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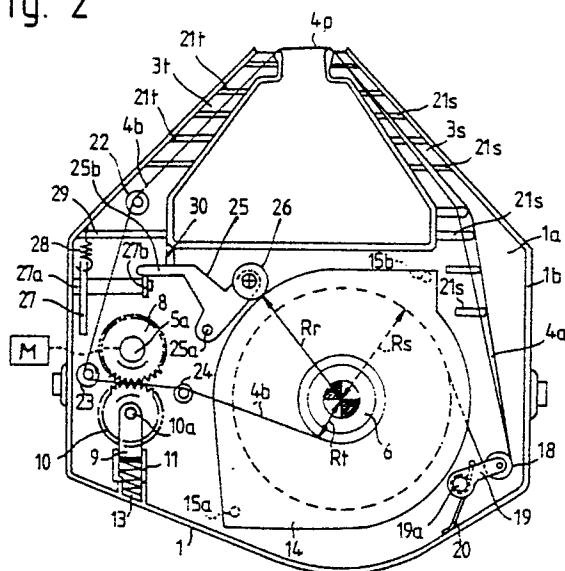
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54 **Inked ribbon cartridge equipped with a ribbon end detecting mechanism.**

57 The inked ribbon cartridge (1) is featured by a ribbon detecting mechanism (25-28) which engages an outer circumferential surface of a wound inked ribbon (4b) around a take-up spool (6) and actuates a ribbon end detecting switch (SW) when a radius of the wound inked ribbon is greater than a predetermined value ( $R_r$ ). This cartridge detects a ribbon end of an inked ribbon with high reliability and feeds an inked ribbon without damaging it.

Fig. 2



## INKED RIBBON CARTRIDGE EQUIPPED WITH A RIBBON END DETECTING MECHANISM

### BACKGROUND OF THE INVENTION

The present invention relates to an inked ribbon cartridge for use in a serial printer, and more particularly to a ribbon end detecting mechanism for an inked ribbon cartridge.

An inked ribbon cartridge of this kind is attached to a carrier unit of a serial printer which includes a print head so that an inked ribbon of the cartridge is supplied to the print head for purpose of printing. The inked ribbon cartridge has a supply spool around which the inked ribbon not yet used is wound and a take-up spool for taking up the inked ribbon from the supply spool such that the inked ribbon passes in front of the print head. Since the printer cannot help stopping the printing operation when all of the inked ribbon of the supply spool has been taken up to the take-up spool, it is necessary to detect a ribbon end of the inked ribbon.

The conventional ribbon end detecting mechanism is disclosed in U.S. Pat. No. 4,115,013, wherein an optical sensor is provided for detecting the ribbon end by sensing a reflective material attached thereto. In this mechanism, the extra manufacturing process is required to attach the reflective material to the ribbon end, with the result that the manufacturing cost of the inked ribbon cartridge is increased. Further, since the optical sensor is employed, the output thereof is disturbed by the dust arising from the inked ribbon and adhering to the optical sensor and the reflective material.

The other ribbon end detecting mechanism is disclosed in Japanese Patent Disclosure No. Sho 56(1981)-77181. This mechanism has a detecting lever which is urged to an outer circumferential surface of the inked ribbon wound around the supply spool. The detecting lever rotates in response to the decrease of the diameter of the inked ribbon around the supply spool, and then actuates a ribbon end switch to turn on when the diameter becomes smaller than a predetermined length. Since the detecting lever always presses the supply spool via the wound inked ribbon, this mechanism has a shortcoming that the supply spool is deflected with respect to a supply spool supporting member by the detecting lever. Accordingly, the supply spool is subject to an excess friction from the spool supporting member, and its rotational stability is degraded. As a result, an irregular and

excess tension arises in the inked ribbon fed by the take-up spool so that the irregular and excess tension often cuts off the inked ribbon.

### SUMMARY OF THE INVENTION

Therefore, an object of the present invention is to provide an inked ribbon cartridge equipped with a ribbon end detecting mechanism capable of detecting a ribbon end of an inked ribbon with high reliability.

Another object of the invention is to provide an inked ribbon cartridge equipped with a ribbon end detecting mechanism capable of feeding an inked ribbon without damaging it.

According to the present invention, an inked ribbon cartridge is featured by a ribbon detecting mechanism which engages an outer circumferential surface of a wound inked ribbon around a take-up spool and actuates a ribbon end detecting switch when a radius of the wound inked ribbon is greater than a predetermined value.

### BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a plan view of an inked ribbon cartridge according to a first embodiment of the present invention;

Fig. 2 is a plan view of the inked ribbon cartridge shown in Fig. 1 with a cover opened;

Figs. 3, 4 and 5 are sectional side views of the inked ribbon cartridge shown in Fig. 1 taken along the lines III-III, IV-IV and V-V of the Fig. 1, respectively;

Fig. 6 is a perspective view showing a ribbon end detecting mechanism used in the inked ribbon cartridge shown in Fig. 1;

Figs. 7 and 8 are perspective views showing a tension mechanism used in the inked ribbon cartridge shown in Fig. 1;

Figs. 9A and 9B are perspective views of the inked ribbon cartridge shown in Fig. 1 attached on a carrier unit;

Fig. 10 is a plan view of an inked ribbon cartridge according to a second embodiment of the present invention;

Fig. 11 is a plan view of the inked ribbon cartridge shown in Fig. 10 with a cover opened; and

Figs. 12, 13 and 14 are sectional side views of the inked ribbon cartridge shown in Fig. 10 taken along the lines XII-XII, XIII-XIII and XIV-XIV of Fig. 10, respectively.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figs. 1 and 2, an inked ribbon cartridge 100 of a first embodiment comprises a base housing 1 having a base plate 1a and side walls 1b rectangularly extending from the outline of the base plate 1a. A cover plate 2 covers over the base housing 1. Two arm portions 3s and 3t extend upward in the figures to guide a film inked ribbon 4 to a printing position 4p. A feed pulley 5 and a pulley portion 6a of a take-up spool 6 project out of the cover plate 2, which are connected in rotation by a feed belt 7. A rotary shaft 5a of the feed pulley 5 extends in the housing 1 and integrally provided with a drive roller 8. The rotary shaft 5a is connected to a motor M provided on a carrier unit 101 on which the ribbon cartridge 100 is attached to receive a rotary force thereof as shown in Fig. 9A.

An idle roller 10 is rotatably supported by a roller holder 9 via an rotary shaft 10a. The roller holder 9 is supported by a guide member 11 and a guide hole 12 to slide thereon. The guide member 11 is integrally formed with the base housing 1 and the guide hole 12 is penetrated through the cover plate 2. The idle roller 10 is urged to the drive roller 8 by means of a spring 13 via the roller holder 9 so that it rotates together with the drive roller 8.

As also shown in Fig. 3, a separating plate 14 is located in the housing 1 by stads 15a and 15b to form upper and lower linked ribbon spaces 16u and 16l separated thereby. The upper space 16u is used for storing used inked ribbon 4b wound around the take-up spool 6 and the lower space 16l is for the inked ribbon 4a not yet used wound around a supply spool 17. Further, the inside of the inked ribbon cartridge 100 is divided into an upper stage portion U and a lower stage portion L. The supply spool 17 is rotatably supported by an outer circumference of a hollow rotary shaft 18 standing on the substantially central portion of the base plate 1a of the housing 1. The take-up spool 6 has a shaft portion 6b extending to the base plate 1a for rotatably engaging an inside of the hollow shaft 18. Thus, the rotary axis A of the supply spool 17 is the same as that of the take-up spool 6. The diameters of the supply spool 17 and the take-up

spool 6 are 20 mm and 18 mm, respectively. As well known, terminal ends of the inked ribbon are secured to the supply spool 17 and the take-up spool 6.

The inked ribbon 4a not yet used is led to an tension mechanism which comprises a tension roller 18, a tension lever 19 and a tension spring 20 as also shown in Fig. 7. The tension lever 19 is rotatably supported by a rotary shaft 19a integrally formed on the base plate 1a. A free end of the tension lever 19 is rotatably provided with the tension roller 18 around which the inked ribbon 4a engages. The tension spring 20 is wound around the shaft 19a and secured to the side wall 1b and the tension lever 19 at its ends, respectively, to supply rotary force to the tension lever 19 in the clockwise direction in Fig. 2. As shown in Fig. 8, a brake shoe 19b may be provided to press the inked ribbon 4a onto the roller 18.

The inked ribbon 4a from the supply side engages the tension roller 18 and is bent toward the arm portion 3s. As also shown in Fig. 4, guide protuberances 21s are formed on the base plate 1a to guide the inked ribbon 4a so as to gradually run apart from the base plate 1a. That is, the inked ribbon 4a is guided upward and leftward in Fig. 4 from the lower stage portion L to the upper stage portion U by the guide protuberances 21s, and then runs out of an opening of the arm portion 3s to reach the printing position 4p.

Subsequently, the inked ribbon 4b used at the printing position 4p enters through an opening of the arm portion 3t. The inked ribbon 4b is guided to run in the upper stage portion U by guide protuberances 21t. Next, the inked ribbon 4b engages a first guide post 22 and a second guide post 23 and passes between the drive roller 8 and the idle roller 10 both having notches therearound. Then, the inked ribbon 4b further engages a third guide post 24 and reaches to the take-up spool 6.

When the rotary force is supplied to the drive roller 8, the drive roller 8 rotates in the counterclockwise direction in Fig. 2 to feed the inked ribbon 4 from the supply spool 17 to the take-up spool 6. The take-up spool 6 is also rotated in the counterclockwise direction via the feed pulley 5, the feed belt 7 and the pulley portion 6a to wind the inked ribbon 4b therearound. Owing to the tension lever 19, the adequate and regular tension is applied to the inked ribbon 4 in a ribbon feed path.

A ribbon end detecting mechanism will be now described in reference further to Figs. 5 and 6. The ribbon end detecting mechanism includes a detect lever 25 provided with a detect roller 26 at one end of the upper stage portion U. The detect lever 25 is rotatably provided around a shaft 25a which stands on the base plate 1a. The other end 25b of the

detect lever 25 contacts one end 27b of a actuating lever 27 which is rotatably supported by a rotatry shaft 27a formed on the side wall 1b. The actuating lever 27 engages one end of a spring 28 the other end of which is connected to a protuberance 29 of the base plate 1a so that the spring 28 supplies a rotary force to the actuating lever 27 in the counterclockwise direction in Fig. 5. The rotary force of the spring 28 is also applied to the detect lever 25 via the end 27b of the actuating lever 27. A stopper 30 is provided to stop the rotation of the detect lever 25 in the clockwise direction in Fig. 2. The actuating lever 27 further has an actuating tip 27c to actuate a switch SW of the carrier unit 101 when the detect lever 25 is moved in the counterclockwise direction in Fig. 2 to turn the actuating lever 27 in the clockwise direction in Fig. 5. A window 31 is formed on the base plate 1a to permit the projection of the actuating tip 27c out of the inked ribbon cartridge 100.

Referring back to Fig. 2, the radius  $R_s$  of the wound inked ribbon 4a around the supply spool 17 from the rotary axis A is 38 mm in the initial state. The detect lever 25 is stopped by the stopper 30 such that the distance  $R_r$  between the rotary axis A and the outer circumferential surface of the detect roller 26 is set by 36 mm. Thus, the detect roller 26 does not contact the outer circumferential surface of the inked ribbon 4b wound around the take-up spool 6 when a radius  $R_t$  of the wound inked ribbon 4b around the take-up spool 6 is smaller than 36 mm. When the radius  $R_t$  is greater than 36 mm, the outer surface of the wound inked ribbon 4b comes to contact with the detect roller 26 and enables the detect lever 25 to rotate around the shaft 25a in the counterclockwise direction in Fig. 2 in accordance with the increase of the radius  $R_t$ . The detect lever 25 moves the actuating lever 27 in the clockwise direction in Fig. 5. When the radius  $R_t$  becomes more than 38 mm, the actuating tip 27c of the lever 27 makes the switch SW turn on to inform that almost all of the inked ribbon 4 is taken up by the take-up spool 6 as shown in Fig. 9B. It is noted that a predetermined amount of the inked ribbon 4a not yet used is left in the supply side in this state so that the printing operation can be continued at least for one line or one page.

Since the detect lever 25 and roller 26 do not press the supply spool 17 for detecting the ribbon end, the supply spool 17 does not subject to an excess friction from the rotary shaft 18, and thus can rotate smoothly. As a result, the inked ribbon 4 is prevented from cutting off. Further, the detect roller 26 does not contact the outer surface of the wound inked ribbon 4b around the take-up spool 6 until the radius  $R_t$  of the inked ribbon 4b becomes a predetermined amount (36 mm). Accordingly, the take-up spool 6 does not subject to a excess

pressure, which makes the friction between the shaft portion 6b and the rotary shaft 18 increase, while the radius  $R_t$  is smaller than the predetermined amount. Consequently, the take-up roller 6 rotates without deflecting and the inked ribbon 4b can regularly be wound around the take-up spool 6.

Figs. 10 to 14 illustrate a second embodiment of the present invention in which the same elements in these figures bear the same reference numerals as in Figs. 1 to 9 and explanation thereof is omitted. The inked ribbon 4 is much wound around the take-up spool 6 than the supply spool 17. In this embodiment, the ribbon end detecting mechanism includes a detect lever 35 rotatably supported around a shaft 35a and provided with a detect roller 36. The detect lever 35 is located near the idle roller 10 and has a actuating tip 35c engageable to the switch SW by the rotation in the clockwise direction in Fig. 11. A window 41 is provided on the side wall 1b for permitting the projection of the actuating tip 35c. The detect lever 35 is supplied with a rotary force in the counterclockwise direction by a spring 38. The detect lever 35 is prevented from rotating in the counterclockwise direction by a stopper portion 40 of the side wall 1b where the window 41 is formed. When the detect lever 35 engages the stopper portion 40, the distance  $R_r'$  between the detect roller 36 and the rotatary axis A is the same as the first embodiment, i.e., 36 mm. When the radius  $R_t$  of the wound inked ribbon 4b becomes 38 mm, the switch SW is turned on. In this embodiment, since the detect lever 35 directly actuates the switch SW, the acuating lever 27 of the first embodiment can be omitted.

Further in the second embodiment, the take-up spool 6 has a disk member 6c integrally formed therewith to guide winding of the inked ribbon 4b around the take-up spool 6, instead of the separating plate 14 of the first embodiment.

As described above, according to the present invention, since the ribbon end detecting mechanism engages the outer circumferential surface of the wound inked ribbon around the take-up spool and actuates the switch to inform the ribbon end when the radius of the wound inked ribbon is greater than the predetermined value, the reliable detection of the ribbon end can be carried out without disturbing the ribbon feeding operation.

## Claims

1. An inked ribbon cartridge characterized by a ribbon detecting mechanism which engages an outer circumferential surface of a wound inked rib-

bon around a take-up spool and actuates a ribbon end detecting switch when a radius of the wound inked ribbon is greater than a predetermined value.

2. An inked ribbon cartridge to be mounted on a carrier unit of a serial printer, in particular according to claim 1, comprising supply and take-up spools rotatably supported by a housing, an inked ribbon wound around said supply and take-up spools, terminal ends of said inked ribbon being secured to said supply and take-up spools, drive means to be coupled with a motor means provided on said carrier unit to receive a rotary force therefrom for feeding said inked ribbon from said supply spool to said take-up spool, said drive means engaging said take-up spool to transmit said rotary force thereto to enable said take-up spool to wind said inked ribbon fed by said drive means whereby a radius of a wound inked ribbon around said take-up spool is gradually increased, and a ribbon end detecting mechanism disposed on an outer circumference of said take-up spool to move in response to a change of said radius by contacting an outer surface of said wound inked ribbon around said take-up spool, said ribbon end detecting mechanism actuating a ribbon end detecting switch provided on said carrier unit when said radius is greater than a predetermined value.

3. The inked ribbon cartridge as claimed in Claim 1 or 2, wherein said ribbon end detecting mechanism includes a movable member engageable to said outer surface of said wound inked ribbon around said take-up spool and stopper means for removing said movable member from said take-up spool with a predetermined distance smaller than said predetermined value, whereby said movable member engages said outer surface of said wound inked ribbon when said radius is greater than said predetermined distance.

4. The inked ribbon cartridge as claimed in any of Claims 1 to 3, wherein said supply and take-up spool is rotatably supported around the same rotary axis.

5. The inked ribbon cartridge as claimed in any of Claims 1 to 4, wherein said housing includes an upper stage portion where said take-up spool is provided and a lower stage portion where said supply spool is provided.

6. The inked ribbon cartridge as claimed in Claim 5, wherein said housing further includes guide protuberances for guiding said inked ribbon from said lower stage portion to said upper stage portion.

7. The inked ribbon cartridge as claimed in any of Claims 1 to 6, wherein said housing is provided with a tension mechanism for applying a tension to said inked ribbon between said supply spool and said take-up spool.

8. An inked ribbon cartridge to be mounted on a carrier unit of a serial printer, in particular according to any of claims 1 to 7, comprising supply and take-up spools rotatably supported by a housing, an inked ribbon wound around said supply and take-up spools, terminal ends of said inked ribbon being secured to said supply and take-up spools, drive means to be coupled with a motor means provided on said carrier unit to receive a rotary force therefrom for feeding said inked ribbon from said supply spool to said take-up spool, said drive means engaging said take-up spool to transmit said rotary force thereto to enable said take-up spool to wind said inked ribbon fed by said drive means whereby a radius of a wound inked ribbon around said take-up spool is gradually increased, and a ribbon end detecting mechanism including a movable member disposed on an outer circumference of said take-up spool to move in response to a change of said radius, stopper means for removing said movable member from said take-up spool with a predetermined distance and actuating means connected to said movable member for actuating a ribbon end detecting switch provided on said carrier unit when said radius is greater than a predetermined value which is greater than said predetermined distance.

Fig. 4

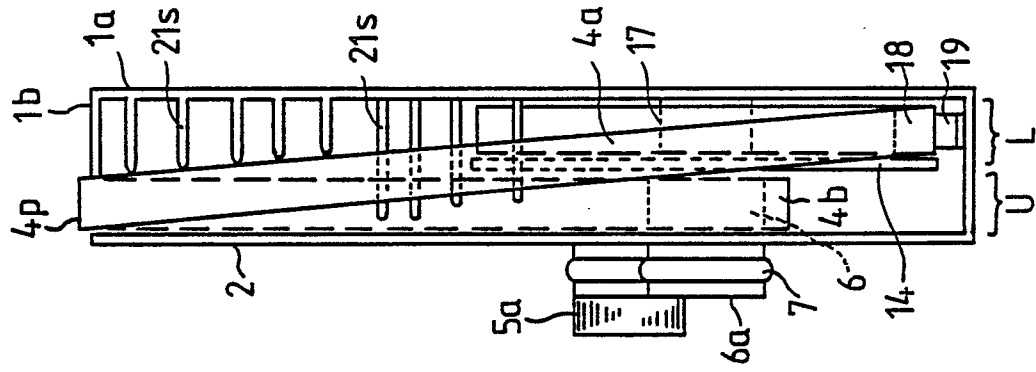


Fig. 1

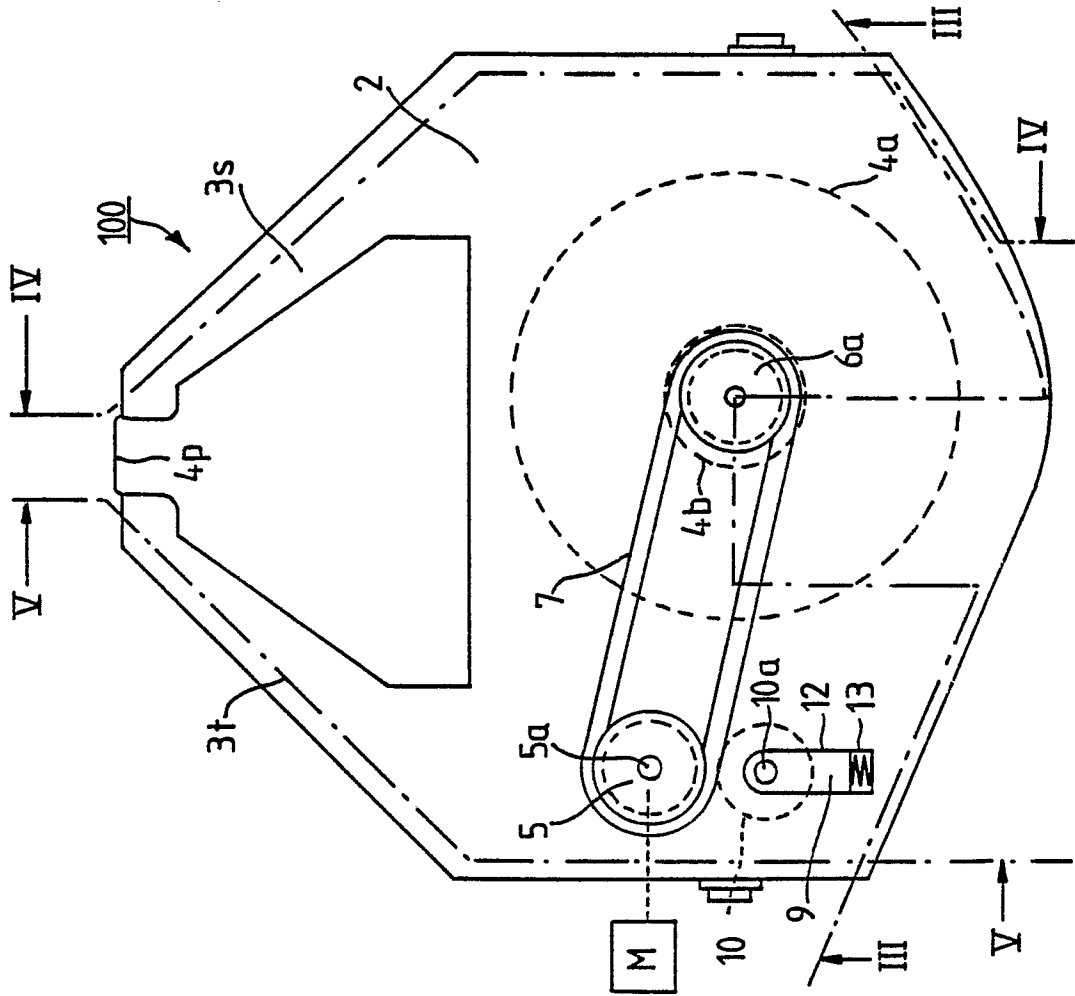


Fig. 5

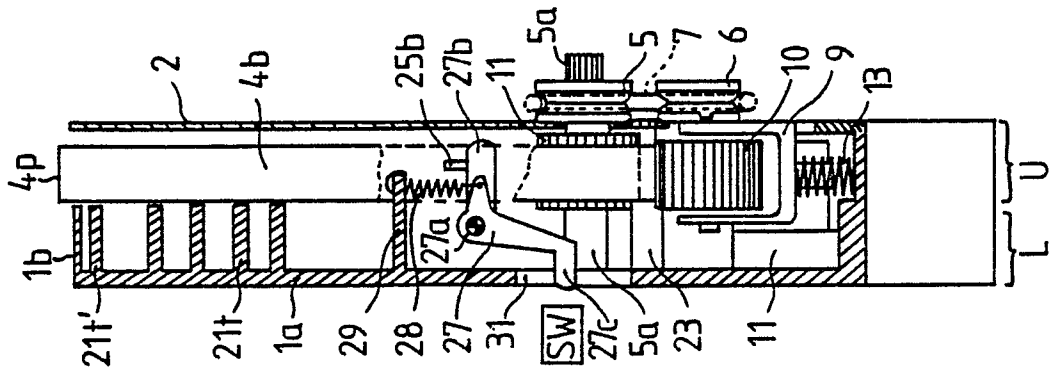


Fig. 2

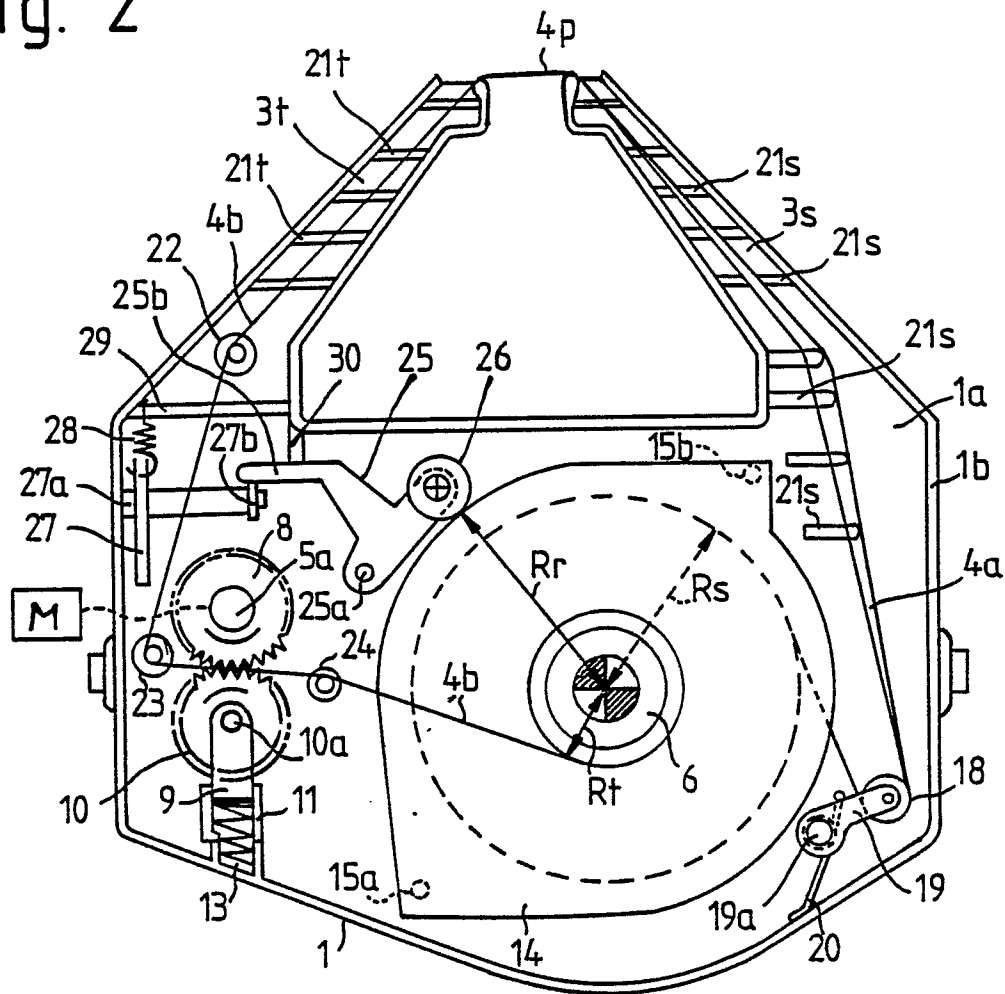
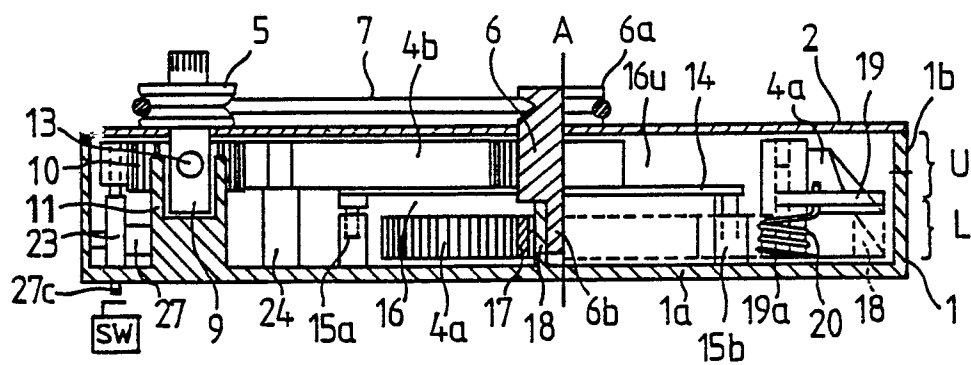


Fig. 3



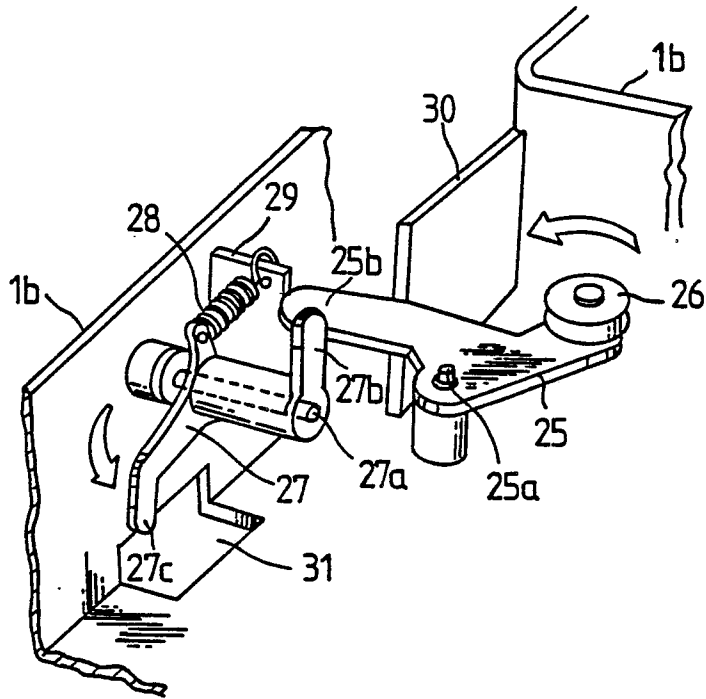


Fig. 6

Fig. 7

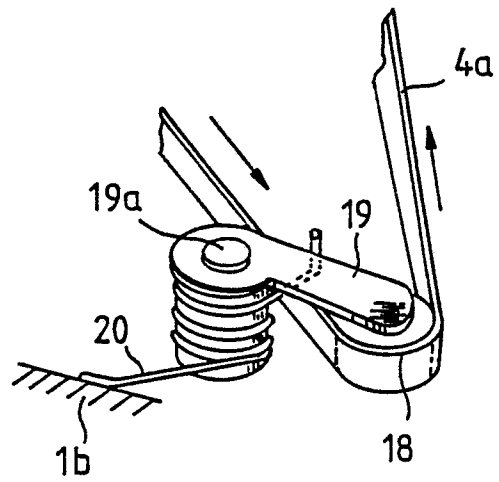


Fig. 8

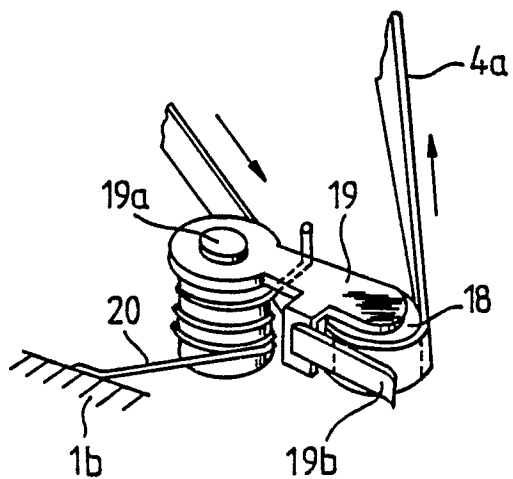




Fig. 9

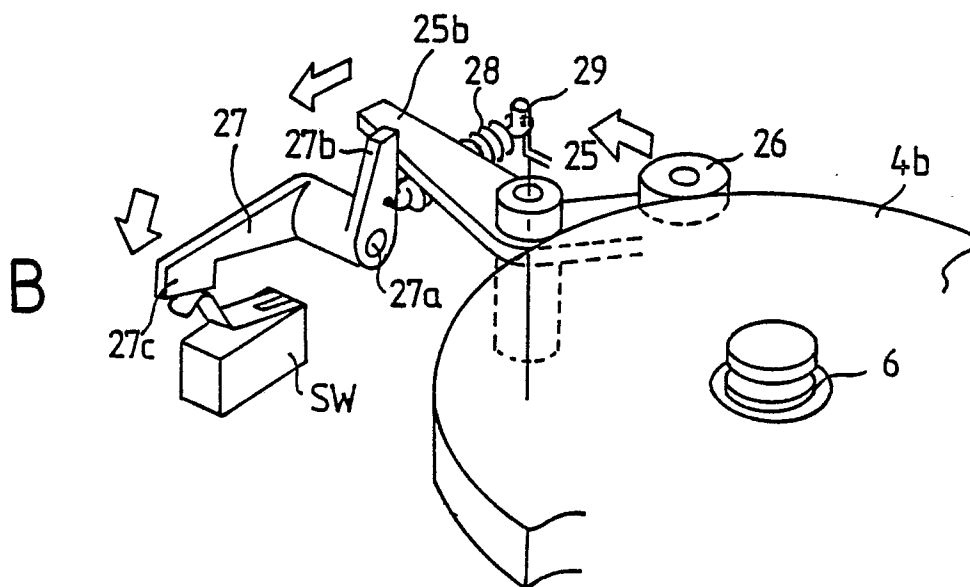
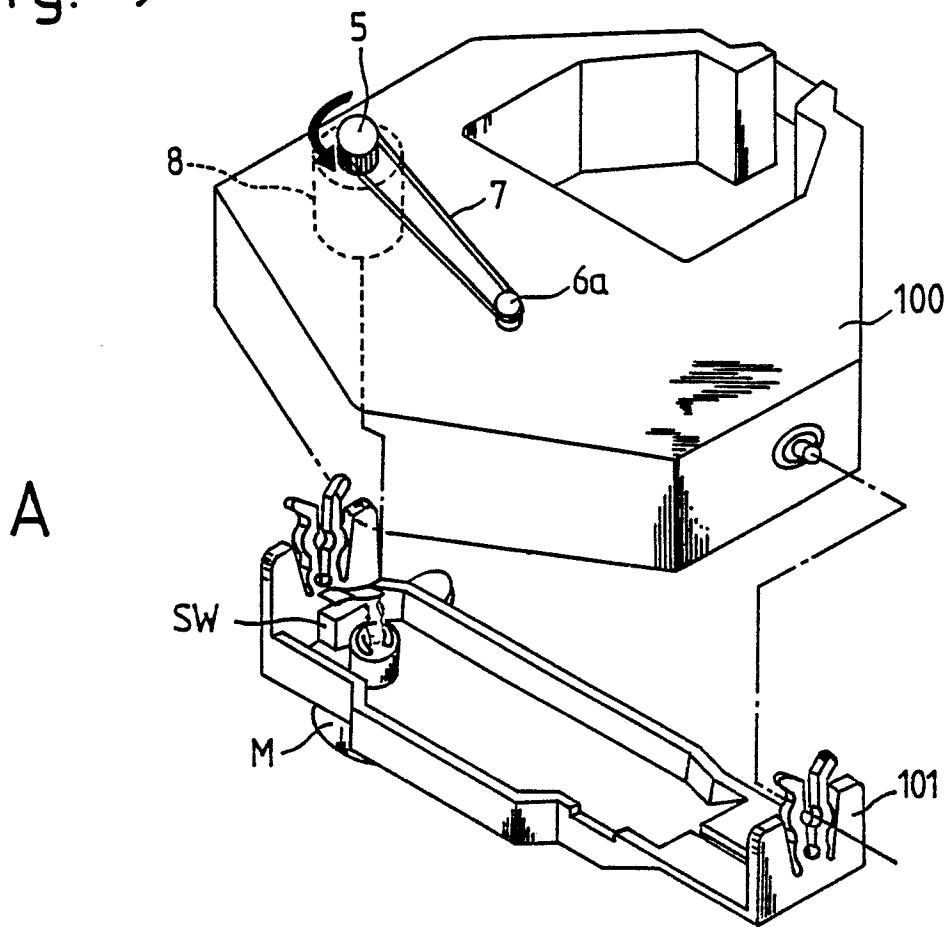


Fig. 11

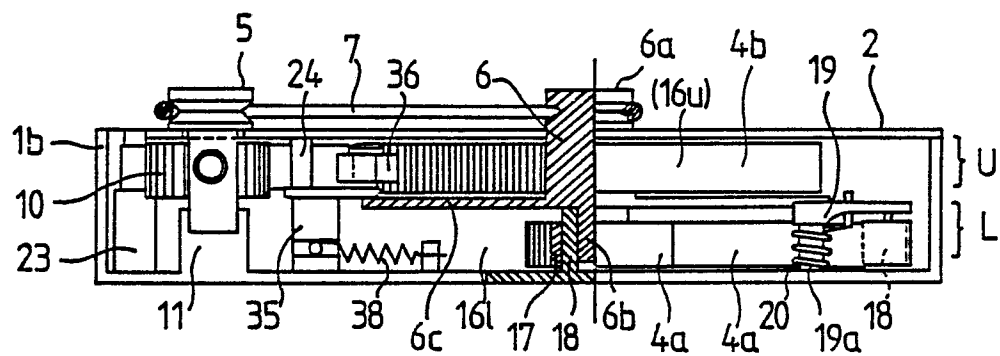
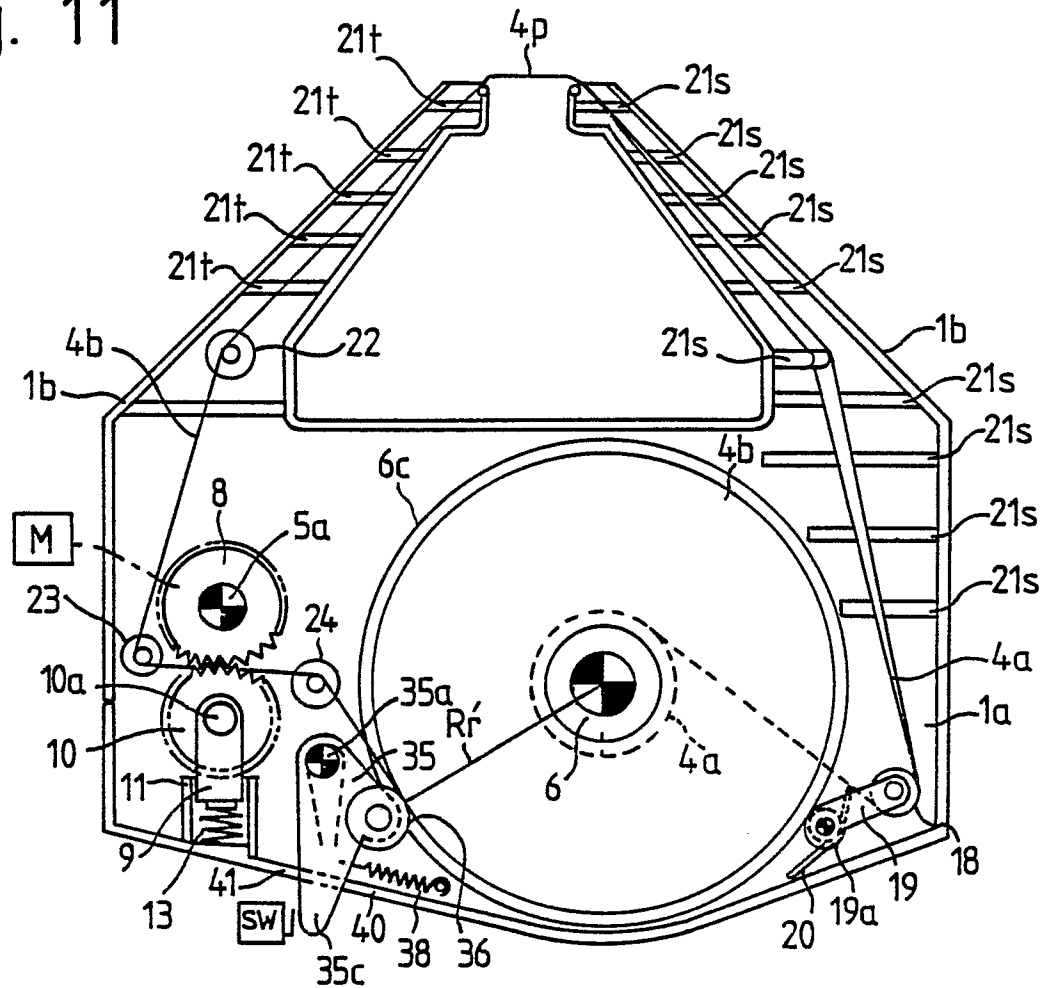


Fig. 14

Fig. 13

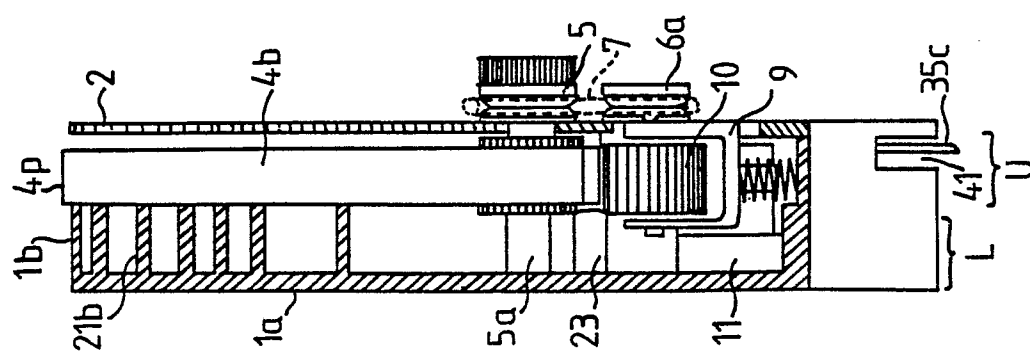


Fig. 10

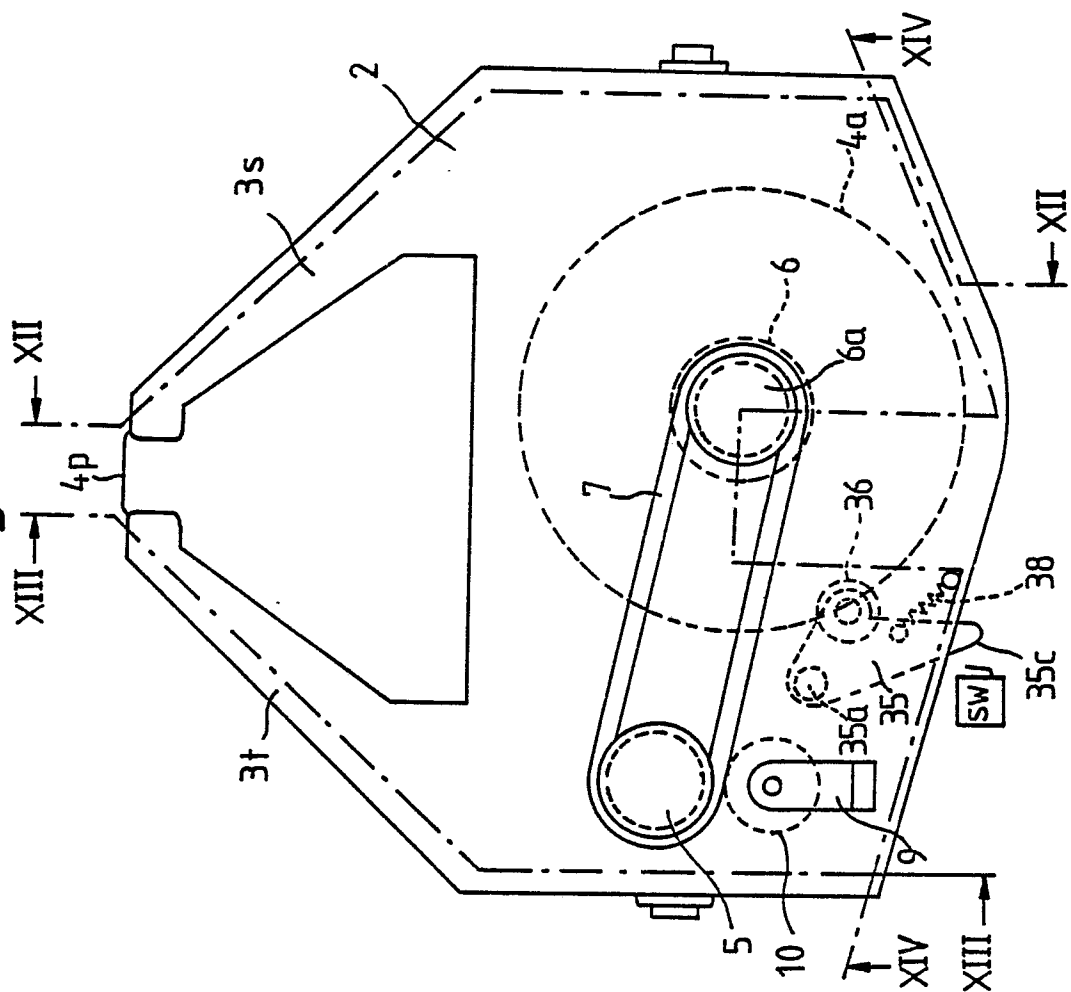
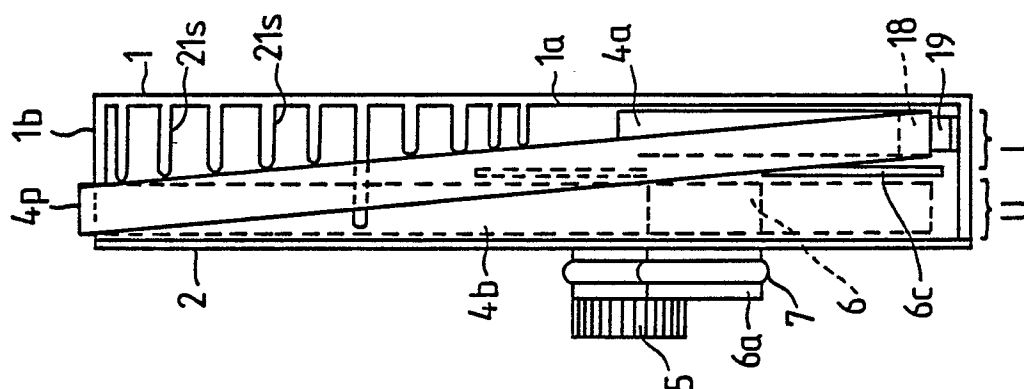


Fig. 12





DOCUMENTS CONSIDERED TO BE RELEVANT			EP 87100657.3
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Y	EP - A - O 008 279 (ANTOLINI) * Fig. 7; page 15, line 12 - page 16, line 4 *	1,2,4- 7	B 41 J 32/00 B 41 J 35/36
A	---	3,8	
Y	PATENT ABSTRACTS OF JAPAN, unexamined applications, section M, vol. 4, no. 41, March 29, 1980 THE PATENT OFFICE JAPANESE GOVERNMENT page 13 M 5 * Kokai-no. 55-11 805 (OKI) *	1,2,4- 7	
A	----	3,8	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			B 41 J B 65 H
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 26-03-1987	Examiner MEISTERLE
<p><b>CATEGORY OF CITED DOCUMENTS</b></p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons &amp; : member of the same patent family, corresponding document</p>			