United States Patent [19]

Kojima et al.

[11] **3,843,114**

[45] **Oct. 22, 1974**

[54] **APPARATUS FOR AUTOMATIC TAKEUP AND RELEASE OF SHEETS**

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[73] Assignee: **Tokyo Shibaura Electric Co., Ltd.,** Kawasaki-shi, Japan

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[30] **Foreign Application Priority Data**

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Sept. 19, 1972 Japan 47-93853

[52] **U.S. Cl.** **271/3,** 271/277, 346/138
[51] **Int. Cl.** **B65h 5/12**
[58] **Field of Search** ..... 271/3, 53; 274/4 J; 346/138, 125, 132; 29/118

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Primary Examiner—Evon C. Blunk
Assistant Examiner—Bruce H. Stoner, Jr.
Attorney, Agent, or Firm—Oblon, Fisher, Spivak, McClelland & Maier

[57] **ABSTRACT**

An apparatus for the automatic take up and release of sheets includes first and second bars supported by first and second bar supports, respectively, each of which has an axial guide slot for permitting the support to rotate and move radially relative to a main shaft. The bar supports are urged in a radial direction and along the slots by means of springs so as to press the bars upon the surface of a rotatable drum associated with the main shaft and may be shifted by suitable shifting means in a radial direction against the biasing action of the springs so as to release the bars from the drum, the bars, when so released, being held in such positions by stopping means.

15 Claims, 27 Drawing Figures

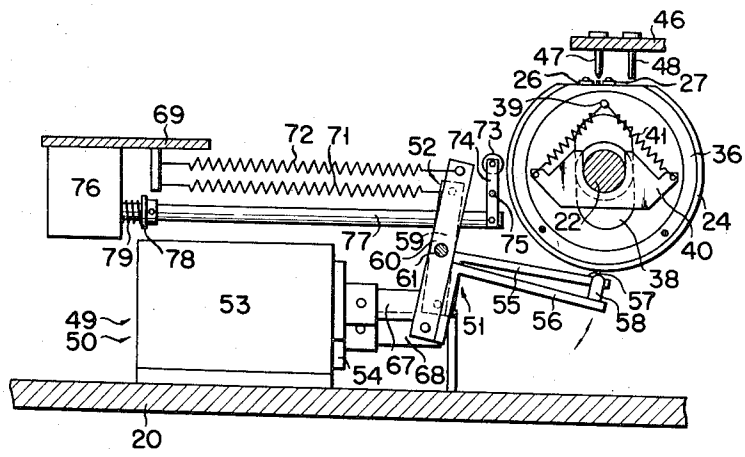


FIG. 1

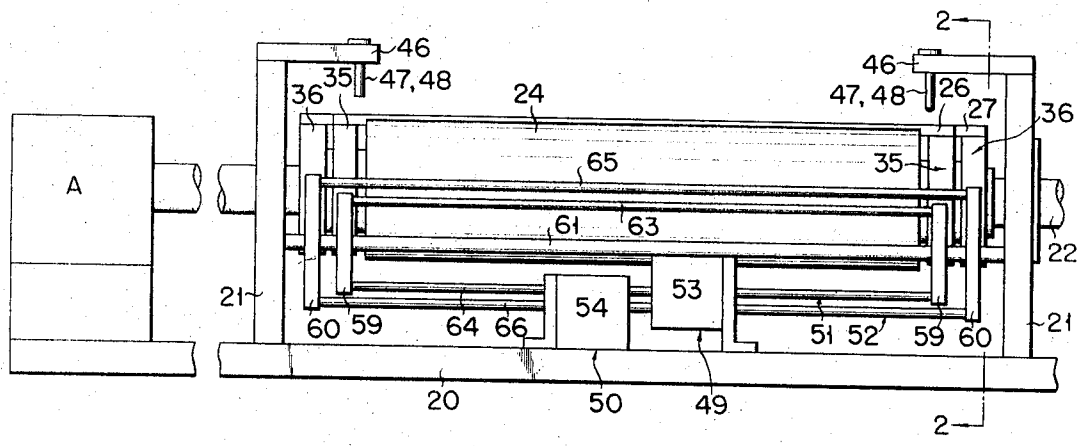

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FIG. 2

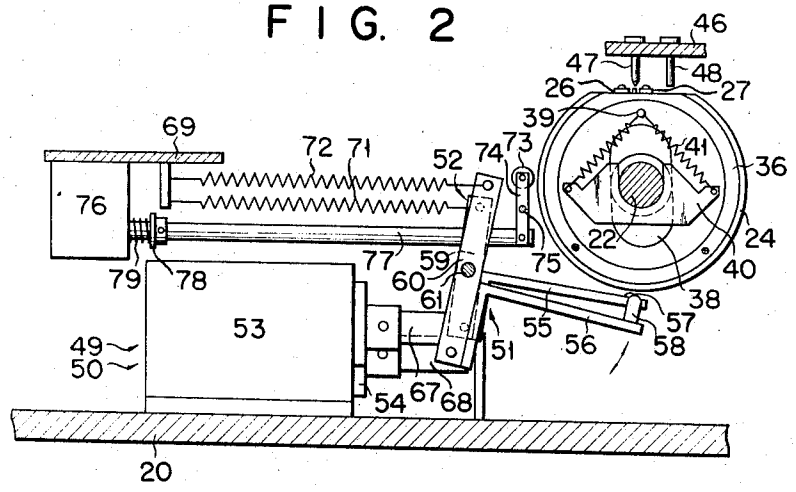

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FIG. 3

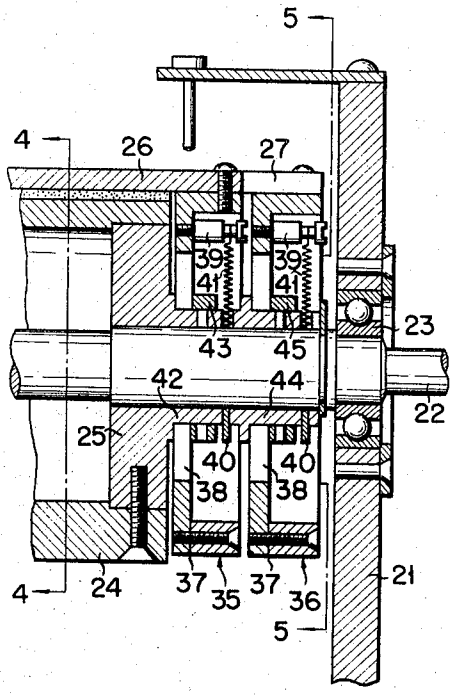


FIG. 4

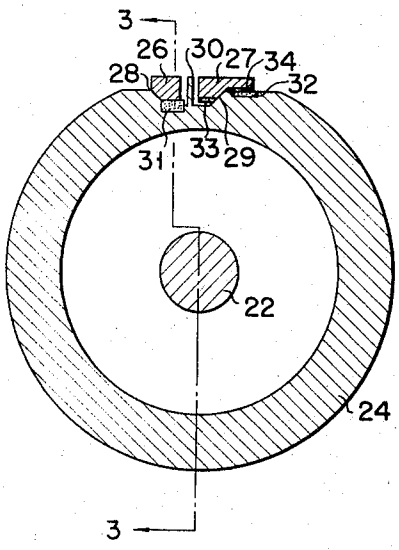


FIG. 5

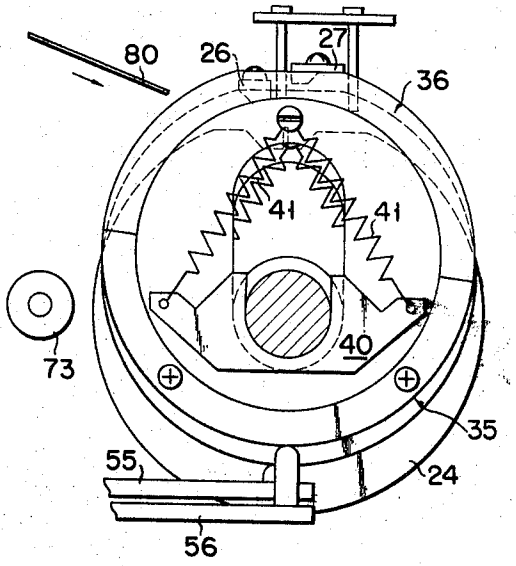


FIG. 6A

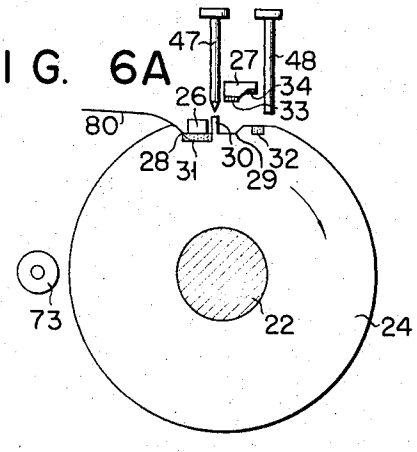


FIG. 6B

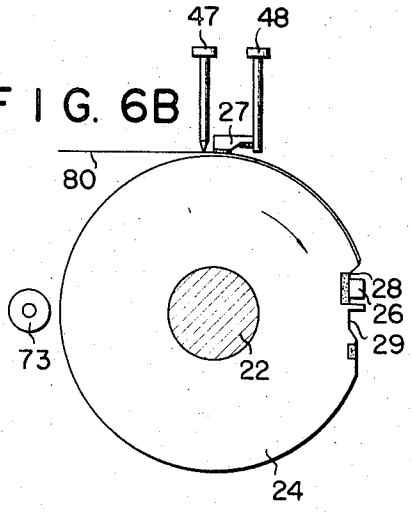


FIG. 6C

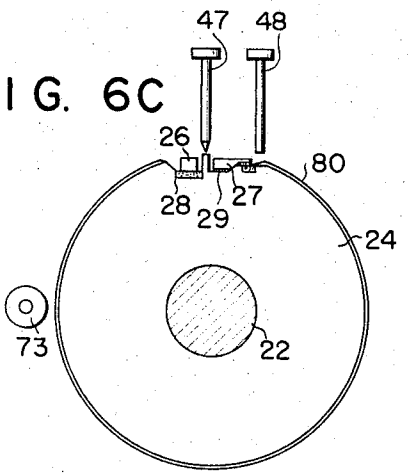


FIG. 6D

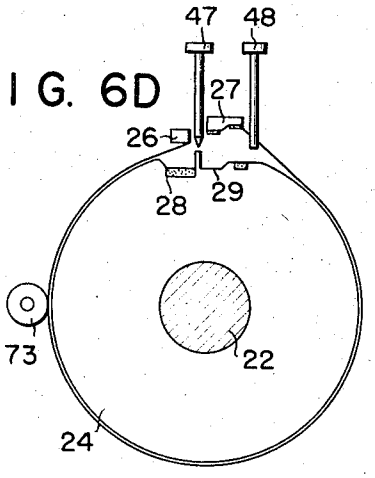


FIG. 6E

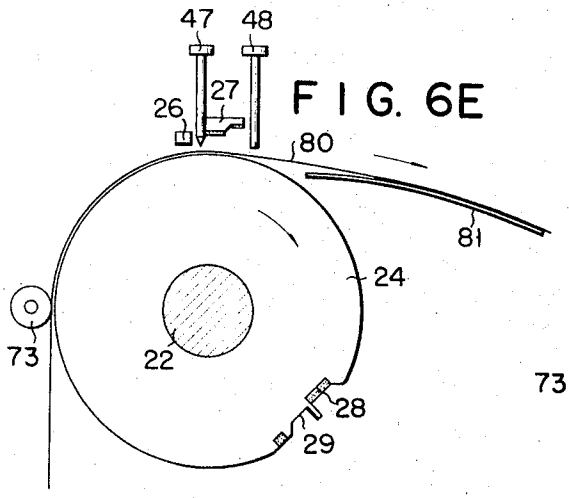
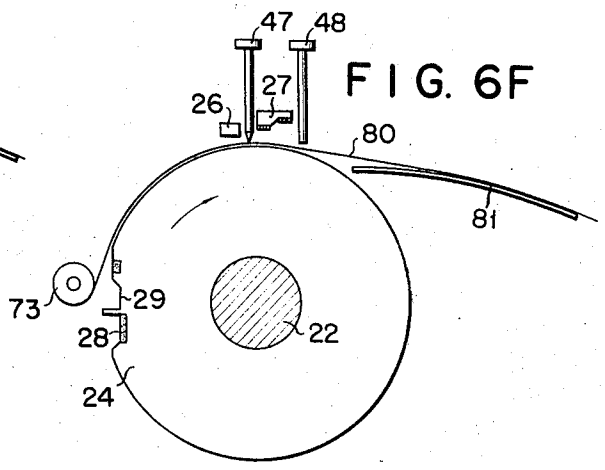


FIG. 6F



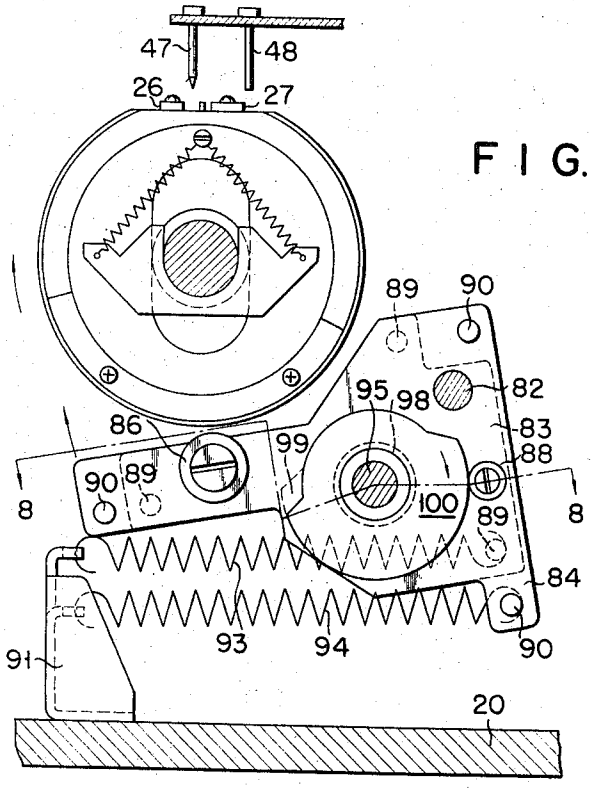

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FIG. 7

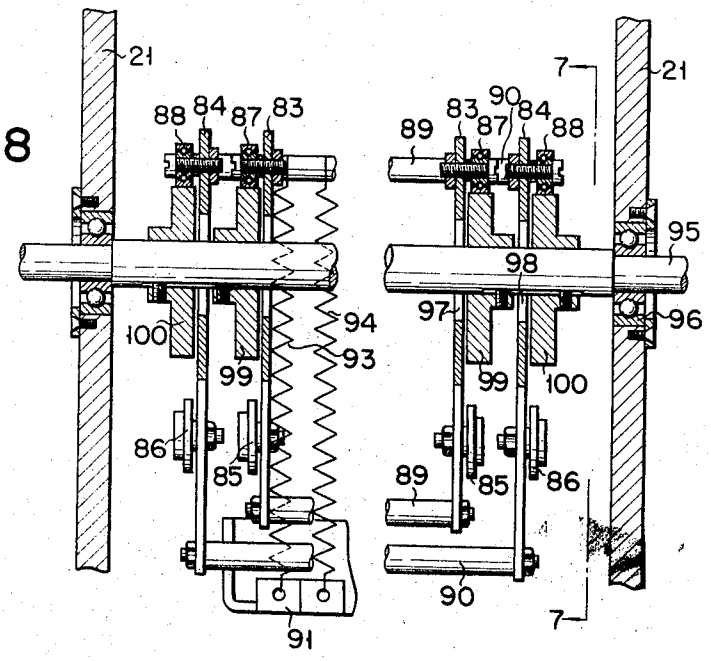

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FIG. 8

FIG. 9A

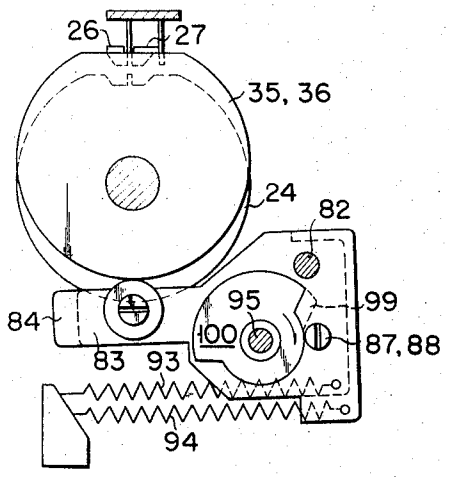


FIG. 9B

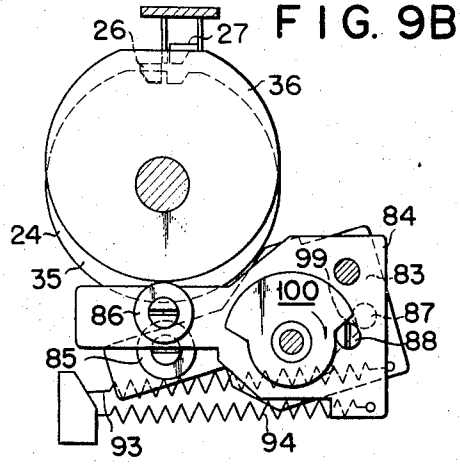


FIG. 10

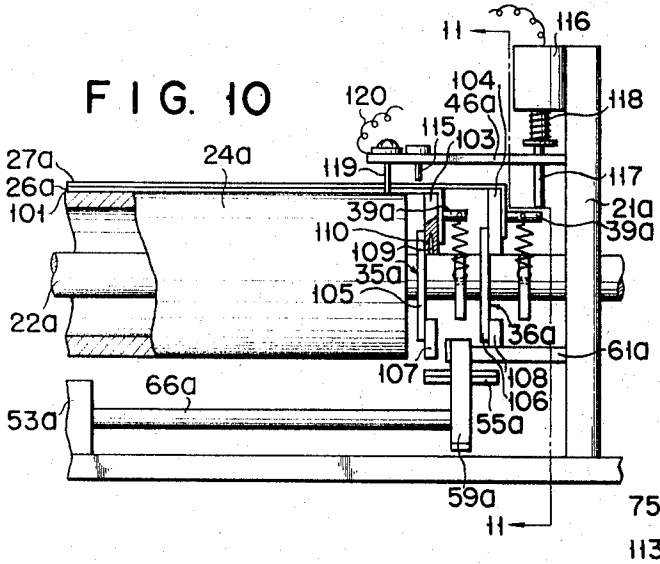


FIG. 11

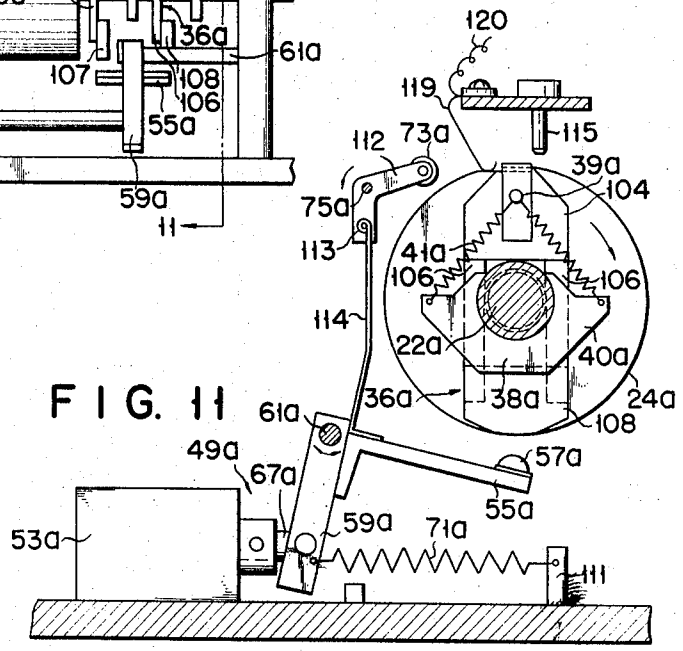


FIG. 12

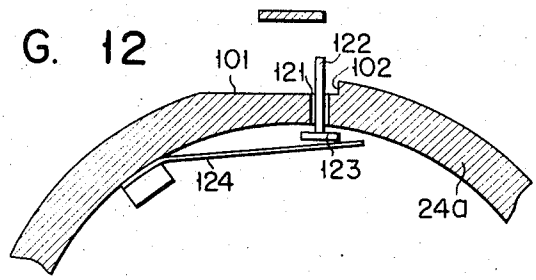


FIG. 13A

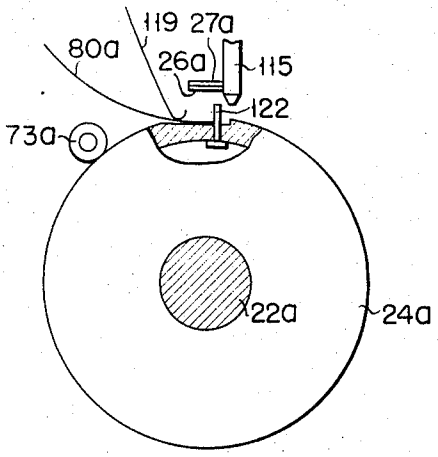


FIG. 13B

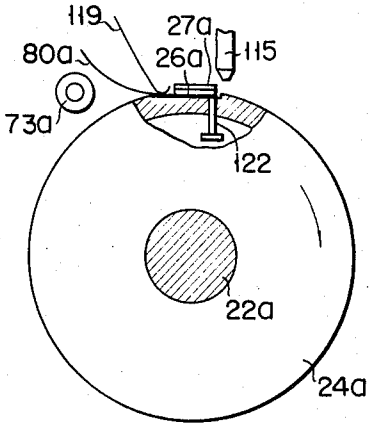


FIG. 13C

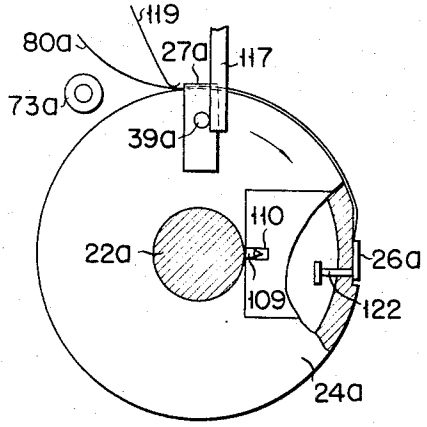


FIG. 13D

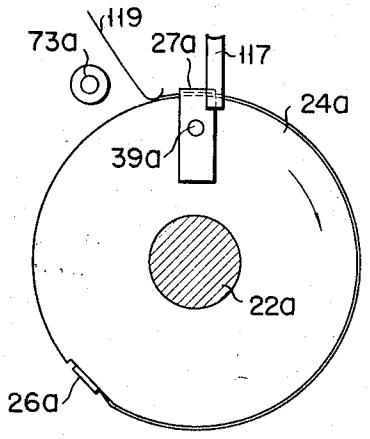


FIG. 13E

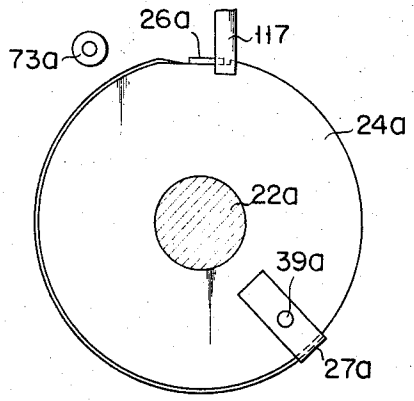


FIG. 13F

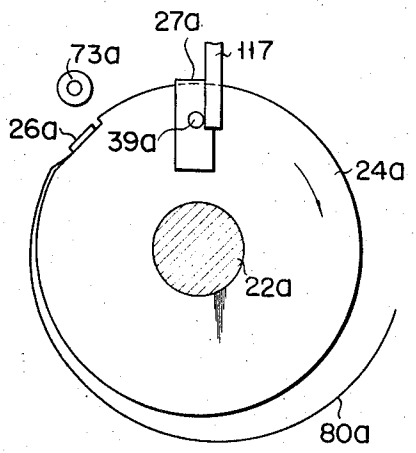


FIG. 13G

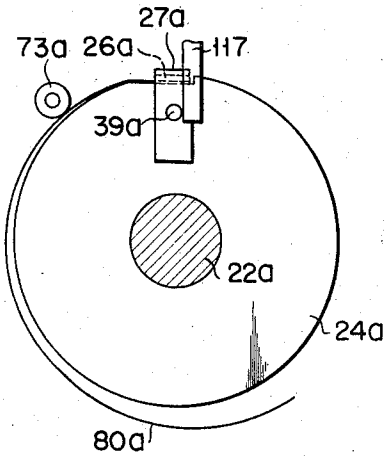


FIG. 13H

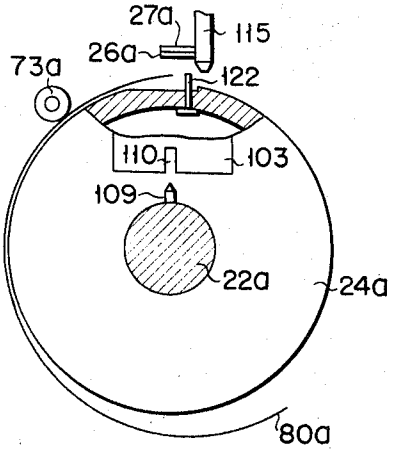
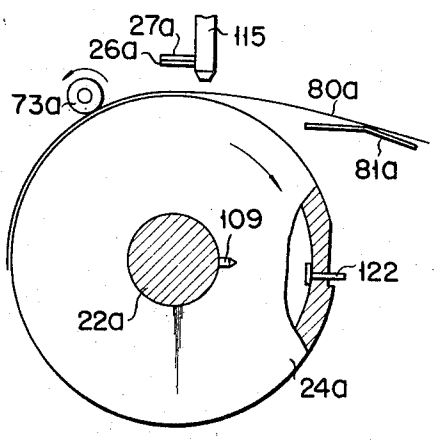


FIG. 13I



APPARATUS FOR AUTOMATIC TAKEUP AND RELEASE OF SHEETS

BACKGROUND OF THE INVENTION

This invention relates to any type of apparatus for automatically winding a sheet about the outer peripheral surface of a rotatable drum and, upon completion of required work, releasing said sheet therefrom and more particularly to a type adapted for facsimile system. As used herein, the term "sheet" is defined to mean any soft sheet-like material such as paper, cloth or a certain kind of plastics.

For facsimile transmission, it is necessary to wind an original sheet for transmission and a recording sheet for reception about a drum provided on each side of operation before commencement of said transmission and thereafter take the sheets off the drums. Hitherto, such operation has been carried out either manually, or by an extremely complicated device, presenting considerable disadvantage in respect of work efficiency and cost.

SUMMARY OF THE INVENTION

It is accordingly an object of this invention to provide an apparatus of simple construction for automatically winding a sheet about the outer peripheral surface of a rotatable drum and, upon completion of required operation, taking it off therefrom.

Another object of the invention is to provide such an apparatus further capable of holding the sheet tightly on the outer peripheral surface of the drum.

Still another object of the invention is to provide such an apparatus further capable of unfailingly holding a sheet on the outer peripheral surface of the drum, even if the sheet happens to be shorter than the peripheral length of the drum.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front elevation of an automatic sheet taking up and releasing apparatus according to an embodiment of the present invention;

FIG. **2** is a cross sectional view on line **2—2** of FIG. **1**;

FIG. **3** is an enlarged longitudinal sectional view of only the right side section of the apparatus of FIG. **1**;

FIGS. **4** and **5** are cross sectional views on lines **4—4** and **5—5** respectively of FIG. **3**; FIG. **5** denotes the case where the subject apparatus is out of operation;

FIGS. **6A** to **6F** illustrate the sequential steps of operation of the embodiment of FIG. **1**;

FIG. **7** is a side view, partly in section, of a modified mechanism for lifting a holding bar;

FIG. **8** is a sectional view on line **8—8** of FIG. **7**;

FIGS. **9A** and **9B** schematically show the relationship of the mechanism of FIG. **7** and the position of the holding bar;

FIG. **10** is a fractional front elevation of an automatic sheet taking up and releasing apparatus according to another embodiment of the invention;

FIG. **11** is a cross sectional view on line **11—11** of FIG. **10**;

FIG. **12** is a fractional sectional view of the drum of FIG. **10**; and

FIGS. **13A** to **13I** schematically illustrate the sequential steps of operation of the embodiment of FIG. **10**.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. **1** to **6** jointly indicate an automatic sheet taking up and releasing apparatus for facsimile system according to an embodiment of the present invention. Throughout the figures, the same parts are denoted by the same numerals. With respect to paired members, description is only given of one of them. Referential numeral **20** is a base frame having a wall **21** erected on both crosswise sides. On said side walls **21** is supported a main shaft **22** rotatable by means of bearings **23** (FIG. **3**), said shaft being driven by a drive means A connected to one end thereof. To the main shaft **22** is concentrically fixed a hollow takeup drum **24** by fitting members **25** (FIG. **3**) so as to be driven together with said main shaft **22.** Close to the outer peripheral surface of the drum **24** are disposed first and second bars **26** and **27** so as to hold a sheet on said drum surface. These bars **26** and **27** are arranged parallel with the axis of the drum **24** and slightly apart from each other in the peripheral direction of said drum **24.** The first and second bars **26** and **27** are longer than the length of the drum, the first bar **26** having a smaller length than the second bar **27** as seen from FIG. **1.** In this case, it is preferred that both bars **26** and **27** have such an initial degree of flexure that the bars may press a sheet against the drum surface with uniform pressure throughout the length of the bars.

In the outer peripheral surface of the drum **24** are cut out two grooves **28** and **29** (FIG. **4**) parallel with the axis of the drum **24** in the shapes corresponding to the bars **26** and **27** respectively. Between said grooves **28** and **29** is disposed an elongate projection extending parallel therewith so as to catch the forward end of a sheet brought to the drum **24.** In the bottoms of the grooves **28** and **29** are embedded friction strips **31** and **32** made of, for example, rubber, which are more or less elastic and have a sufficiently large friction coefficient to hold the sheet firmly. On the underside of the second bar **27** are provided a similar friction strip **33** so as to cause the sheet to be tightly attached to the outer peripheral surface of the drum and another very elastic friction strip **34** made of, for example, spongy material in order to hold the rear end of the sheet.

On each crosswise side of the drum **24** are disposed a pair of bar supports **35** and **36** for holding the end portions of the first and second bars **26** and **27** respectively (FIGS. **1, 2, 3** and **5**). Each bar support **35** or **36** is provided with a shallow blind cylindrical member **37,** to whose peripheral wall there is fitted one end of each bar **26** or **27** by means of a screw. The bottom of said cylindrical member **37** is bored at the center with an radially extending guide slot **38** to allow the free passage of the main shaft **22.** Further on the bottom of said cylindrical member **37** near one end of said guide slot **38** is fitted a screw pin **39.** On the opposite side of the main shaft **22** to said screw pin **39** is provided an engagement member **40** rotatably engageable with the main shaft **22.** Across the screw pin **39** and the engagement member **40** is stretched a supporting spring **41** for pulling the bar support **35** or **36** (and consequently bar **26** or **27**) toward the center of the drum **24** along the guide slot **38.**

The bar support **35** has its axial position fixed by a boss **42** of the fitting member **25** and a ring **43** fixed to said boss **42,** while the bar support **36** has its axial position fixed by a boss **44** mounted on the main shaft **22**

and a ring 45 engaged with said boss 44. The abovementioned arrangement enables the bar supports 35 and 36 to rotate independently of the main shaft 22 and be shifted in the radial direction of the drum 24 along the guide slots 38, but prevents said supports 35 and 36 from moving in the axial direction of the main shaft 22. The bars 26 and 27 are released from the outer periphery of the drum 24, when the bar supports 35 and 36 are lifted against the force of the springs 41 (FIG. 5).

From the top of each side wall 21 of the subject apparatus horizontally extends a projecting plate 46 so as to be positioned above the drum 24. Each projecting plate 46 is fitted with hanging stop pins 47 and 48, which engage the bars 26 and 27 respectively when the bars are lifted to the position of FIG. 5, thereby preventing the rotation of the bars 26 and 27 and bar supports 35 and 36.

The base frame 20 is provided with shift mechanisms 49 and 50 for lifting the bar supports 35 and 36 to release the bars 26 and 27 from the drum 24. Said shift mechanism 49 consists of a link 51 engageable with the lower ends of the bar supports 35 and a solenoid 53 for actuating said link 51, which includes a pair of L-shaped bars 55 on both crosswise sides thereof, each L-shaped bar having an engaging member 57 formed at the outer end. Similarly, the outer shift mechanism 50 includes a link 52 and a solenoid 54 for the bar supports 36, said link 52 being also provided with a pair of L-shaped bars 56 each of which has an engaging member 58 (FIGS. 1 and 2). The L-shaped bar 55 is indicated in a higher position than the other L-shaped bar 56 for convenience of illustration. Said paired L-shaped bars 55 and 56 are fixed to respective pairs of arms 59 and 60, which in turn are rotatably supported by a common shaft 61 fixed to the crosswise side walls 21 of the subject apparatus. The upper and lower ends of said paired arms 59 are connected by upper and lower rods 63 and 64. Similarly, the upper and lower end ends of said paired arms 60 are connected by upper and lower rods 65 and 66. From the solenoids 53 and 54 reciprocably extend plungers 67 and 68, the outer ends of which are connected to the lower rods 64 and 66 respectively. The section 69 (FIG. 2) of the base frame 20 is fitted with operating tension springs 71 and 72 whose ends are fixed to the upper rods 63 and 65 respectively (FIG. 1 omits said springs 71 and 72.).

When, under the aforesaid arrangement, current passes through the solenoids 53 and 54, the plungers 67 and 68 are retracted thereinto against the force of the springs 71 and 72. As the result, the paired arms 59 and 60 and consequently the L-shaped bars 55 and 56 rotate clockwise of FIG. 2 about the common shaft 61, causing the bar supports 35 and 36 to be brought down to the position of FIG. 2, and in consequence the bars 26 and 27 to be fitted into the grooves 28 and 29 or pressed against the outer peripheral surface of the drum 24. When current stops passing through the solenoids 53 and 54, the respective pairs of arms 59 and 60 are made to rotate counterclockwise of FIG. 2 by the force of the springs 71 and 72, so that the bar supports 35 and 36 are lifted to the position of FIG. 5 by the L-shaped bars 55 and 56. As the result, the bars 26 and 27 are released from the drum 24 and caught by the stop pins 47 and 48 to be prevented from rotation. At this time, the stop pins 47 and 48 also serve to guide the release movements of the bars 26 and 27. The solenoids 53 and 54 can be operated by a well known electric circuit (not shown).

Close to the outer peripheral surface of the drum 24 is disposed a roll 73 (FIG. 2) for releasing a sheet from the drum 24. (Said roll 73 and its driving mechanism are omitted in FIG. 1.). The roll 73 is rotatably pivoted to one end of an arm 74, which in turn is rotatably supported at the intermediate part by a shaft 75 fixed to the crosswise side walls 21 of the subject apparatus. The aforesaid section 69 of the base frame 20 is provided with a solenoid 76, from which a plunger 77 reciprocably extends outward. The plunger 77 has its forward end connected to the other end of the arm 74, and is provided with a flange 78 near the solenoid 76. Across the flange 78 and solenoid 76 is stretched a compression spring 79.. When the solenoid 76 is electrically magnetized, the plunger 77 is pulled thereinto, causing the arm 74 to rotate clockwise of FIG. 2 about the shaft 75. At this time, the roll 73 is pressed against the outer peripheral surface of the drum 24. When the solenoid 76 is demagnetized, the plunger 77 is moved in the opposite direction to the preceding case by the spring 79 to release the roll 73 from the drum 24. The solenoid 76 can be operated by a well known electric circuit (not shown).

There will now be described by reference to FIGS. 5 and 6 the operation of a sheet taking up and releasing apparatus according to an embodiment of this invention. When the apparatus is out of operation, the respective pairs of arms 59 and 60 are pulled by the springs 71 and 72 since the solenoids 53 and 54 of the shift mechanism are demagnetized. As the result, the respective pairs of L-shaped bars 55 and 56 lift the bar supports 35 and 36 to keep the holding bars 26 and 27 apart from the drum 24 (FIG. 5). At this time, the drum 24 is brought to rest in the prescribed position by stop means (not shown). The solenoid 76 is also demagnetized to set the roll 73 apart from the drum 24,

When a sheet 80 delivered from a feed mechanism (not shown) is inserted into the groove 28 with the forward end of said sheet 80 pressed against the elongate projection 30 disposed between the grooves 28 and 29, then the solenoid 53 is magnetized to release the paired L-shaped bars 55 from the bar supports 35, which in turn are pulled toward the center of the drum 24 by springs 41, causing the first holding bar 26 to be fitted into the groove 28. At this time, the forward end of the sheet 80 is held by said bar 26 and the friction strip 31 of the groove 28, and the first holding bar 26 is disengaged from the stop pin 47, ready to rotate with the drum 24 (FIG. 6A).

When the drum 24 slowly rotates in the direction of the indicated arrow, the sheet 80 is pulled by the first bar 26 to have its forward portion attached to the outer peripheral surface of the drum 24. When the drum 24 completes the prescribed amount of rotation, the solenoid 54 is magnetized, and the second holding bar 27 is brought downward by the springs 41 to press the sheet 80 against the outer peripheral surface of the drum 24 (FIG. 6B). The second bar 27 which is not fitted into the groove 29 at this time projects on to the drum surface and is prevented from rotating by the stop pin 48. When, therefore, the drum continues to rotate, the second bar 27 furnishes the sheet 80 with a tension acting in the opposite direction to that in which the drum rotates, by means of the friction strip 33, enabling the sheet 80 to be tightly pressed against the outer pe-

ripheral surface of the drum 24 without giving rise to any crease on the sheet 80 and any gap between the sheet 80 and the drum surface. When the drum 24 makes a substantially full rotation, the groove 29 is brought right under the second bar 27, causing the second bar 27 to be fitted into said groove 29 by the force of the springs 41 and the rear end of the sheet 80 to be held between the friction strips 32 and 34 (FIG. 6C). At this time, the second bar 27 is released from the stop pin 48, ready to rotate with the drum 24. Thereafter the drum rotates at a high speed for facsimile transmission or reception. During such operation, the bars 26 and 27 are tightly fitted into the grooves 28 and 29 by the force of the springs 41, preventing the sheet 80 from being displaced or coming off the drum 24.

Upon completion of facsimile transmission or reception, the drum 24 is again brought to rest in the position of FIG. 6C. At this time, the solenoid 76 (FIG. 2) is magnetized to press the roll 73 against the sheet 80 placed on the drum surface. Next, when the solenoids 53 and 54 are demagnetized, the bar supports 35 and 36 are lifted by the respective pairs of L-shaped bars 55 and 56, thereby causing the first and second bars 26 and 27 to be set apart from the drum 24 (FIG. 6D). Later when the drum 24 rotates slowly, the roll 73 is driven by the drum 24, so that the sheet 80 is delivered forward by the roll 73 and drum 24 while being guided by a guide member 81 (FIG. 6E). The stop pins 47 and 48 which are disposed outside of the ends of the drum 24 do not obstruct the delivery of the sheet 80. The first and second holding bars 26 and 27 additionally guide the sheet 80 by controlling its travel.

When the groove 29 of the drum 24 is brought immediately ahead of the roll 73, the solenoid 76 is demagnetized to separate the roll 73 from the drum 24 (FIG. 6F). At this time, the sheet 80 is held by another guide means (not shown) to be delivered to any other succeeding process than facsimile transmission. When the drum 24 is brought to rest in the position of FIG. 5, the entire facsimile operation is completed.

The shift mechanism for lifting bar supports 35 and 36 may consist of cam mechanism as seen from FIGS. 7 and 8 jointly illustrating a modification of said shift mechanism. This modified mechanism includes a support shaft 82 fixed to the crosswise side walls 21 of the subject apparatus and pairs of arms 83 and 84 respectively which are rotatably supported by said shaft 82. These paired arms 83 and 84 are positioned below the bar supports 35 and 36 and obstructed in making any movement in the axial direction of said shaft 82. Abutting members 85 and 86 engageable with the bar supports 35 and 36 are supported by the paired arms 83 and 84 near one end of said members 85 and 86. Cam followers 87 and 88 are rotatably supported also by said paired arms 83 and 84 near the opposite end thereof. A pair of arms 83 are connected by three rods 89 for a simultaneous movement and another pair of arms 84 are connected similarly by three rods 90 so as to be moved jointly. On the base frame 20 is formed a raised portion 91 to which there is connected one end each of operating tension springs 93 and 94. These springs 93 and 94 are connected at the opposite end to the rods 89 and 90 respectively which are disposed below, so as to normally urge the paired arms 83 and 84 for their clockwise rotation about the support shaft 82.

On both crosswise side walls 21 of the subject apparatus is rotatably provided another support shaft 95 by means of bearings 96. Said support shaft 95 is rotated by a drive means (not shown) which is controlled by a well known control mechanism. Said support shaft 95 can freely pass through holes 97 and 98 bored in the arms 83 and 84. These holes 97 and 98 have a sufficiently large size to prevent the peripheral wall of said holes from being brought into contact with the support shaft 95 even when the arms 83 and 84 swing for operation. On the support shaft 95 are fixed pairs of cams 99 and 100 engageable with the cam followers 87 and 88. Said cams 99 and 100 each have a larger diameter section and a smaller diameter section. When said larger diameter sections abut on the cam followers 87 and 88, then the arms 83 and 84 rotate counterclockwise about the shaft 82 to be released from the bar supports 35 and 36, causing the holding bars 26 and 27 to abut against the peripheral surface of the drum 24 (FIG. 7). When the cams 99 and 100 rotate in the direction of the indicated arrow to have the smaller diameter sections engaged with the cam followers 87 and 88, then the arms 83 and 84 rotate clockwise by the force of the springs 93 and 94 to lift the bar supports 35 and 36, causing the holding bars 26 and 27 to be removed from the drum 24 (FIG. 9A).

The cams 99 and 100 have substantially the same form, but, as seen from FIG. 7, the cam 99 is so shaped as to have its larger diameter section abut against the corresponding cam follower 87 earlier than the larger diameter section of the cam 100 engages the corresponding cam follower 88. When, therefore, the cams 99 and 100 rotate to the positions of FIG. 9B, only the first holding bar 26 engages the drum 24, with the second holding bar 27 still kept apart from the drum 24. Obviously, change of the position of the aforesaid cam mechanism to FIG. 7, FIG. 9A or FIG. 9B easily permits the operating steps of FIGS. 6A to 6E. The mechanism of FIG. 7 only requires a single support shaft 95 to be rotated according as a sheet is wound about the drum or released therefrom.

FIGS. 10 to 13 jointly illustrate another embodiment of this invention. Throughout these figures, the parts the same as those of the preceding embodiments are denoted by the same numerals suffixed by the letter *a*.

Since the embodiment of FIGS. 10 to 13 has the right and left sides arranged in the same manner, FIG. 10 only indicates the arrangement of the right side. In the embodiment of FIG. 10, the drum 24*a* may wholly consist of a permanent magnet. In such case, the drum 24*a* should preferably have its peripheral wall polarized in the radial direction. Where most of the drum 24*a* is formed of a nonconducting material, for example, ferrite, it is advised to prepare the peripheral portion of both ends of the drum 24*a* from a conducting material and connect said conducting peripheral portions to the earth terminal of the subject apparatus through the main shaft 22*a*. Further, if the drum 24*a* is designed to act as an electrode for facsimile reception, then the drum 24*a* will have its outer peripheral surface coated with a thin conducting layer.

In the embodiment jointly illustrated by FIGS. 10 to 13, the grooves 28 and 29 formed in the outer peripheral surface of the drum 24 of the first embodiment are collectively replaced by a single flat notch 101 extending parallel with the axis of the drum 24*a*. The notch

101 has the later described stepped portion formed on one lengthwise side with the prescribed thickness. Further, first and second holding bars 26*a* and 27*a* (FIG. 10) are provided in proximity to the outer peripheral surface of the drum 24*a*. Said first and second holding bars 26*a* and 27*a* are parallel with the axis of the drum 24*a* and are normally superposed on each other in the radial direction of the drum 24*a*. As in the preceding embodiments, said first and second holding bars 26*a* and 27*a* act to hold the forward and rear ends of a sheet respectively on the outer peripheral surface of the drum 24*a*. In the case of FIG. 10, the outer peripheral surface of the drum 24*a* is normally polarized and the first and second holding bars 26*a* and 27*a* are formed of a magnetically sensitive material, or this arrangement may be reversed. Obviously, it is possible magnetically to polarize both drum 24*a* and holding bars 26*a* and 27*a*. Said holding bars 26*a* and 27*a* are supported by bar supports 35*a* and 36*a* respectively on both crosswise sides of the drum 24*a*, though FIG. 10 only indicates only the pair of said bar supports. Said bar supports 35*a* and 36*a* respectively consist of upper plates 103 and 104 to which one end each of the holding bars 26*a* and 27*a* is fixed and lower plates 107 and 108 connected to said upper plates 103 and 104 by pairs of side plates 105 and 106. Each of said upper plates 103 and 104, each of said lower plates 107 and 108 and each of the pairs of said side plates 105 and 106 collectively define a rectangular free space 38*a* corresponding to the guide slot 38 of the preceding embodiments, and further are fitted into an annular groove formed in the peripheral surface of the main shaft 22*a* to have their axial positions fixed. Across the screw pins 39*a* inserted into the upper plates 103 and 104 and engagement members 40*a* rotatably engageable with other annular grooves formed in the main shaft 22*a* are respectively stretched supporting tension springs 41*a* so as to pull the first and second holding bars 26*a* and 27*a* toward the center of the drum 24*a*. The bar supports 35*a* and 36*a* of the embodiment of FIGS. 10 to 13 have substantially the same function as those of the preceding embodiments.

The main shaft 22*a* is fitted with engagement pins 109 projecting in the radial direction. Each pin 109 is so designed as to be fitted into a corresponding hole 110 bored in the upper plate 103 of each bar support 35*a*, when the first holding plate 26*a* is pressed against the outer peripheral surface of the drum 24*a*. At this time said bar support 35a is prevented from rotating independently of the drum 24*a*. In contrast, the supports 36*a* of the second holding bar 27*a* lack such device and are rendered rotatable independently of the drum 24*a*.

A single shift mechanism 49*a* for lifting the bar supports 35*a* and 36*a* has a pair of lifting bars 55*a* formed into an L-shape in cross section and provided with abutting sections 57*a*. Said lifting bar 55*a* is fixed to each of a pair of arms 59*a* disposed on both crosswise sides of the drum 24*a*. Said arms 59*a* have their lower ends connected to a plunger 67*a* of a solenoid 53*a* through a single rod 66*a* (FIG. 10). Across each of a pair of pins 111 projecting upward from the base frame 20*a* and the lower ends of the arms 59*a* are stretched operating tension springs 71*a* respectively. According to the embodiment of FIGS. 10 to 13, when the solenoid 53*a* is magnetized, the L-shaped bars 55*a* are released from both bar supports 35*a* and 36*a*, and when the solenoid 53*a* is demagnetized, the L-shaped bars 55*a* lift said bar supports 35*a* and 36 *a* by the force of the springs 71*a*. According to the embodiment of FIGS. 10 to 13, a single bar 55*a* lifts the bar supports 35*a* and 36*a* disposed on one crosswise side of the drum 24*a* at the same time.

A roll 73*a* made of, for example, rubber is rotatably pivoted to one end of an L-shaped member 112, which in turn is rotatably suupported by a support shaft 75*a* fixed to the crosswise side walls 21*a* of the subject apparatus. Said L-shaped member 112 is provided at the opposite end with a pin 113, which is connected to a plate spring 114 fixed to the bar 55*a*. When, therefore, the L-shaped bar 55*a* rotates so as to remove the holding bars 26*a* and 27*a* from the drum 24*a*, then the roll 73*a* is pressed against the outer peripheral surface of the drum by means of the plate spring 114 and L-shaped member 112. When the L-shaped bar 55*a* rotates in the opposite direction, the roll 73*a* is detached from the drum 24*a* The mechanism of said roll 73*a* is indicated in FIG. 11.

Stop pins 115 each fitted to plates 46*a* horizontally projecting inward from the crosswise side walls 21*a* engage both of the holding bars 26*a* and 27*a* when the bars move away from the drum 24*a*, thereby preventing them from rotating with the drum 24*a*. From a solenoid 116 fixed at the upper part of each crosswise side wall 21*a* hangs down an operable stop pin 117 to penetrate a hole bored in the horizontal projecting plate 46*a*. When the solenoid 116 is magnetized, said pin 117 contacts neither of the holding bars 26*a* and 27*a*, but when the solenoid 116 is demagnetized, said pin 117 is pushed down by a compression spring 118 to abut against only the screw pin 39*a* of the second bar support 36*a*.

The horizontal plate 46*a* is further provided with a whisker electrode 119 whose free end is made to touch the outer peripheral surface of the drum 24*a*. When the whisker electrode 119 has its free end brought into direct contact with the drum surface, namely, when the rear end of a sheet leaves the whisker electrode 119, then the solenoid 116 is magnetized by said whisker electrode 119 through a lead 120 and a well known circuit (not shown) to lift the operable stop pin 117 as later described. The position of the rear end of the sheet may be detected by a known optical means.

Referring to FIG. 12, the notch 101 cut out in the outer peripheral surface of the drum 24*a* is bored with a vertical hole 121 extending toward the interior of the drum 24*a*. A pin 122 inserted into said hole 121 has its inner end formed into a large diameter section 123. Against the underside of said large diameter section 123 abuts the free end of a spring 124 fixed to the inner peripheral surface of the drum 24*a*, causing the outer end of said pin 122 normally to project from the outer peripheral surface of the drum 24*a*. When, however, the holding bars 26*a* and 27*a* are pressed to the outer peripheral surface of the drum 24*a*, the pin 122 is pulled into the drum 24*a*.

There will now be described the operation of the embodiment of FIGS. 10 to 13. When the subject apparatus is out of operation, the solenoid 53*a* (FIG. 10) remains demagnetized to keep the holding bars 26*a* and 27*a* apart from the drum 24*a* by the force of the operating springs 71*a*, said force being so designed as to be larger than a sum of the force of the supporting springs

41*a* and a magnetic force prevailing across the drum 24*a* and the holding bars 26*a* and 27*a*.

When a sheet 80*a* is brought to the surface of the drum 24*a* through a guide (not shown), said sheet 80*a* has its forward end stopped by the pin 122 (FIG. 13A). The whisker electrode 119 only applies a sufficiently low elastic pressure on the sheet 80*a* to permit its free travel.

When the solenoid 53*a* is magnetized, the bar supports 35*a* are pulled away by the force of the spring 41*a*, causing the bars 26*a* and 27*a* to be removed from the first stop pins 115 and abut against the outer peripheral surface of the drum 24*a*. Further, the bars 26*a* and 27*a* push down the pin 122, causing the forward end of the sheet 80*a* to be held between said bars 26*a* and 27*a* and the notch 101 (FIG. 13B). At this time, the bars 26*a* and 27*a* are tightly pressed against the outer peripheral surface of the drum 24*a* all along the length without any gap left by a magnetic force occurring across said bars 26*a* and 27*a* and the drum 24*a*. Each of the bar supports 35*a* for the first holding bar 26*a* engages the main shaft 22*a* by means of the pin 109 and hole 110. On the other hand, the pin 39*a* of each of the bar supports 36*a* is held by the operable stop pin 117 due to the demagnetization of the solenoid 116.

When the drum 24*a* slowly rotates in the direction of the arrow indicated in FIG. 13C, then the first holding bar 26*a* rotates with the drum 24*a* by the force of the springs 41*a*, while pressing the forward end of the sheet 80*a* to the outer peripheral surface of the drum 24*a*. On the other hand, the second holding bar 27*a* is prevented from rotation by the second stop pins 117, thereby applying a tension to the sheet 80*a* acting in the opposite direction to that in which the drum 24*a* rotates. Since the bar 27*a* is tightly pressed against the outer peripheral surface of the drum 24*a* all along its length due to a magnetic force prevailing between said bar 27*a* and the drum 24*a*, the sheet 80*a* is firmly attached to the drum surface without any gap or crease.

Even if the sheet 80*a* happens to be shorter than the peripheral length of the drum 24*a*, the sheet 80*a* can be tightly held on the drum surface. Following is the reason. When the whisker electrode 119 is brought into direct contact with the drum 24*a* the moment sheet 80*a* leaves said electrode 119, the solenoids 116 are magnetized to pull the stop pins 117. At this moment, the second holding bar 27*a* is released from the pins 117 and begins to rotate with the drum 24*a* while holding the rear end of the sheet 80*a* by the force of the spring 41*a* as well as by the magnetic force occurring between said bar 27*a* and the drum 24*a* (FIG. 13D). Thereafter the drum 24*a* is once brought to rest in the position of FIG. 13E, ready for the succeeding facsimile transmission or reception.

Upon completion of said facsimile operation, the drum 24*a* commences a slow rotation from the position of FIG. 13E. At this time, the pin 117 is again pulled downward by the demagnetization of the solenoid 116 to engage the pin 39*a*. As the result, the second holding bar 27*a* is brought to rest in the position of FIG. 13F, causing the sheet 80*a* to have its rear end released from the second bar 27*a* and rotate with the drum 24*a*. And then the first bar 26*a* is brought right under the second bar 27*a*, because the stepped section 102 of the notch 101 has a larger thickness than the first bar 26*a* (Fig. 13G). At this moment, the solenoid 53*a* is demagnetized, causing the roll 73*a* to press the sheet 80*a* against the outer peripheral surface of the drum 24*a* by means of the L-shaped bar 55*a* and the first and second holding bars 26*a* and 27*a* to move away from the drum by the supports 35*a* and 36*a* (FIG. 13H). At this time, the pins 109 are disengaged from the bar supports 36*a* and the holding bars 26*a* and 27*a* are prevented from rotation by the pins 115.

Later when the drum 24*a* continues to rotate, the sheet 80*a* is delivered from the drum 24*a* by the frictional rotation of the roll 73*a* with the drum 24*a* and conducted by the guide 81*a* to the succeeding process (FIG. 1). The drum 24*a* is again brought to rest in the position of FIG. 13A to complete the entire facsimile operation.

As previously described, the embodiment of FIGS. 10 to 13 enables the sheet 80*a* to be firmly pressed to the outer peripheral surface of the drum 24*a*, even through the sheet 80*a* may be shorter than the peripheral length of the drum 24*a*. Further, in this embodiment, the drum surface is not provided with any groove as in the first embodiment, preventing the end portion of the sheet 80*a* from being folded by being perchance drawn into said groove. Moreover, the holding bars 26*a* and 27*a* are attracted to the drum surface by the cooperation of the springs 41*a* and the magnetic force occurring across said bars 26*a* and 27*a* and the drum 24*a*, thereby enabling the sheet 80*a* to be firmly held to the outer peripheral surface of the drum 24*a* without any gap.

What we claim is:

1. An apparatus for automatic takeup and release of sheets which comprises:

a base frame;

a main shaft rotatably supported on said base frame;

means for driving said main shaft;

a sheet takeup drum coaxially fixed to said main shaft and rotatable about the axis of said shaft;

first sheet holding means disposed close to the outer peripheral surface of the drum to hold the forward end of the sheet on the drum surface when said sheet is taken up thereon, and to release said forward end when the sheet is taken off the drum;

second sheet holding means provided in proximity to the outer peripheral surface of the drum to press the sheet tightly to the drum sheet and then hold the rear end of the sheet on the drum surface when the sheet is taken up thereon and to release said rear end when the sheet is removed from the drum;

said first and second sheet holding means being first and second bars extending parallel with the axis of said drum;

pairs of first and second bar supports for supporting said first and second sheet holding bars at both ends of said drum, respectively, said supports being movable in the radial direction relative to said shaft and also rotatable independently of said drum about said shaft;

means for urging said first and second bar supports toward one side of said drum in said radial direction for pressing said first and second sheet holding bars against the outer peripheral surface of said drum;

a shift mechanism for moving said first and second bar supports toward the opposite side of said drum

in said radial direction for releasing said first and second sheet holding bars from said drum; and

means for delivering the sheet from the drum.

2. The apparatus according to claim **1** wherein there are provided stop means for preventing the rotation of the second sheet holding bar when said bar is pressed against the outer peripheral surface of the drum.

3. The apparatus according to claim **2** wherein a groove is formed in the outer peripheral surface of the drum to extend along its axis in a shape corresponding to that of the second sheet holding bar, said second bar being released from the stop means when inserted into said groove.

4. The apparatus according to claim **2** wherein there are further provided means for generating a signal upon detection of the position of the rear end of the sheet and means for releasing the stop means from the second sheet holding bar upon receipt of said detection signal.

5. The apparatus according to claim **1** wherein the shift mechanism includes a link system.

6. The apparatus according to claim **1** wherein the shift mechanism includes a cam mechanism.

7. The apparatus according to claim **1** wherein at least one of, said first and second sheet holding bars, and said drum, is magnetically polarized.

8. The apparatus according to claim **1** wherein the means for delivering the sheet includes a roll frictionally pressed to the drum surface when the sheet is taken off the drum.

9. An apparatus for automatic take up and release of sheets which comprises:

a sheet take up drum coaxially fixed to a rotatable shaft and in which a first longitudinal bar holds the forward end of said sheet upon the drum surface and a second longitudinal bar presses said sheet tightly to said drum and retains the rearward end of said sheet upon said drum surface when said sheet is taken up thereon, said first and second bars releasing said both ends of said sheet when said sheet is to be removed from said drum;

pairs of first and second support members for supporting the ends of said first and second bars at said both ends of said drum respectively;

said support members each having a radially extending guide slot through which said shaft passes and which permits the associated support member to rotate and move radially relative to said shaft;

supporting spring means for imparting tension to said first and second support members along said guide slots for pressing said first and second bars to said drum surface;

means for shifting said first and second support members along said guide slots against the supporting spring means for releasing said first and second bars from said drum surface; and

stopping means disposed near said drum surface for holding said first and second bars in position and thereby preventing the rotation of said bars when said support members are shifted by said shifting means.

10. An apparatus according to claim **9** wherein; said drum surface is provided with first and second longitudinal grooves for accommodating said first and second bars respectively; and

said stopping means has first and second stop pins for engaging said first and second bars respectively, whereupon said second bar may be released from said second stop pin when said second bar is inserted into said second groove.

11. An apparatus according to claim **9,** wherein said stopping means has an operable stop pin for holding said second bar until said rearward end of said sheet is disposed below said second bar.

12. An apparatus according to claim **11,** wherein there is further provided:

means for generating a signal upon detection of the position of the rearward end of said sheet; and

means for releasing said operable stop pin from said second bar upon receipt of said detection signal.

13. An apparatus according to claim **9,** wherein there is further provided a roll for delivering said sheet from the drum, said roll being connected to said shifting means and adapted to be frictionally pressed to said drum surface when said shifting means shifts said support members.

14. An apparatus according to claim **9,** wherein said shifting means includes:

operating spring means for urging said first and second support members against said supporting spring means when said support members are shifted; and

actuating means for releasing said shifting means from said first and second support members against said operating spring means.

15. An apparatus according to claim **9,** wherein at least one of, said drum, and said bars, is magnetically polarized.

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