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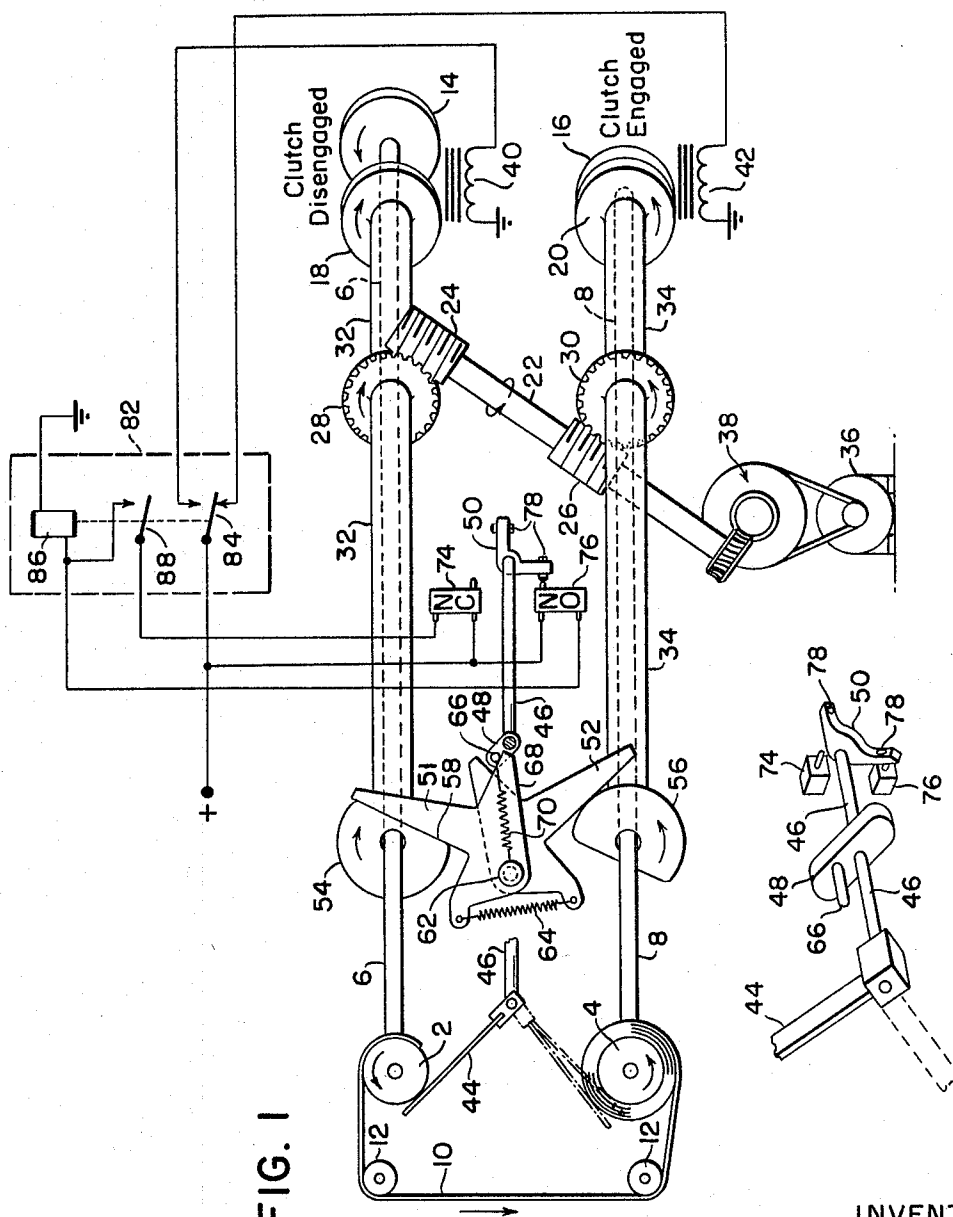


FIG. 1

FIG. 2

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AUTOMATIC REWINDING APPARATUS

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This invention relates to automatic rewinding apparatus, more particularly of a type which reels a web between one roll and another, reversing the direction of winding as the supply becomes depleted from either roll. Mechanism of this kind is particularly useful in handling inked printing ribbons in printing machines, typewriters, and the like, although it finds many applications in reeling other types of web and sheet materials.

It is the primary object of the present invention to provide an improved automatic rewinding apparatus, which senses the alternate depletion of a web from either of two rolls and quickly reverses the winding direction, by means of an improved mechanism of simplified and reliable construction. It is a feature of the invention that a single control mechanism is utilized to sense the depletion of web from either roll. Further objects and advantages of the invention will become apparent as the following description proceeds.

The invention may be carried out in a winding apparatus which includes two rolls arranged on parallel axes for winding an elongated web, such as a printing ribbon, from one to the other and back again. A portion of the ribbon extending between the rolls is arranged for engagement of one surface with paper which is to be printed, and of the opposite surface by a type-carrying member which produces an inked impression on the paper. Such a reeling arrangement is conventionally used in typewriters and other printing machines, and the rolls may be driven continuously or intermittently.

Each roll is drivingly connected with the output element of one of a pair of clutches, so that either roll can be driven by engaging its connected clutch. Each clutch has an input drive element which is constantly driven by motive means such as an electric motor, the two input elements being driven in opposite rotary directions; upon engagement of either clutch, the connected roll is driven in a direction to wind the ribbon thereon and withdraw the ribbon from the other roll. Reversible pressure-actuated control means are provided for alternatively engaging either clutch, so that the direction of winding can be reversed. In a preferred form, electromagnetic clutches are alternatively energized by momentary contact of an actuating element with pressure-actuated switch means.

An improved control mechanism is provided for sensing the depletion of the ribbon from either roll and actuating the control means in response. This mechanism includes a single paddle mounted on a rock shaft for oscillatory movement into momentary peripheral engagement with first one and then the other ribbon roll. The rock shaft also bears the actuating element, for oscillation with the paddle through an arc determined by the interferences of the paddle with the two ribbon rolls. Completion of the unwinding of either roll results in movements of the paddle and the actuating element to one terminal position, in which the element operates the switch means and thus reverses the direction of ribbon feed.

The oscillating motion of the paddle is produced by a pair of cams, driven by the input elements of the clutches in opposite angular directions; these cams alternately release each of a pair of pivotally-mounted levers for movement by biasing means to oscillate a crank

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connected to the rock shaft. This oscillation is not positive, being induced only by a spring bias, and so is limited by the interference of the paddle with the ribbon rolls, until the terminal position with respect to either roll is attained. Alternating detection of the diameters of the two ribbon rolls is thus obtained by means of a single sensing means, which automatically reverses the ribbon feed direction as either roll becomes depleted.

While the specification concludes with claims particularly pointing out the subject matter which I regard as my invention, it is believed that a clearer understanding may be gained from the following detailed description of a preferred embodiment thereof, referring to the accompanying drawing, in which FIGURE 1 is a schematic diagram of the rewinding apparatus and FIGURE 2 is a perspective diagram of a portion of the apparatus shown in FIGURE 1.

Referring to FIGURE 1, the illustrated rewinding apparatus includes a pair of ribbon rolls 2 and 4, which are mounted on drive shafts 6 and 8, respectively, for reeling a ribbon 10 from one roll to the other. The ribbon is guided by rolls 12 for impression of an image by conventional type mechanism (not shown) in any conventional printing process which utilizes such an inked ribbon. In the condition shown in the drawing, the ribbon is fully wound on a roll 4 and depleted from the roll 2, and it is the function of the apparatus to reverse the direction of ribbon feed from that indicated by the arrows, and to rewind the roll 2, repeating the process cyclically so as to continually present a fresh ribbon area for printing. It should be understood that the device is particularly useful for printing ribbons of the type in which the ink redistributes itself after each impression, so that it may be re-reeled a number of times and continue to yield a satisfactory impression.

The rolls 2 and 4 are connected by the drive shafts to output elements 14 and 16, respectively, of a pair of electromagnetic clutches. The input elements 18 and 20 of the clutches are driven continuously in opposite angular directions by means of a drive shaft 22, having worms 24 and 26 meshed with worm gears 28 and 30, respectively. The worm gears are drivingly engaged with the input elements by means of hollow shafts 32 and 34, which are co-axial with the drive shafts and freely rotatable thereon. Means for driving the clutches include a motor 36 and reduction gearing 38. Alternative engagement of either clutch is secured by energizing one of the clutch coils 40 and 42 to drive the corresponding roll 2 or 4. In the condition shown in the drawing, the ribbon is fully wound on the roll 4, whose clutch element 16 is currently driving; the apparatus is prepared to reverse the direction of ribbon feed.

According to the invention, alternate detection of the diameters of both ribbon rolls is performed by a single paddle 44, which is caused to oscillate between limiting positions determined by its interferences with the peripheries of the respective rolls and any ribbon reeled on them. A maximum or terminal arcuate displacement of the paddle, which indicates depletion of the ribbon from either roll, is translated into a reversal of the feed direction. The paddle is shown in such a terminal position, bearing against the surface of the roll 2. The complete range of variation of the interfering positions during a reeling cycle is shown in dotted lines with respect to the roll 4 and to the ribbon now reeled upon it.

Referring to FIGURES 1 and 2, the paddle 44 is carried by a rock shaft 46, which also bears a crank arm 48 and a clutch-actuating element 50. An oscillating movement is induced in the rock shaft by means of a pair of levers 51 and 52, and cams 54 and 56 se-

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cured to the hollow shafts 32 and 34, respectively. Each cam has a flat 58, one being angularly out of phase with the other, so that the levers are alternately released from an inactive position in which the lever 52 is shown, and allowed to move toward a terminal position in which the lever 51 is shown. The levers are mounted pivotally upon a common axle 62, which is preferably parallel to but offset from the rock shaft 46; and are biased in opposite angular directions, toward their terminal positions, by means of a tension spring 64 interconnecting them.

Each lever is provided with an arm 68 for drivingly engaging a crank pin 66, as the lever is released by coincidence with the flat 58. A tension spring 70 is connected between the axle 62 and the crank pin 66, to bias the crank toward a neutral position and thus cause it to follow the arm 68 of either lever which is currently active.

In operation, as either lever is released by coincidence with the flat 58 of its cam, it is biased by the spring 64 to rock the shaft in a corresponding direction. However, this angular motion is limited by the interference of the paddle with the corresponding ribbon roll, and the lever does not actually contact the flat of its cam until the ribbon is fully depleted from the corresponding roll, as is the case with roll 2 in the illustrated terminal position of the paddle. At this juncture, the displacement of the actuating element 50 is just sufficient to actuate a corresponding one of two appropriately-placed microswitches 74 or 76, through adjustable studs 78 borne by the actuating element. These switches control suitable circuitry for reversing the ribbon feed direction by disengaging the element 16 of one clutch and engaging the element 14 of the other, thereby to re-reel the ribbon from the roll 4 to the roll 2.

It will be understood that upon the subsequent oscillation of the paddle toward the roll 4, the angular displacement of the paddle and of the actuating element will be limited by interference with the reeled ribbon, so that the switch 74 will not be actuated until such time as the roll 4 becomes depleted; at that stage, the switch 74 will be actuated to reverse the drive once again.

While various forms of circuitry may be employed for reversing the clutch engagements under the control of the switches 74 and 76, a relay device 82 is shown by way of illustration. The relay includes a double throw contact 84, which energizes the clutch coil 42 while the relay coil 86 remains deenergized, and energizes the clutch coil 40 upon actuation of the relay. In the state shown in the drawing, the switch 76, which is of a normally open variety, is being actuated by the element 50. The relay will then become energized to raise the contact 84, thus reversing the energization of the clutch coils. A holding contact 88 is provided to maintain the energization of the relay coil after the release of the switch 76, and the holding circuit is completed through the normally-closed switch 74. At such time as the ribbon becomes depleted from the roll 4 and the actuating element 50 consequently strikes the switch 74, the holding circuit will be broken and the relay will release to reverse the clutch energization once again. The circuit will thus be returned to the state shown in the drawing, with the ribbon feeding in the indicated direction.

The improved rewinding apparatus is applicable to a wide variety of printing machines, typewriters, and the like, as well as to other applications in which it is desired to reel and re-reel an elongated web automatically from one roll to another. It will be apparent to those skilled in the art that various changes and modifications may be made in the embodiment which has been described without departing from the true spirit and scope of the invention. For example, the control circuit might comprise merely a single-pole double-throw toggle switch adapted to reverse the clutch energization upon each subsequent actuation; and various other alternatives may

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be employed. Furthermore, the clutch control means may be operated upon engagement of the paddle with a fully-wound ribbon roll having a certain minimum diameter, as well as by engagement with a depleted roll. I therefore intend to define the invention in the appended claims without limitation to the details of the illustrated embodiment.

What I claim is:

1. Automatic rewinding apparatus for an elongated web, comprising a pair of rolls rotatably supported on parallel axes for attachment to the opposite ends of an elongated web to reversibly wind the web thereon; a pair of disengageable clutches each including an input drive element and an output drive element; each of said rolls being connected with the output drive element of a different one of said clutches; reversible pressure-actuated control means operatively connected with said clutches for alternatively engaging either one thereof; motive means connected to drive the input elements of said clutches in opposite rotational senses; a pair of cams drivingly connected with said input elements; an oscillatory rock shaft provided with a sensing paddle, a crank arm, and an actuating element for said pressure-actuated means; a pair of pivotally-mounted levers, and means biasing said levers in opposite angular directions each toward engagement with one of said cams; said cams being formed to release said levers alternately for actuation by said biasing means into driving engagement with said crank arm, to oscillate said paddle alternately into biased engagement with the web rolled on each of said rolls, whereby the angular displacements of said actuating element are limited by the alternate engagements of said paddle with the web rolls; said actuating element being arranged for angular displacement to a terminal position, to actuate said control means and thus reverse the direction of winding of said web on said rolls, as the web is fully wound on one roll and depleted from the other.

2. Automatic rewinding apparatus as recited in claim 1, in which said levers are mounted for pivotal movement about a common axis, said biasing means comprising a tension spring interconnecting said levers.

3. Automatic rewinding apparatus as recited in claim 2, in which said levers are provided with arms for alternate engagement with said crank to produce angular displacement of said shaft in opposite angular directions from an intermediate neutral position, together with means urging said crank toward the neutral position for returning said paddle from engagement with said rolls upon release of said crank by said levers.

4. Automatic rewinding apparatus for an elongated web, comprising a pair of rolls rotatably supported on parallel axes for attachment to the opposite ends of an elongated web to reversibly wind the web thereon; a pair of disengageable electromagnetic clutches each including an energizing coil, an input drive element, and an output drive element; each of said rolls being connected with the output drive element of one of said clutches; control means including pressure-actuated switch means and circuit means electrically connected with said coils for alternative energization of either one thereof; motive means connected to drive the input elements of said clutches in opposite rotational senses; a pair of cams drivingly connected with said input elements; an oscillatory rock shaft provided with a sensing paddle, a crank arm, and an actuating element for said switch means; a pair of pivotally-mounted levers, and means biasing said levers in opposite angular directions each toward engagement with one of said cams; said cams being formed to release said levers alternately for actuation by said biasing means into driving engagement with said crank arm, to oscillate said paddle alternately into biased engagement with the web rolled on each of said rolls, whereby the angular displacements of said actuating element are limited by the alternate engagements of said paddle with the web rolls; said actuating

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element being arranged for angular displacement to a terminal position, to actuate said switch means and thus reverse the direction of winding of said web on said rolls, as the web is fully wound on one roll and depleted from the other.

5. Automatic rewinding apparatus as recited in claim 4, in which said switch means comprise a normally-closed momentary-contact switch and normally-open momentary-contact switch each arranged for actuation by said element upon angular displacement of said paddle to a different terminal position engaging one of said rolls upon depletion of said web therefrom; said circuit means including a relay having a first double-throw contact connected to energize one of said clutch coils upon energization of said relay, and to energize the other of said clutch coils upon de-energization of said relay, said normally-open switch being connected to energize said

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relay momentarily when actuated; said relay further having a holding contact connected to maintain energization of said relay through said normally-closed switch following momentary energization by said normally-open switch; said normally-closed switch being adapted to de-energize said relay upon a subsequent actuation thereof.

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