such mechanisms as the thermal head 12 and the tape drive motor 44. Then, the printing tape rewinding process is executed each time after the ribbon cassette 30 is exchanged and corresponding printing process is completed.

In rewinding the printing tape 22, the head release mechanism 70 is activated based on the cover open and close signal VS from the cover open and close detection switch 102. At the same time, if all of the six detection switch signals making up the ribbon detection signal RS from the group of ribbon detection switches 103 are "H" level signals which is indicative of the removal of the ribbon cassette 30 from the tape cassette 20, a message prompting the user not to insert another ribbon cassette 30 is displayed in the display 5. The tape drive motor 44 is then driven in the counter-clockwise direction. After the printing tape 22 is automatically rewound, rewinding is stopped at the print start point of origin, based on the tape detection signal TS from the tape detection sensor 91. Tape is always rewound to the print start point of origin in each rewinding process after each printing operation.

In this way, as each printing process is completed, the tape can only be moved in the rewinding direction by the ribbon/tape transfer mechanism 40, after removal of the ribbon cassette 30 from the tape cassette 20 is detected. Therefore, even though the ribbon take-up spool 34 within the ribbon cassette 30 is driven to rewind in synchronicity with the rewinding of the tape, jamming of the ink ribbon does not occur because of the non-existence of the ink ribbon cassette. Therefore, the ink ribbon 32 can reliably be prevented from rewinding without being provided with such a device as an interlocking-release mechanism which prevents the ribbon take-up spool 34 from being driven to rewind in synchronicity with the rewinding of the tape.

Further, in the above described embodiment, printing tape rewinding operation by the tape/ribbon transfer mechanism 40 is prohibited at a phase other than detection of the head release by the head releasing mechanism 70. On the other hand, if the cassette cover 3 is opened and the head releasing mechanism 70 performs head releasing operation for allowing the printing tape to be rewound, the printing tape 22 is rewound to the print start point of origin as shown in Fig. 28(a).

In this way, the head releasing operation of the mechanism 70 is not provided by a head release driving mechanism but is provided by manual opening operation of the cassette cover 3, so that the one of the thermal head 12 and the platen roller 65 is moved away from the remaining one of the thermal head and the platen roller. Accordingly, the label printing device can be provided at low cost.

Further, the rewinding operation of the printing tape 22 is prohibited at a phase other than the detection phase of the head releasing operation of the head releasing mechanism based on the cover open close signal VS. In this case, the rewinding operation of the printing tape 22 cannot be performed until the head releasing mechanism 70 performs head releasing operation and the ribbon cassette 30 is removed from the tape cassette 20 in a case where the ribbon cassettes 30 of different colors are sequentially used for multi color printing. Accordingly, can be prevented the rewinding operation of the ink ribbon synchronous with the rewinding operation of the printing tape, and consequently, jamming of the ink ribbon can be prevented.

While the invention has been described in detail with reference to the specific embodiments thereof, it would be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the scope of the invention.

For example, in the illustrated embodiment, when the removal of the ribbon cassette 30 is detected, a message prompting the user not to insert another ribbon cassette 30 is displayed in the display 5, and then, rewinding of the printing tape 22 is automatically begun. However, alternative process may be conceivable. For example, rewinding of the printing tape 22 is not begun immediately in spite of the detection of the removal of the ribbon cassette 30. Instead, automatic tape rewinding operation can be started after elapse of predetermined period during which the removal of the ribbon cassette 30 has been completed. Another alternative may be such that a message such as "Press the some key" is displayed in the display 5 along with the message prompting the user not to insert another ribbon cassette 30. Then, when some key is pushed on the keyboard 4, rewinding of the printing tape 22 is begun. In this way, by starting the tape rewinding operation after the prescribed amount of time has passed, or at the moment of a key being pressed, it is possible to avoid tape jamming which otherwise may be caused by starting the rewinding operation of the printing tape 22 during the removal operation of the ribbon cassette 30 and the printing tape is brought into contact with the ink ribbon, harming the printing surface of the printing tape 22 and preventing rewinding operation of the printing tape 22.

Further, the leading end of the tape can be detected when the printing tape 22 is being rewound based on the tape detection signal TS which is switched from "tape exist" to "tape non-exist". Furthermore, a group of ribbon detection switches 103 can be provided by various sensors, such as proximity switches and photo-interrupters.

Further, it is possible to provide a manipulation member instead of the cassette cover for performing head releasing operation of the head releasing mechanism 70. Furthermore, photointerrupter can be used as a cover open/close detection switch 102.

## Claims

### 1. A tape-shaped label printing device including:

a tape transfer mechanism (40) for alternatively transferring a tape printing medium (22) in a tape feeding direction (T) or rewinding direction;  
 a ribbon cassette (30) housing an ink ribbon (32) and mounted detachably to a portion (20);  
 cassette detection means (36, 103) for detecting the mounting of the ribbon cassette (30);  
 printing means (10) for print an image on the tape printing medium (22); and  
 control means (CD) for controlling the printing process;

characterized by:

means (S73, S74, S75) for permitting the control means (CD) to rewind the tape (22) with the tape transfer mechanism (40) in the rewinding direction provided that the ribbon cassette (30) has been detached from the portion (20) as a result of a ribbon cassette detection signal (RS) transmitted from the cassette detection means (103).

2. A tape-shaped label printing device as claimed in claim 1, characterized in that the ribbon cassette is a selected one of a plurality of ribbon cassettes each housing therein an ink ribbon of different colors from each other in order to perform multi-color printing on the tape printing medium by sequentially replacingly mounting and detaching the ribbon cassette with respect to the portion (20).

3. A tape-shaped label printing device as claimed in claim 1 or 2, characterized in that the control means comprises tape rewinding control means (S75, S76) for controlling the tape transfer mechanism (40) to automatically rewind the tape (22) to a print start position (Fig.28(a)) when the tape is allowed to be fed in the rewinding direction.

4. A tape-shaped label printing device as claimed in one of claims 1 to 3, characterized in that a main frame (11) is provided having an accommodating portion for detachably installing a tape cassette (20), the ribbon cassette (30) being detachably mounted to the tape cassette (20).

5. A tape-shaped label printing device as claimed in claim 4, wherein the cassette detection means (36, 103) comprises a cassette detection switch (103) provided on the main frame (11), the ribbon cassette (30) being provided with a detected portion (36) detected by the detection switch (103) when

the ribbon cassette (30) is mounted on the tape cassette (20).

6. A tape-shaped label printing device as claimed in one of claims 1 to 5, characterized in that the printing means comprises a print head (12) and a platen (65) in confrontation therewith, in that a head releasing mechanism (70) is provided for moving one of the print head (12) and the platen (65) away from remaining one of the platen (65) and the print head (12) for releasing the print head from the platen, and in that preferably a manual operation member (3) is provided for manually driving the head releasing mechanism so as to perform the releasing operation.

### 7. A tape-shaped label printing device including

a tape transfer mechanism (40) for alternatively feeding a tape printing medium (22) in a tape feeding direction or a tape rewinding direction;  
 printing means (10) including a print head (12) and a platen (65) in confrontation therewith for printing an image on the tape printing medium (22);  
 control means (CD) for controlling printing process;

characterized by:

a head releasing mechanism (70) for releasing one of the print head (12) and the platen (65) from remaining one of the platen (65) and the print head (12);  
 a manual operation member (3) for manually driving the head releasing mechanism so as to perform the releasing operation;  
 means (102) for detecting operating state of the head releasing mechanism (70), the head detecting means generating a head detection signal (VS) indicative of the releasing; and  
 means (S72, S73, S74, S75) for preventing the tape transfer mechanism (40) from performing tape rewinding operation in a state other than a state where the head detection signal (VS) is transmitted from the head detection means.

8. A tape-shaped label printing device as claimed in claim 7, characterized in that a ribbon cassette (30) is detachably mounted to a portion (20), one of a plurality of ribbon cassettes each housing therein an ink ribbon of different colors from each other being selectively used in order to perform multicolor printing on the tape printing medium by sequentially replacingly mounting and detaching the ribbon cassette with respect to the portion (20).

9. The tape-shaped label printing device as claimed in claim 7 or 8, characterized in that a main frame (11) is provided having an accommodating portion for detachably installing a tape cassette (20), and a cassette cover (3) is pivotally connected to the main frame (11) for covering the accommodating portion, the manual operation member comprising the cassette cover (3), preferably a selected one of the ribbon cassette (30) is detachably mounted to the tape cassette (20). 5 10
10. The tape-shaped label printing device as claimed in one of claims 7 to 9, characterized in that the control means (CD) comprises tape rewinding control means (S75,S76,S77) for controlling the tape transfer mechanism (40) to be driven to rewind the tape to a print start position (Fig. 28(a)) in a state where the preventing means allows the tape transfer mechanism (40) to perform tape rewinding operation. 15 20
11. The tape-shaped label printing device as claimed in one of claims 3 to 5 or 10, characterized by tape detection means (91,92,93) for detecting the tape (22) at a position near a terminal end of a tape transfer path of the tape transfer mechanism (40), the tape rewinding control means (S75,S76,S77) stopping tape rewinding operation when the tape detection means (91) transmits a tape detection signal (TS) as a result of a detection of a leading end of the tape, the tape detection means (92, 93) preferably being positioned downstream of the printing means (10) in the feeding direction (T) of the tape. 25 30 35
12. A tape-shaped label printing device as claimed in claim 11, characterized in that the tape rewinding control means recognizes the leading edge of the tape when the signal of the tape detection means changes from a signal (L) indicative of the presence of tape to a signal (H) indicative of non-existence of the tape. 40
13. The tape-shaped label printing device as claimed in one of claims 1 to 12, further characterized by input means (4) for inputting characters and symbols and various commands, data memory means (121) for storing input text data, and display means (5) for displaying images corresponding to the input characters, symbols and various commands. 45 50
14. The tape-shaped label printing device as claimed in one of claims 6 to 13, characterized in that the head releasing mechanism comprises: 55
- a roller holder (67) pivotally supported to the main frame (11) and movable between a head pressing position and a head releasing posi-

tion, the platen (65) being rotatably supported on the roller holder (67);

a release lever (71) movable toward and away from the roller holder (67); and

an operation plate (74) disposed beside the main frame (11) and connected to the release lever (74), the operation plate (74) being operatively connected to the cassette cover (3) so that the roller holder is movable toward its head releasing position in response to the opening movement of the cassette cover (3) through the operation plate (74) and the release lever (71).

FIG. 1

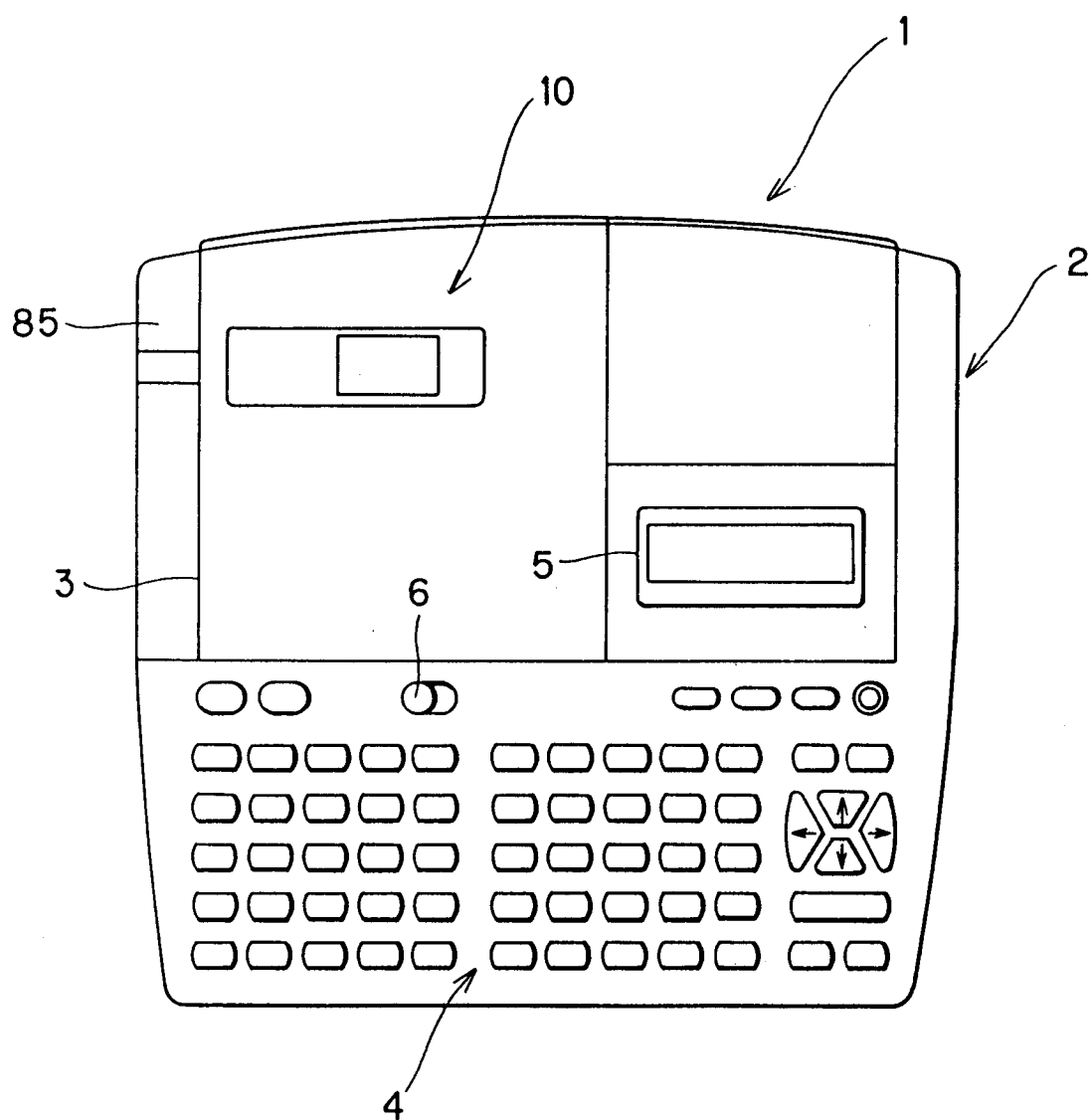


FIG. 2

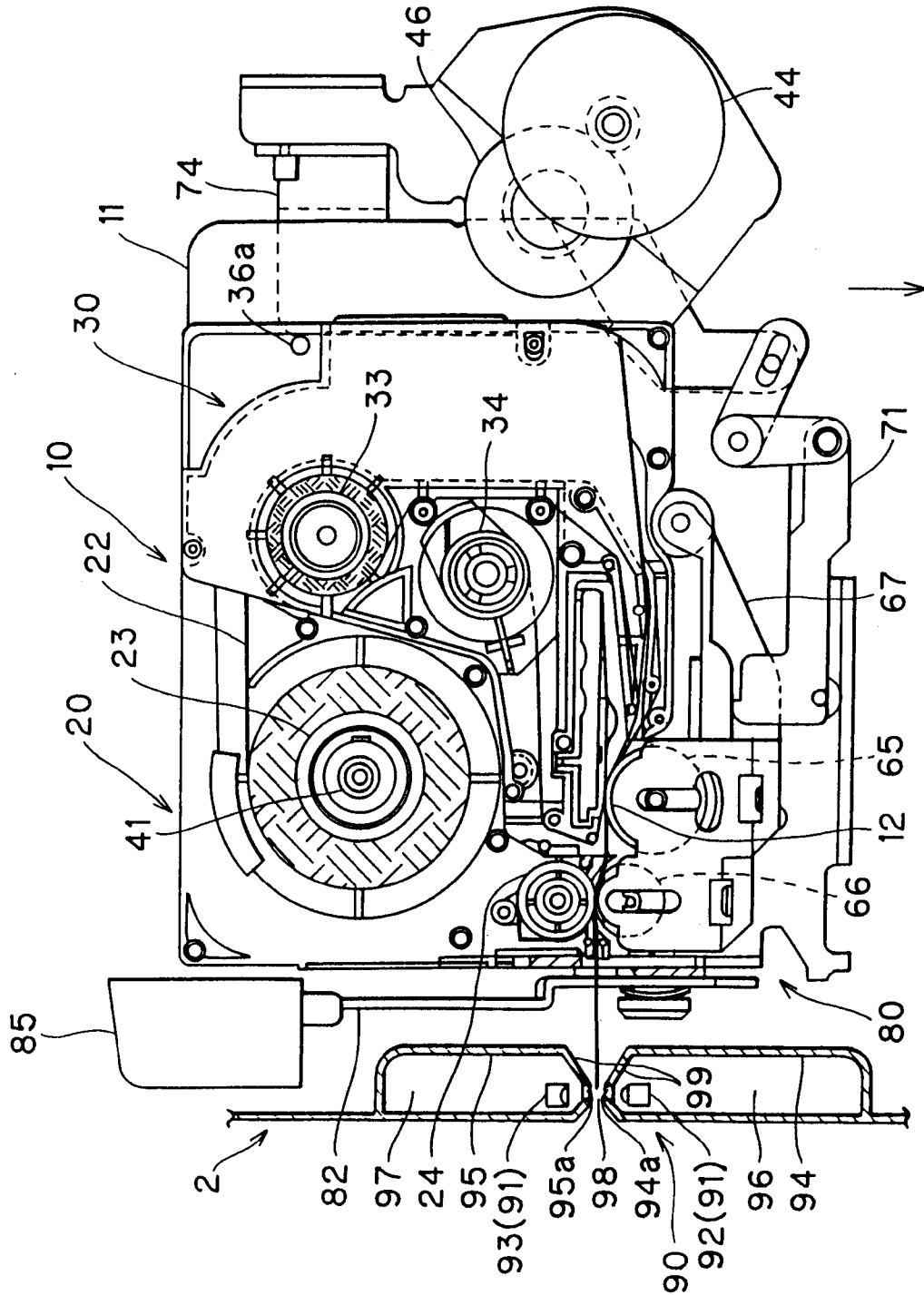




FIG. 3

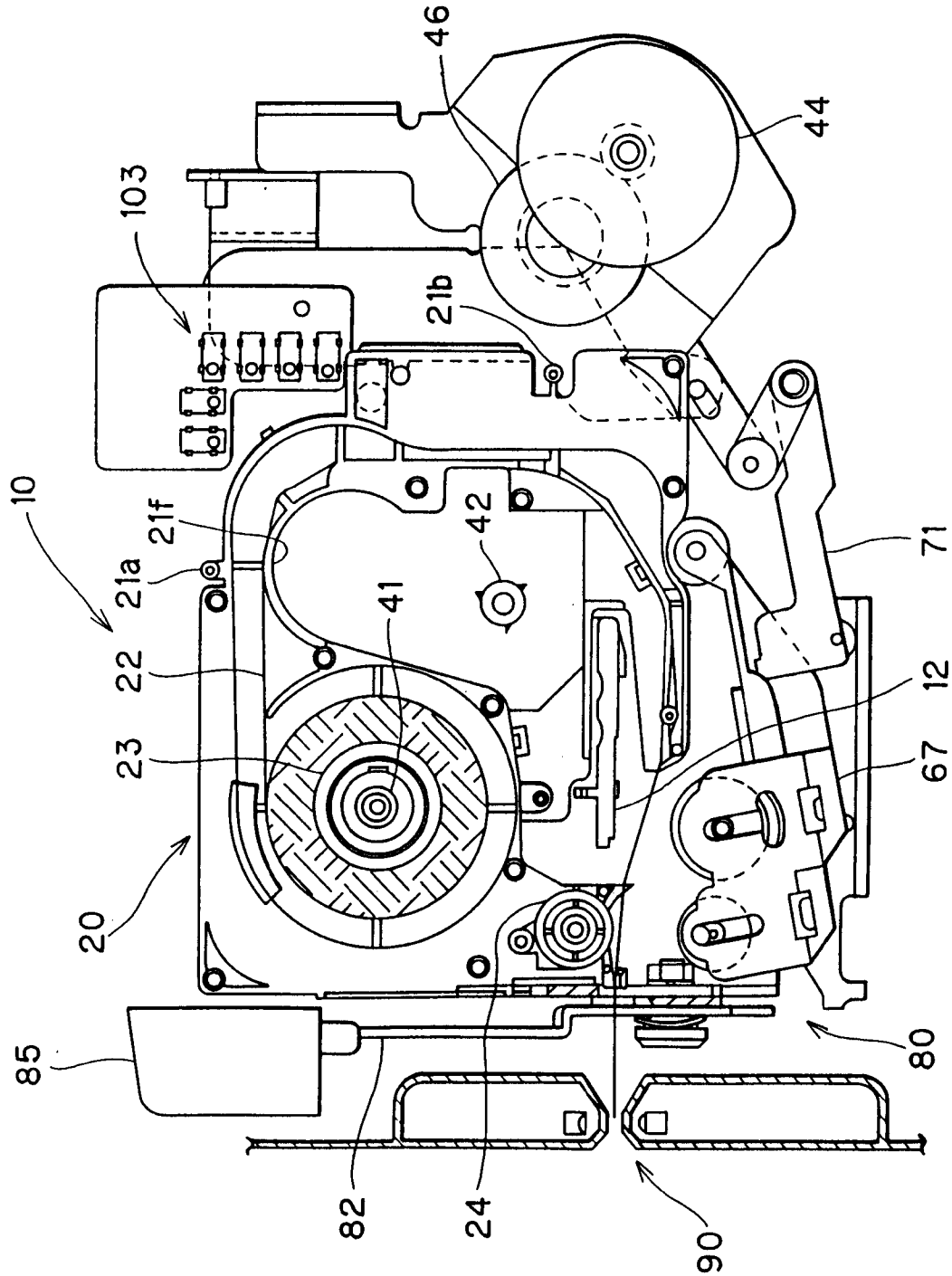


FIG. 4

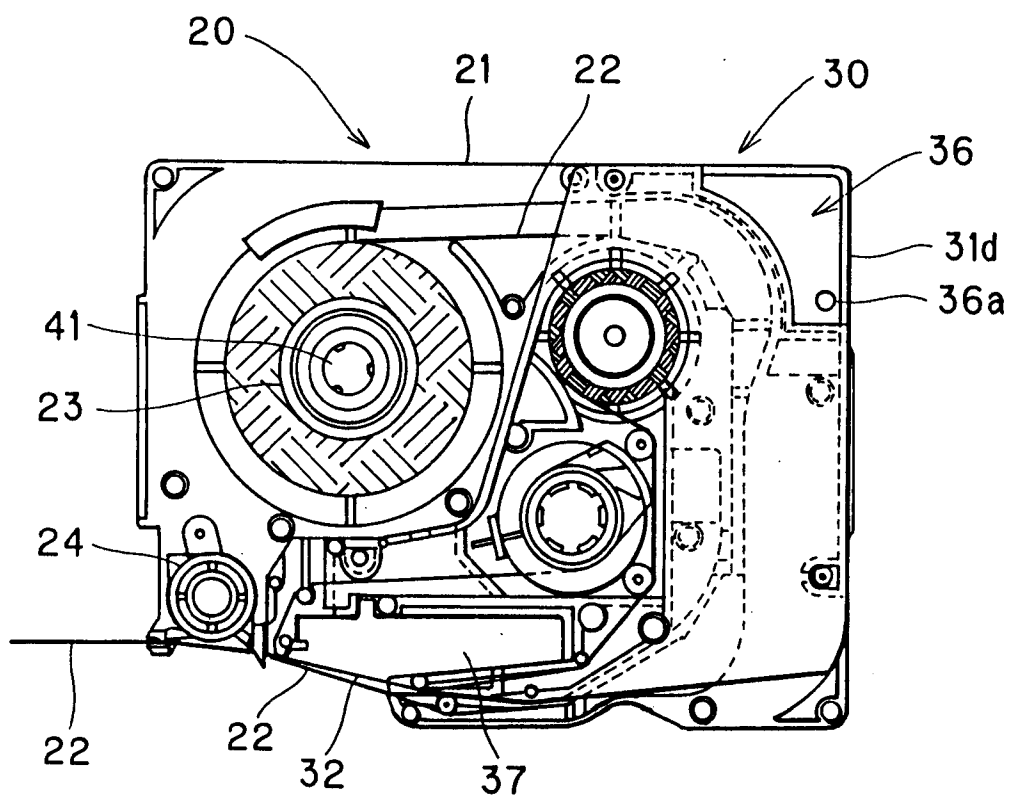


FIG. 5

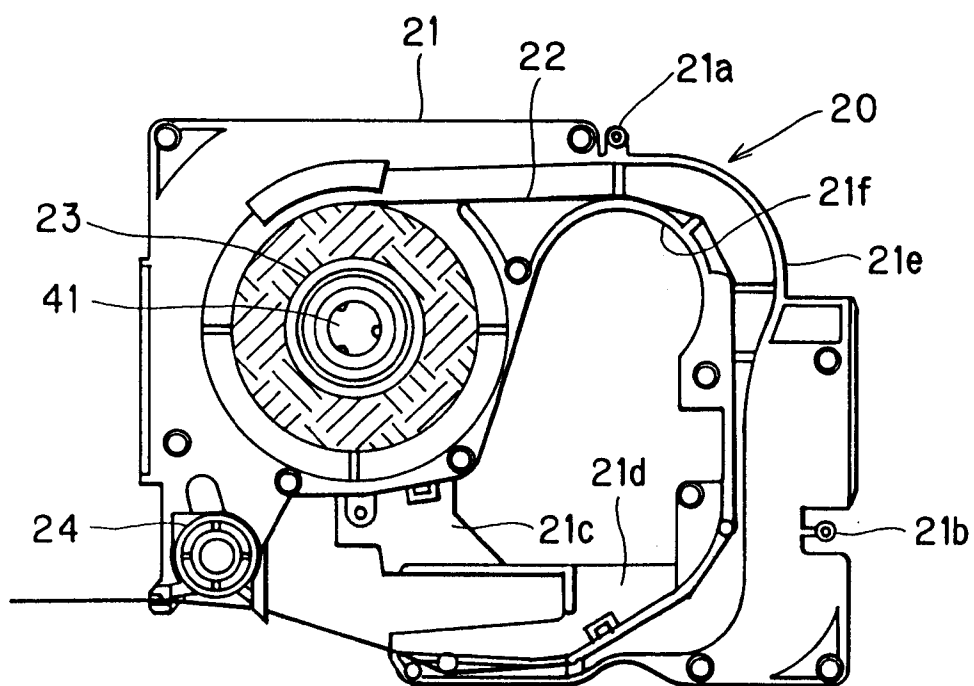


FIG. 6

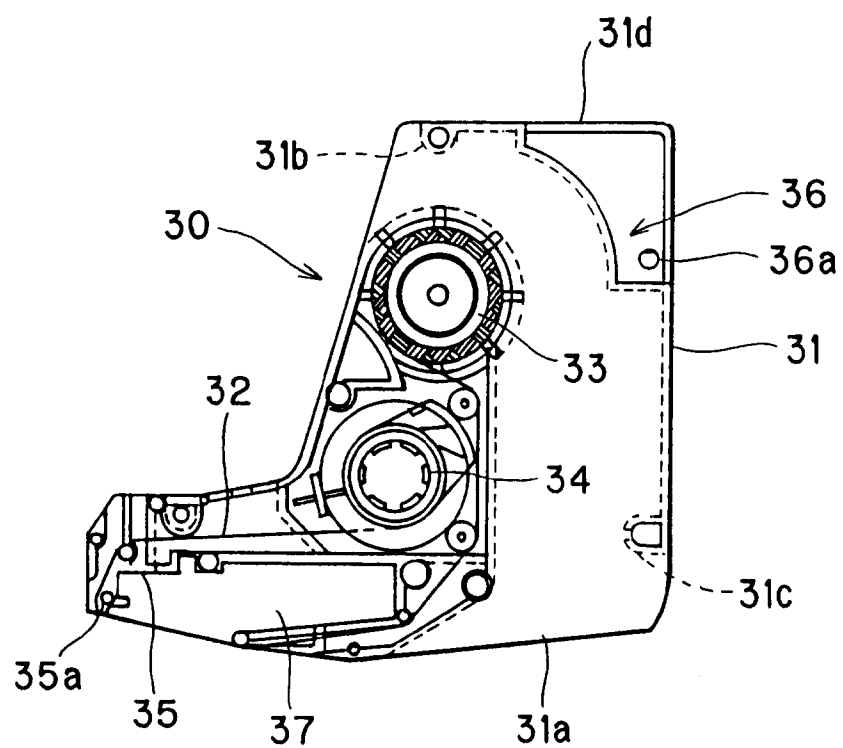


FIG. 8

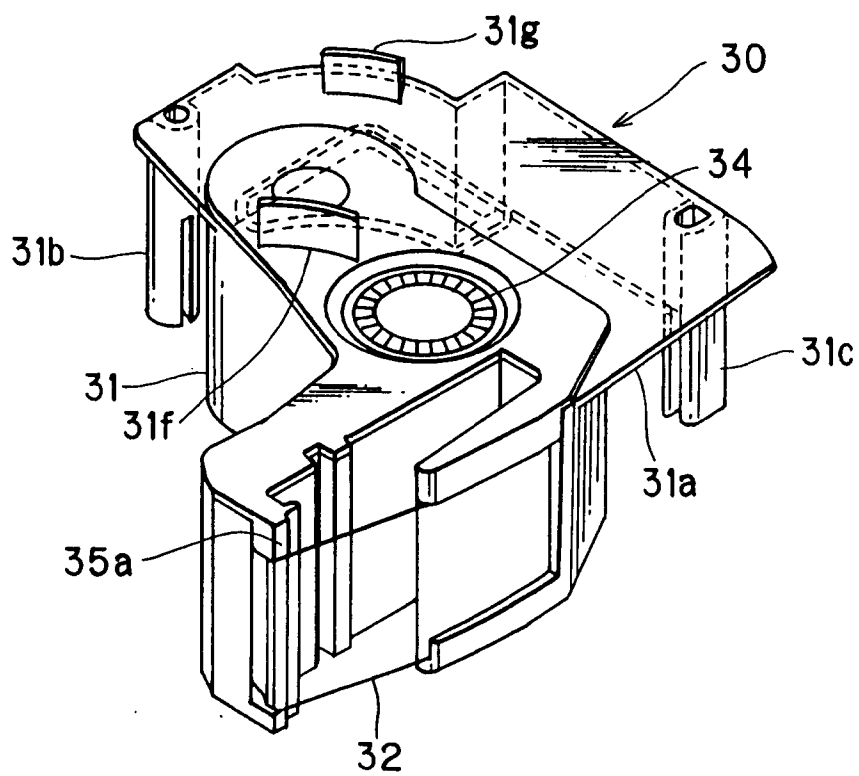


FIG. 7

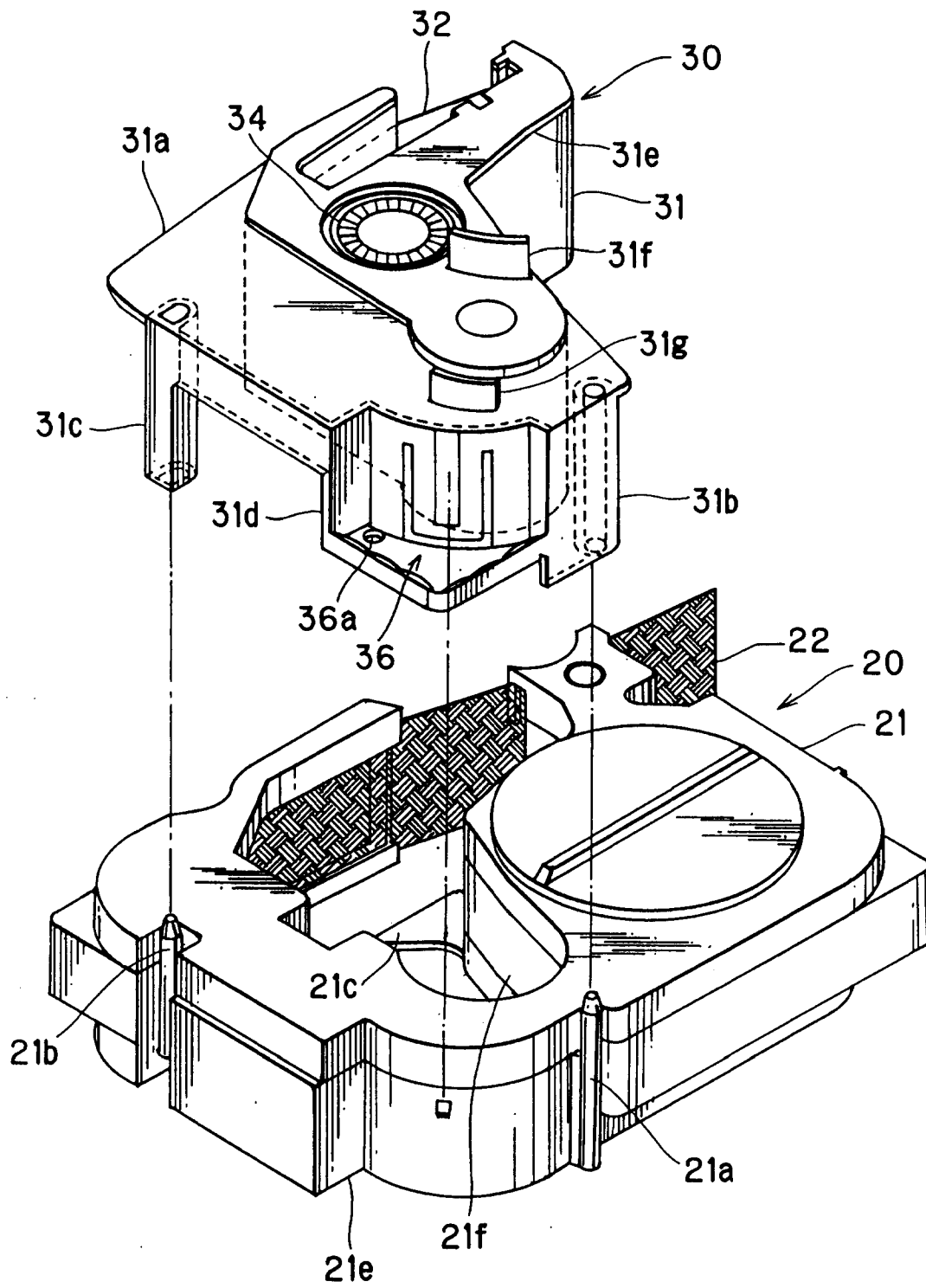


FIG. 9

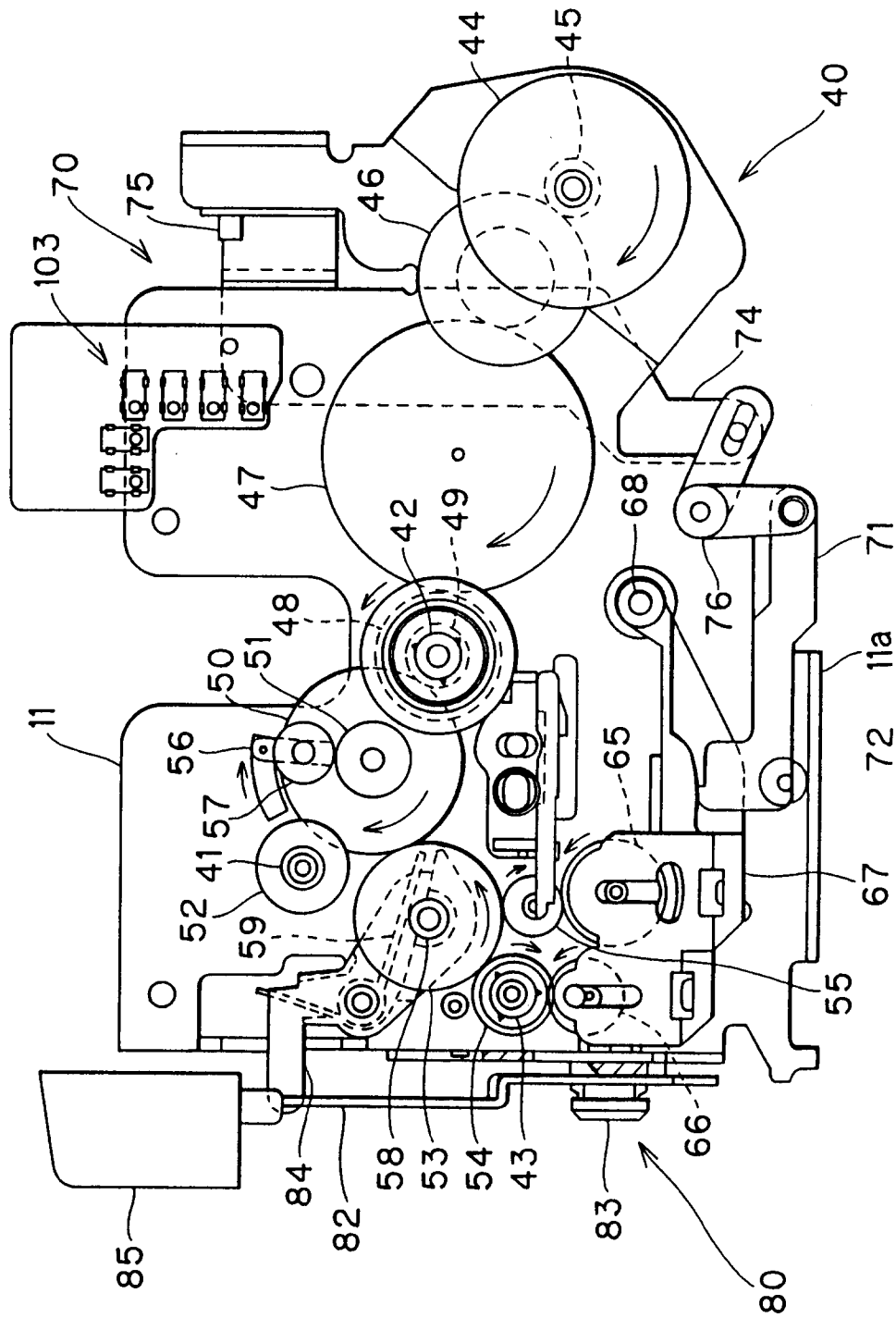


FIG. 10

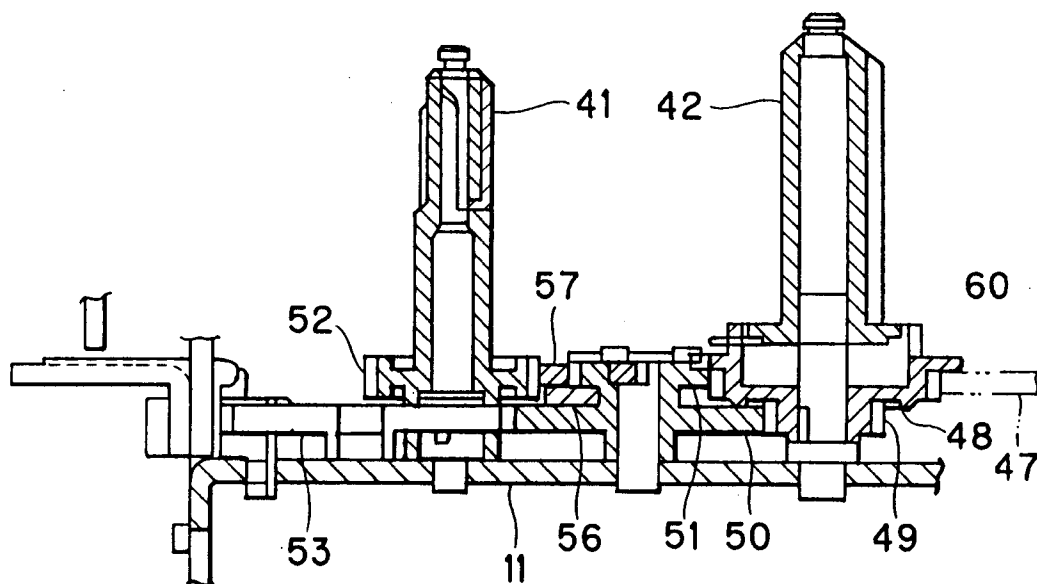


FIG. 11

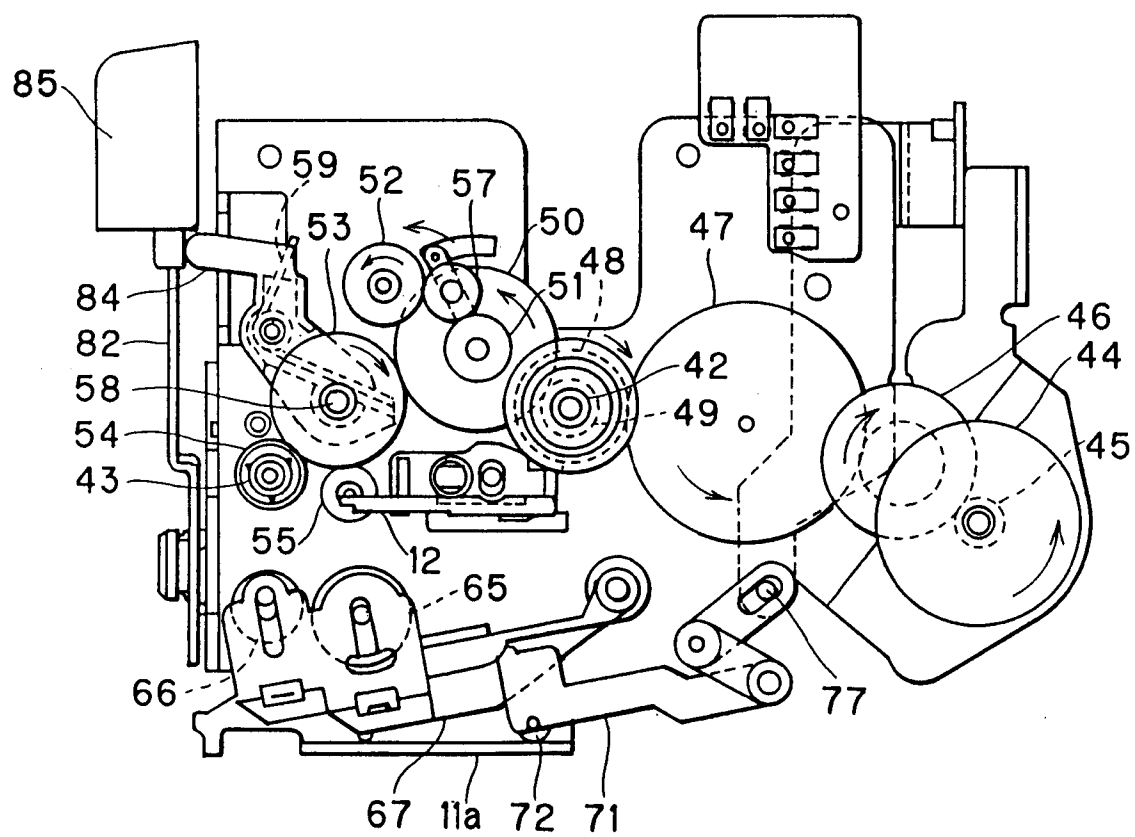


FIG. 12

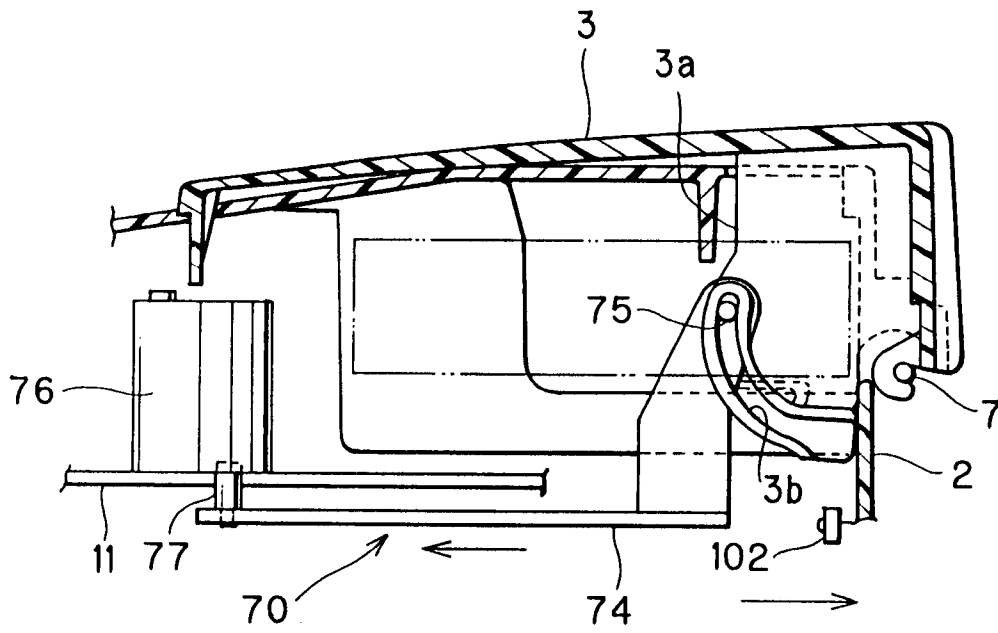


FIG. 13

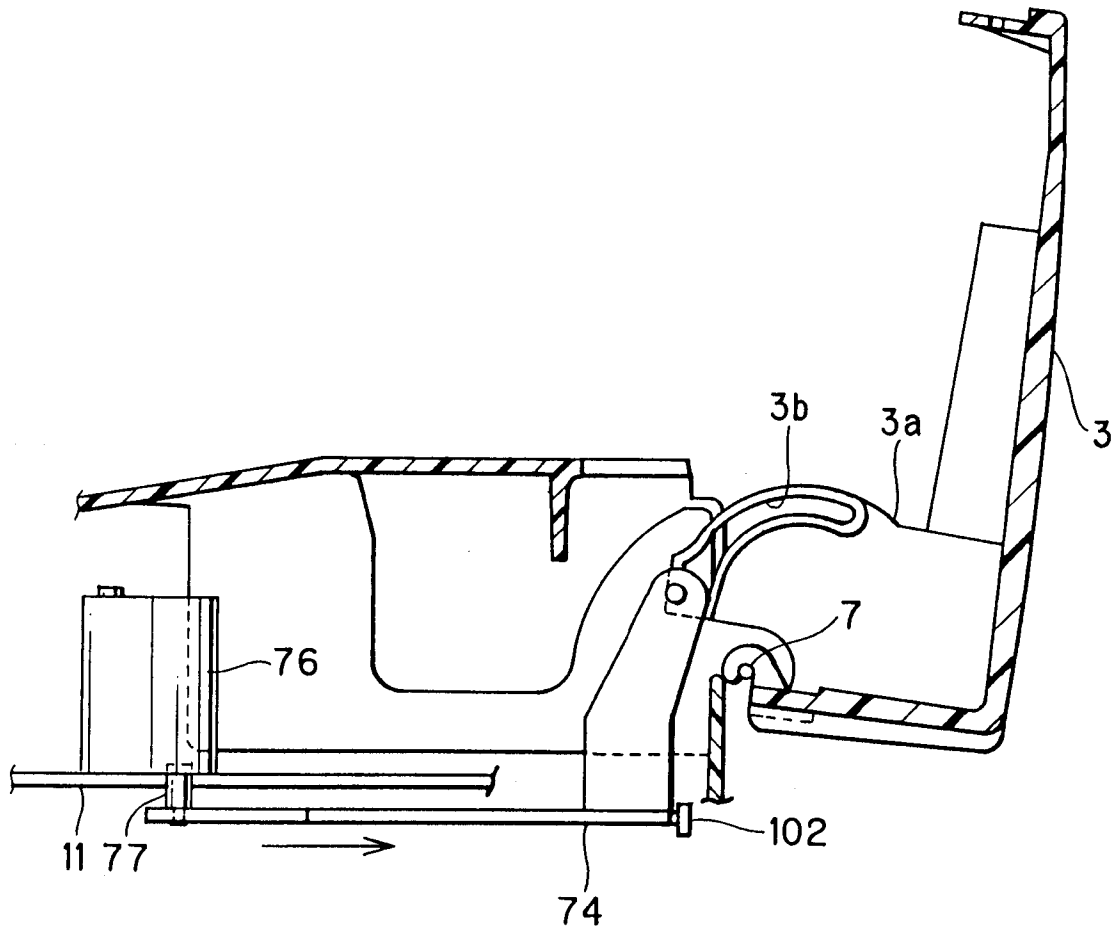


FIG. 14

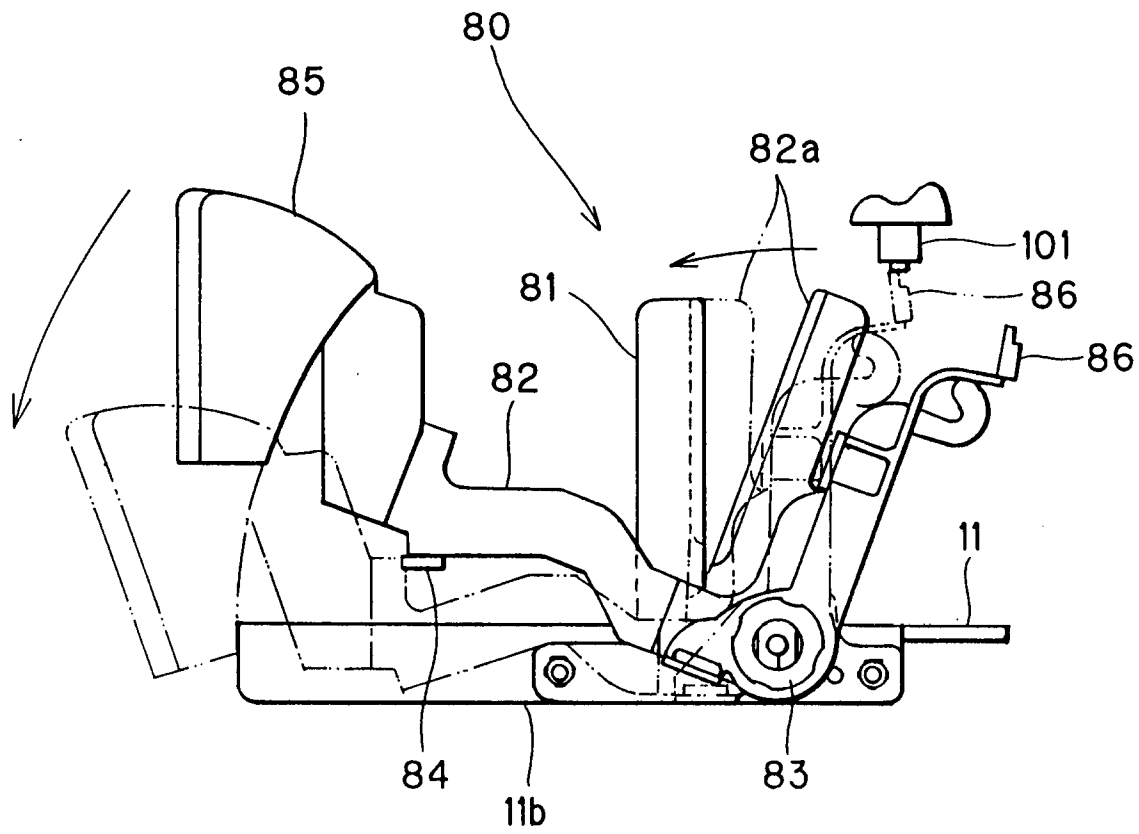




FIG. 15

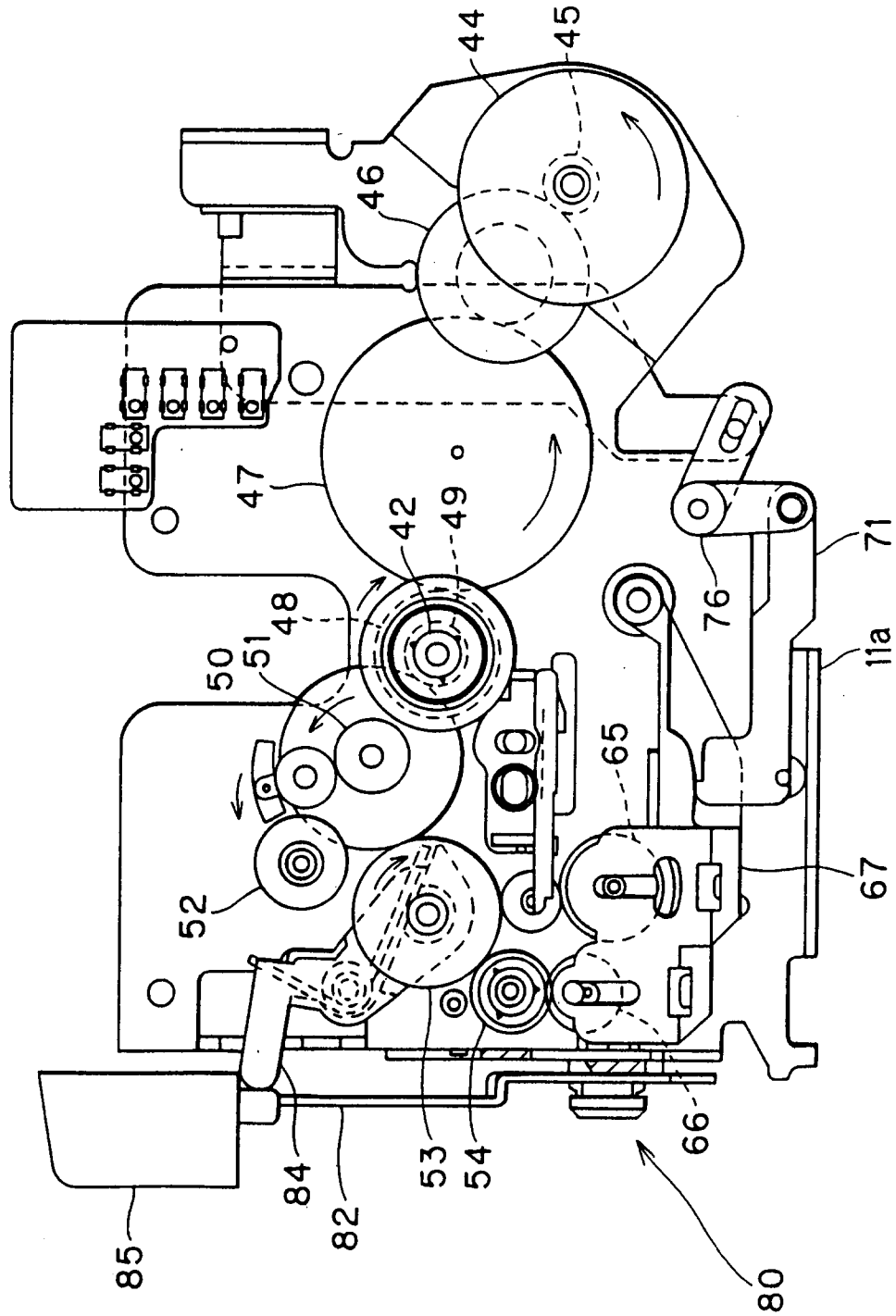


FIG. 16

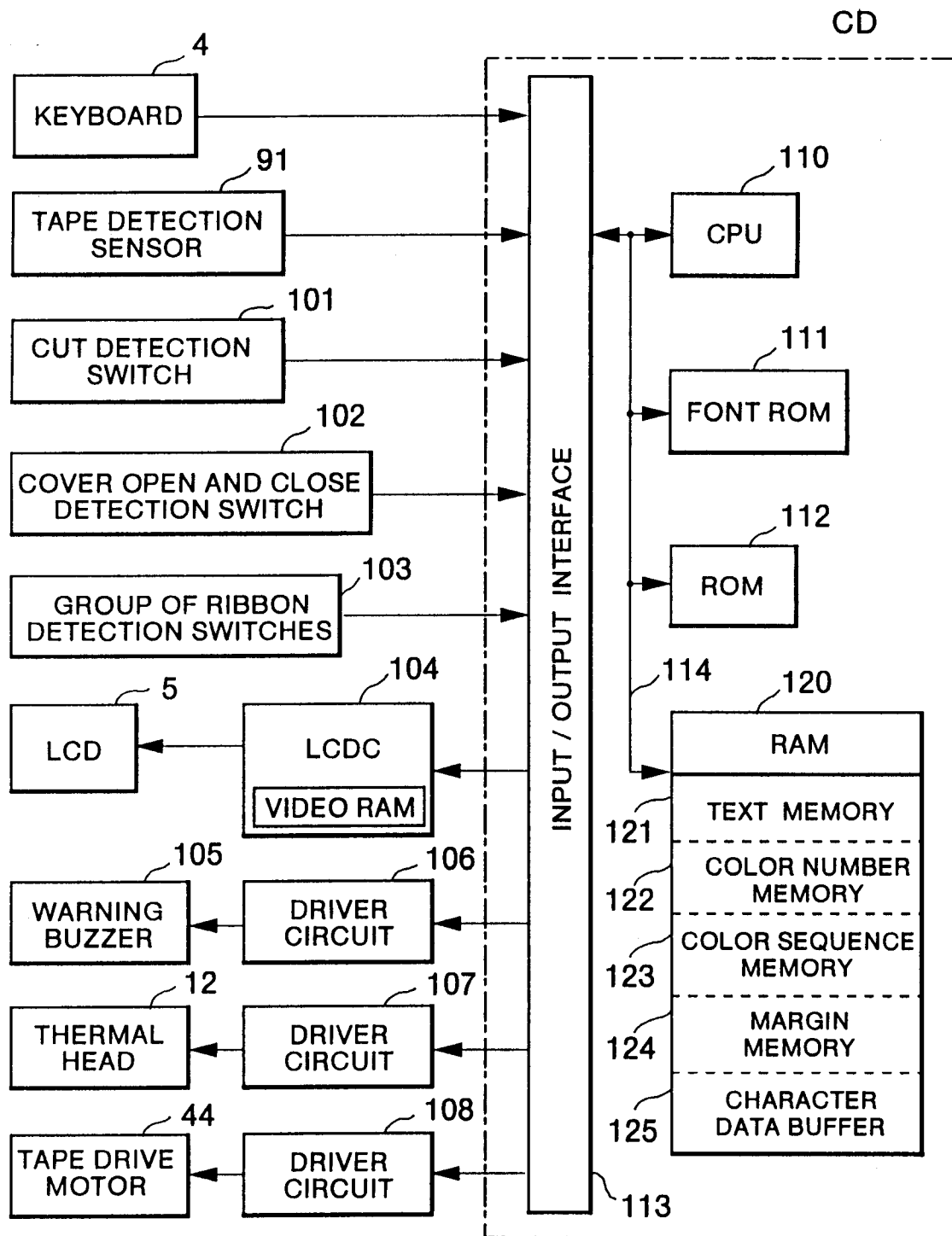


FIG. 17

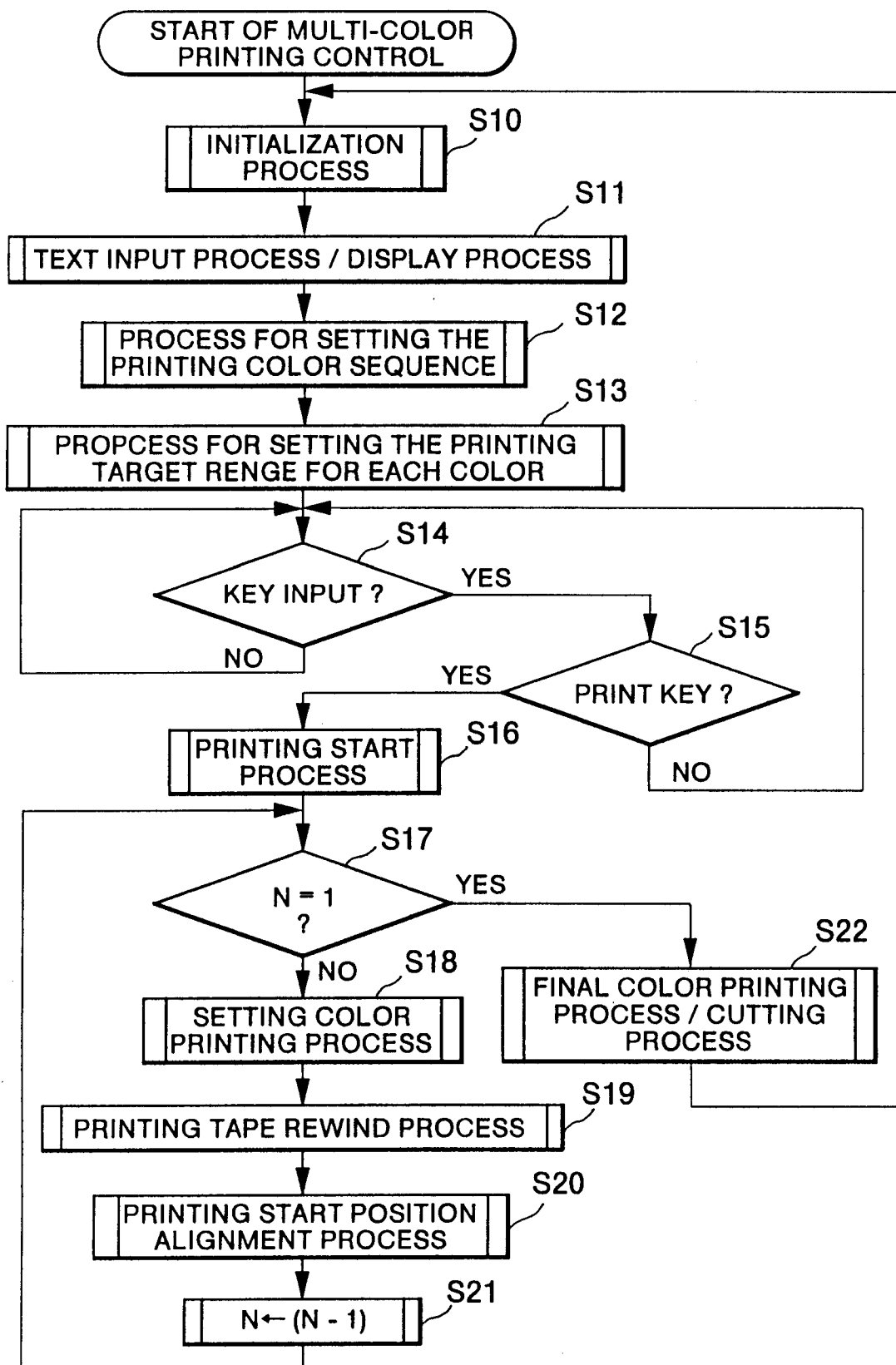


FIG. 18

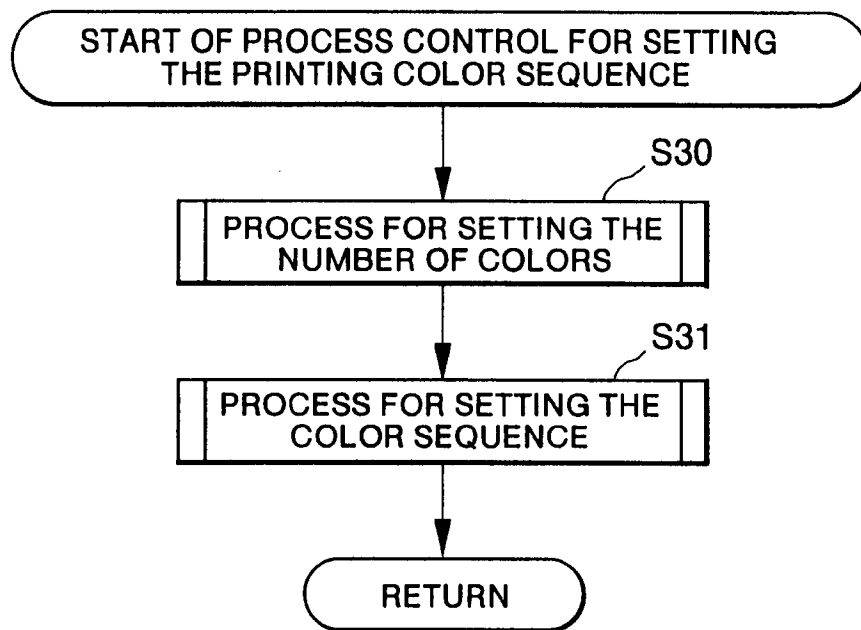


FIG. 19

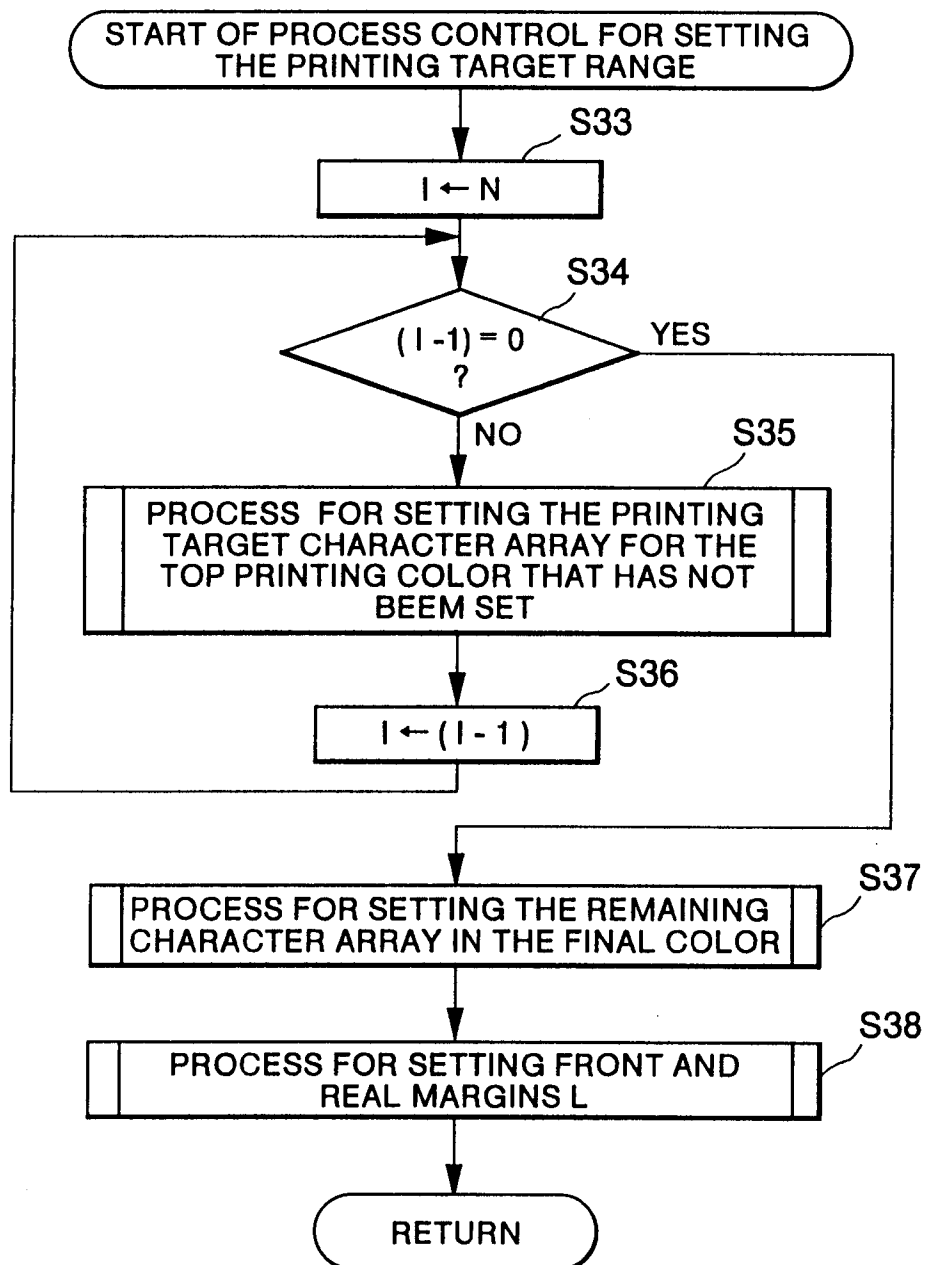


FIG. 20

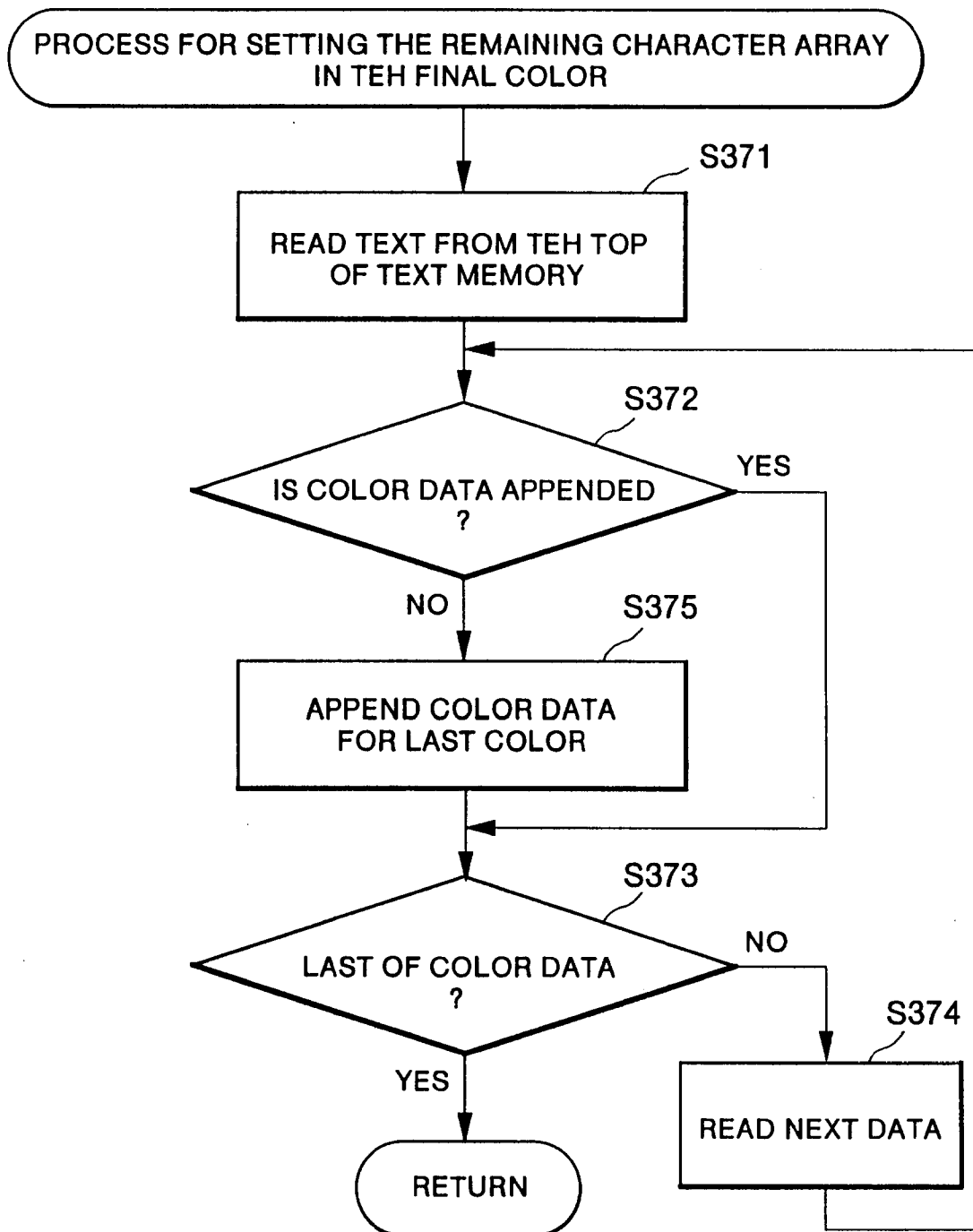


FIG. 21

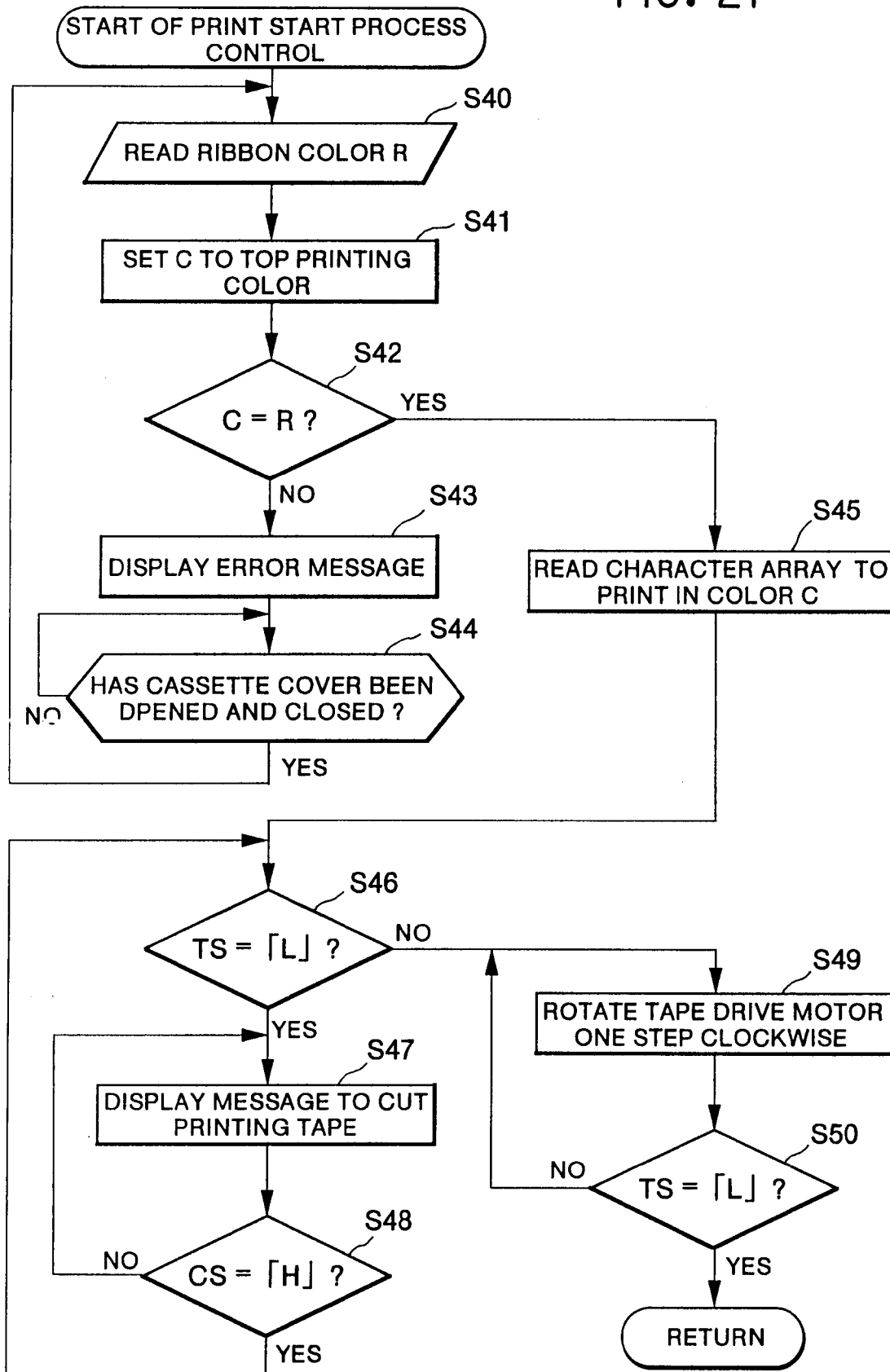


FIG. 22

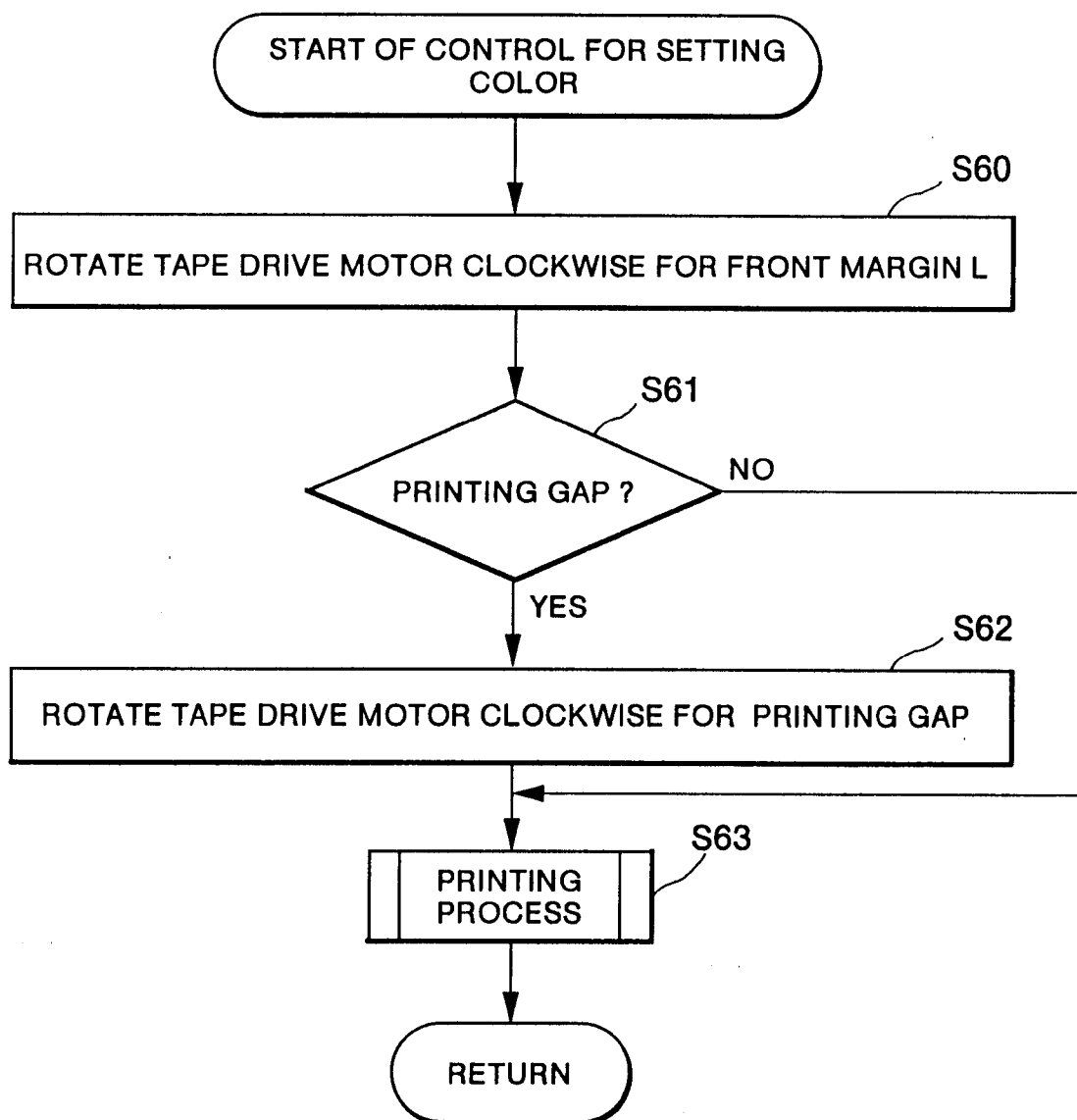




FIG. 23

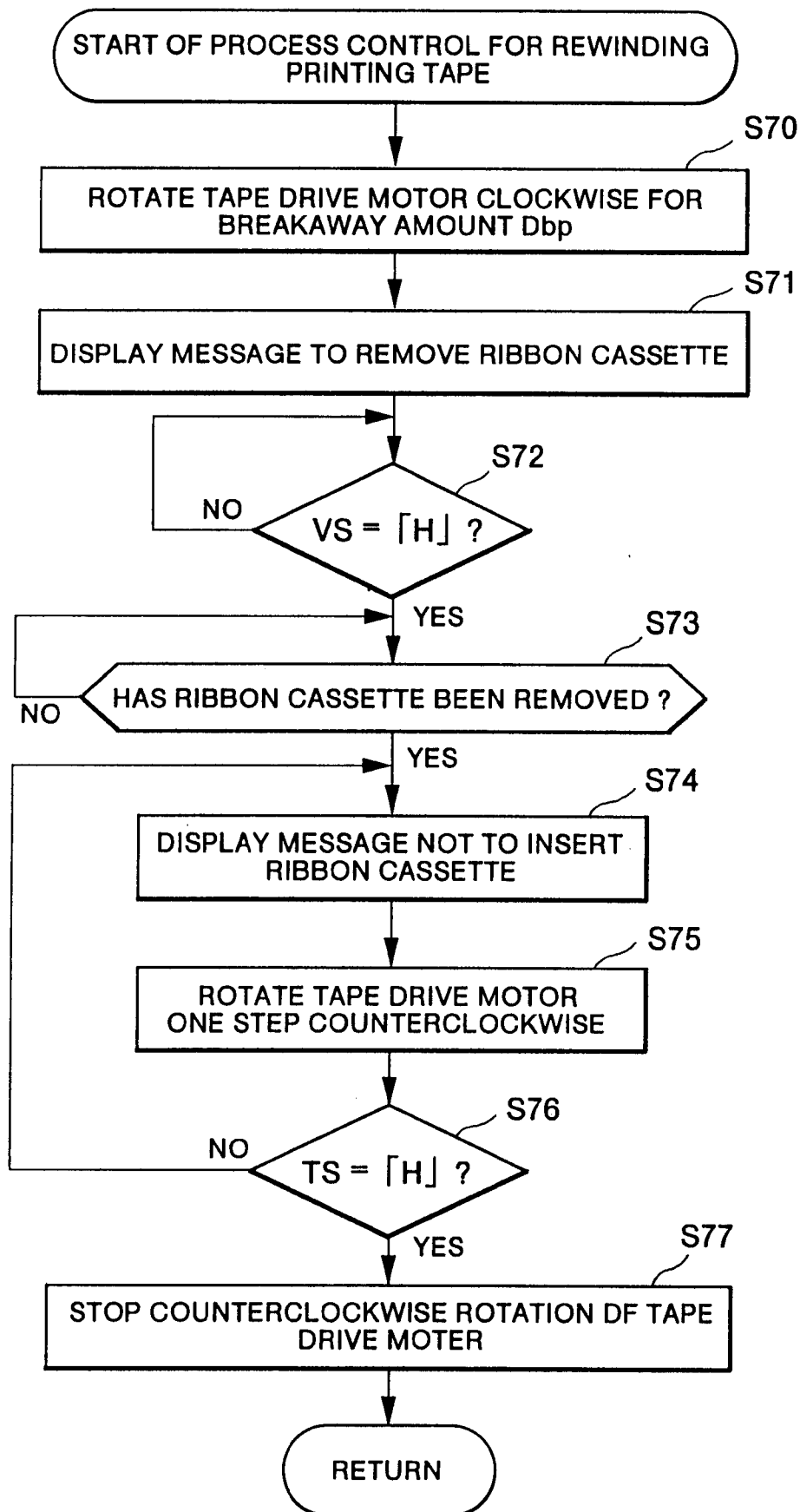


FIG. 24

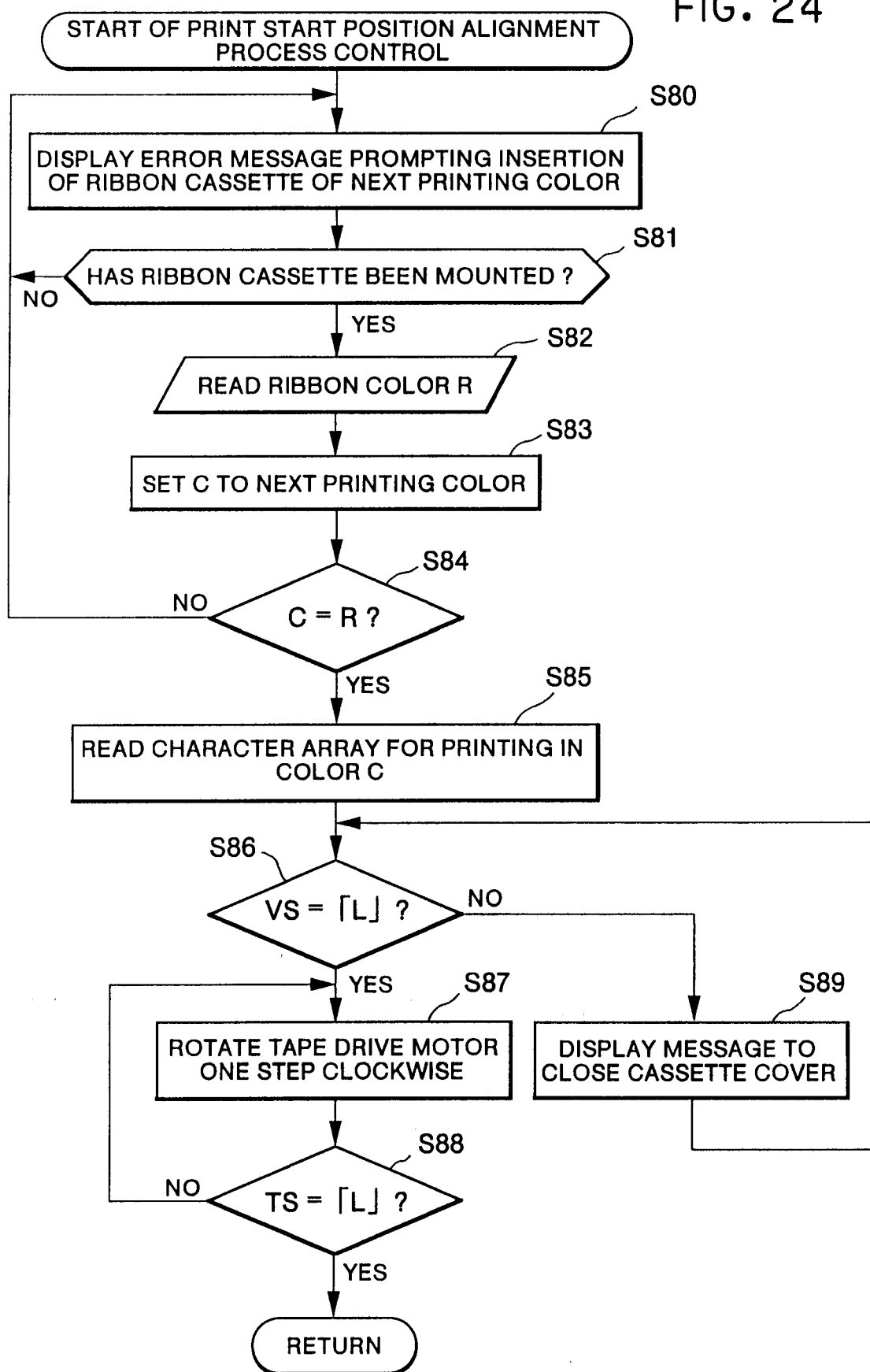


FIG. 25

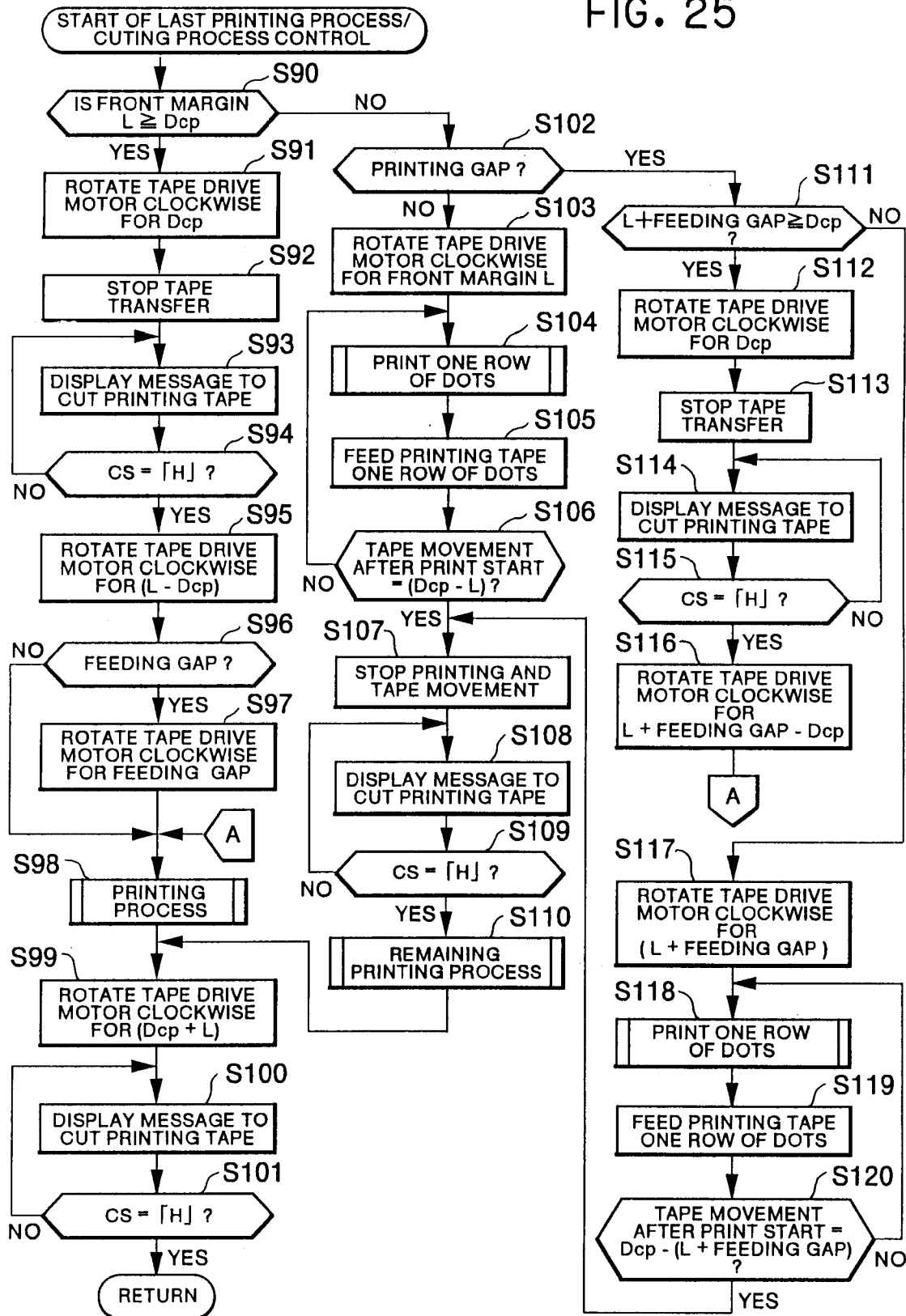


FIG. 26

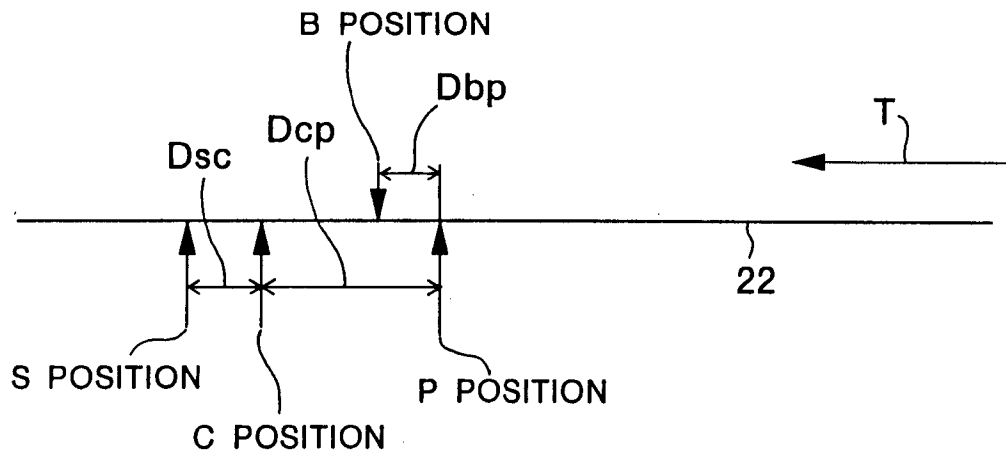


FIG. 27

121

A	RED
B	RED
SP	
C	GREEN
D	GREEN
E	GREEN
SP	
F	BLACK
G	BLACK

FIG. 28(a)

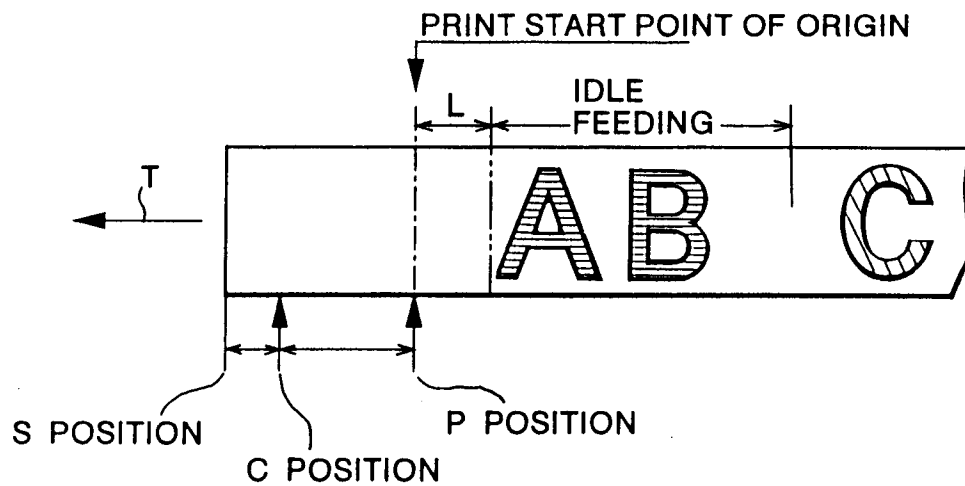


FIG. 28(b)

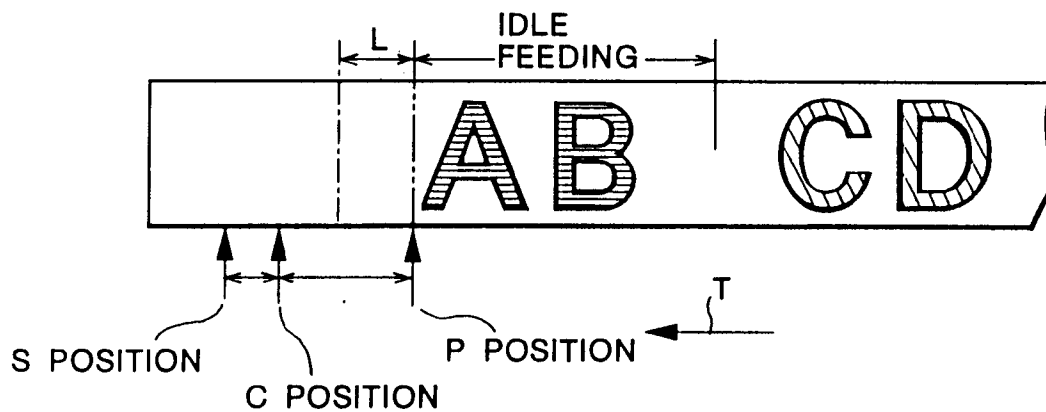


FIG. 28(c)

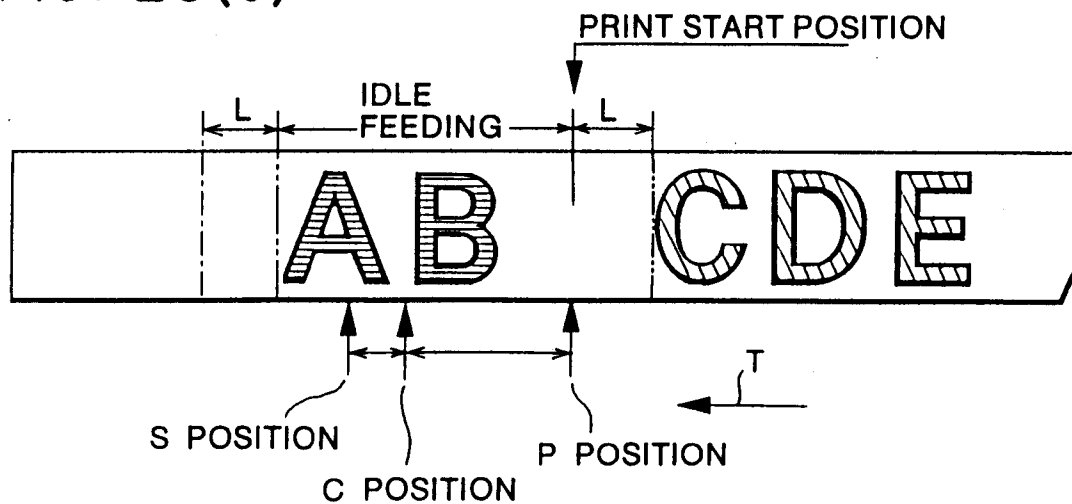


FIG. 29

