Fig. 1
Fig. 3

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Fig. 4

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Fig. 6

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ARRANGEMENTS RELATING TO THE PRINTING RIBBON IN PRINTING MACHINES

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The present invention relates to improvements in systems for moving the printing ribbon in printing machines. These feed systems are designed to move the inked ribbon employed in the printing alternately in one of two opposite directions, the reversal of the direction of movement of the ribbon taking place when the latter has reached either one of its two ends. The inked ribbon thus performs a series of forward and backward travels, whereby it is possible to obtain a large number of high-quality impressions with the same ribbon. This mode of utilisation is found to be the most advantageous with a moist ribbon since, after each passage, the ink remaining in the ribbon is redistributed therein by capillary action.

In methods for printing characters which are visually identifiable and can be automatically scanned by optical, magnetic or other methods, it is essential for the printing to be of very high quality in order that the scanning of these characters may thereafter take place by means of appropriate detecting members with a minimum danger of errors. By reason of this condition, there is used for the printing a dry ribbon in which all the ink actually utilised for the printing of the characters is completely transmitted from the ribbon to the paper to be printed on, because the ink necessary for the formation of each character must be transferred in a well-defined quantity in order that it may have appropriate, for example optical or magnetic, properties which can act effectively and correctly on the corresponding detecting members. Consequently, that portion of the said total-transfer dry ribbon which has already served for the printing cannot be reused, and the said ribbon is therefore fed only in one direction. In addition, when a line of characters has been completely printed on the paper, it is essential to move this ribbon to a sufficient distance to prevent the inked portion which is then positioned opposite the strike hammer from interfering with that portion which has previously been used. This condition requires that the dry total-transfer ribbon be moved very rapidly at each line shift through a distance at least equal to the height of a printed character, the movement of the ribbon being stopped at the time when a line is printed. This mode of feed makes it possible to effect a considerable saving of ribbon, which is the more appreciable since the latter can be used only once.

An object of the present invention is to improve the system of feed for feeding an ordinary wet or dry partial-transfer ribbon to enable them also to be employed in devices for feeding a total-transfer dry ribbon.

In accordance with the present invention there is provided a system for moving an inked ribbon in a printing mechanism in either of two opposite directions or, where necessary, in only one of the two ends of the ribbon being fast with a first support roller on which a part of the said ribbon is wound, the other end being fast with a second support roller, the first support roller being mechanically coupled to a first electric driving motor through a reversible reduction gear, the second support roller being likewise coupled to a second electric driving motor through another reversible reduction gear, the said motors being induction motors whose inductors winding may be energised either with direct current or with alternating current, the said system comprising a clutch disposed between each reduction gear and the associated support roller to connect each roller to the associated motor, the said clutches being adapted to be energised either with a relatively weak direct current to enable them to slip, or with a stronger direct current for maintaining them in the firmly engaged condition, an irreversible speed-changing device disposed between the clutch of the first roller and the reduction gear associated therewith, and switching means so designed that when the clutch of the first roller is in the firmly engaged condition and the first motor is energised with alternating current for winding the ribbon on to the first roller, a tension of the ribbon is obtained either by energising only the clutch of the second roller with a direct current of high strength, or by energising this clutch in such manner that it slips and simultaneously energising the second motor with direct current, while when the clutch of the second roller is in the firmly engaged condition and the second motor is energised with alternating current to wind the ribbon on to the second roller, the tension of the ribbon is obtained by energising the clutch of the first roller in such manner that it slips, it not being possible for the first motor to be driven by the ribbon owing to the irreversibility of the speed-changing device.

Further features of the invention and the manner in which the invention is put into practice will become apparent from the following description, which is given by way of example, with reference to the accompanying drawings, in which:

FIGURE 1 is a diagrammatic view in perspective indicating the relative positions of the ribbon, the type drum and various parts in the machine;

FIGURE 2 is a diagrammatic view in section along the line 2—2 of FIGURE 3 of the drum-ribbon mechanism;

FIGURE 3 is a fragmentary section along the line 3—3 of FIGURE 2 through various members of the left-hand part of the drum-ribbon mechanism;

FIGURE 4 is a first part of the diagram of the electric circuits for monitoring and controlling the movements of the ribbon;

FIGURE 5 is a second part of the diagram of the electric circuits for monitoring and controlling the movements of the ribbon;

FIGURE 6 is a third part of the diagram of the electric circuits for monitoring and controlling the movements of the ribbon.

The machine which will now be described by way of example is a high-speed printing machine comprising a type drum, similar to that already described and illustrated in patent application Ser. No. 436,108, filed in the United States by Mr. Michel Andre Bernard on Mar. 1, 1965, now Patent No. 3,291,043 issued Dec. 13, 1966. For the constructional details of the printing machine, reference may be made to said United States patent application. However, it is desirable to recall here with reference to FIGURES 1 and 2 that the printing machine comprises a type drum 102 which rotates at constant speed and past which there travels a paper web 139 and a printing ribbon 101. A striker mechanism assembly 114 is disposed opposite the drum in such manner as to apply the paper and the ribbon to the drum for a very brief time and thus to effect the printing of the paper. The printing takes place at the level of a line 107 called the printing line.

The printing machine just described by way of example may be employed both for printing standard characters and for printing characters intended to be visually identified or to be scanned by an automatic reading device. In the latter case, the machine is designed to operate with a total-transfer dry ribbon which must be driven at relatively high speed. It will be recalled that the total-transfer dry ribbon must be moved very rapidly at the end of the printing of a line through a distance sufficient...
to prevent the inked portion which is then positioned opposite the striker hammers, from interfering, before the printing of the succeeding line, with that portion of the ribbon which has previously been used. It follows that such a ribbon is subjected to very considerable acclerations and decelerations which, in the described example, are obtained by means of electromagnetic clutches. Moreover, its use requires that its feed should be monitored by monitoring means which will shortly be described. In addition, it is essential that the said ribbon be maintained taut in order not to smudge the paper. Means which will hereinafter be described are provided to ensure an appropriate tension of the ribbon.

FIGURE 1 shows that, in all cases of use, the ribbon 101, which optionally may be a total-transfer dry ribbon, is secured by its two ends to a first support roller 103 and to a second support roller 104, respectively, by means of flexible bands 105 and 106, each of which is provided with a bar 108 and a bar 109, respectively. These bars serve to close under conditions which will hereinafter be specified electric contacts C1 and C3 intended to control the reversal of the ribbon. At a point close to the upper support roller 103, the ribbon 101 passes over the roller 112 by which, as will hereinafter be seen, the effective advance of the ribbon can be monitored. The said roller, which is adapted to turn freely about its axis, is rotated by the friction of the ribbon when the latter is in motion. It is to be noted that the total-transfer dry ribbon generally consists of a web of paper or flexible plastics, such as the plastics known commercially under the name “Mylar” for example, and on the surface of which there has been deposited an appropriate magnetic or non-magnetic ink which is completely transferable during the printing. Consequently, this ribbon, which may be relatively fragile, has to provide only a moderate effort for driving the roller 112 by which its feed is monitored. The described construction utilizes a photo-electric device for monitoring the feed, which satisfies this requirement, but it is to be understood that this device, which will now be described, may be replaced by any other equivalent feed-monitoring device which only requires a relatively small effort from the ribbon in order to be set in operation. In the described example, the roller 112 is covered by a layer of rubber intended to increase the adhesion necessary to enable it to be driven by the ribbon. As will be seen in FIGURE 1, the said roller is provided, at its end, with a conical portion which may be engaged in one of the rollers 140 and 150 of the ribbon support roller, or in the case of the use of a total-transfer dry ribbon, between the upper driving chuck and the sleeve of a non-return device. The upper driving chuck 150 is coupled to a first motor MRS through a reduction gear RS, a speed-changing device CV and a clutch WS. The lower driving chuck 151 is coupled to a second motor MRI through a reduction gear RI and a clutch WI. In the described example, the clutches WS and WI are known electromagnetic clutches of the type in which a continuously rotating driving shaft is provided with a cylindrical magnetic circuit, in the body of which there is disposed an excitation coil, which, when energized, produces the attraction of a friction disc which is fast in rotation with a shaft to be driven. The invention is not limited to the adoption of this type of clutch. The strength of the current flowing through the excitation coil is so adjusted that the magnetic attracting force by which the disc is maintained against the magnetic circuit is exerted either with a low value which is just sufficient to maintain the disc weakly applied against the magnetic circuit and thus to cause the clutch to slip, or with an appreciably higher value to keep the disc firmly applied to the magnetic circuit. Of course, in the absence of current, the disc is maintained at a distance from the magnetic circuit by known means. The clutches WS and WI are diagrammatically illustrated at WS and WI in the diagram of FIGURE 5. The motors MRS and MRI are single-phase induction motors of known type, the particular operating conditions of which will shortly be described, and which are diagrammatically illustrated at MRS and MRI in the diagram of FIGURE 6. The speed-changing device CV is a pinion and spur-wheel device of known type comprising a driving shaft 211, a driven shaft 221 and an intermediate-pinion support 223 adapted to pivot about the shaft 221 and to be driven and driven by the driving shaft 211, and the driving and driven shafts are provided with a gear set 224 of suitable ratio. A lever 224 fast with the pinion support 223 is provided to close one of two switching elements, here consisting of two electric contacts C3 and C30, when the said support is brought into each of its two positions. In one of these two positions, the shaft 221 is driven at low speed, of the order of three revolutions per minute, while the contact C3, or first switching element, is closed by the lever 224. In the other position, the shaft 223 is driven at a relatively high speed, of the order of thirty revolutions per minute, while the contact C36, or
second switching element, is closed by the lever 224. For reasons which have already been explained in the foregoing, this relatively high-speed device is utilised in the case of the drive of a total-transfer dry ribbon. The reduction gears RS and RI are reversible, while the speed-changing device which drives the shaft 222 either at low speed or at high speed has a reduction ratio which does not permit it to be reversible. Consequently, if the coils of the clutches WS and WI are energised, the upper support roller is driven by the motor MR, the motor MRI is driven by the lower support roller under the effect of the traction exerted on the ribbon by the motor MRS. On the other hand, if the disc of the clutch WS is firmly held in engagement, and if the lower support roller is driven by the motor MRI, the motor MRS cannot, owing to the irreversibility of the speed-changing device CV, be driven by the upper support roller which turns under the effect of the traction of the ribbon. Under these conditions, in order to avoid danger of tearing of the ribbon, the disc of the clutch WS is not firmly engaged. However, in the latter case the coil of the clutch WS may be weakly energised so that this clutch, which is driven by the upper support roller, slips and then brakes the movement of the upper support roller, whereby it is possible to ensure an appropriate tension of the ribbon during its travel.

For a rational utilisation of the ribbon, whether it be of the total-transfer dry type or not, it is desirable that it should be automatically fed forwards as a function of the printing operations performed by the machine. This automatic feed is effected by switching means which are controlled partly by the contacts C3 and C30 and which will now be described with reference to FIGURES 4, 5 and 6. The electric circuit diagram of FIGURES 4, 5 and 6 is a basic diagram of the circuits monitoring the movements of the ribbon, and comprises manually controlled contacts comprising relays, which are designed to be used under the conditions which will now be described. FIGURES 4, 5 and 6 relate to the same circuit diagram, in which the +48-volts, +48-volts direct-current supply is common to the diagrams of these figures. The relay contacts are denoted by the same reference as the winding by which they are controlled, preceded by the letter C. A contact which is normally closed when the relay controlling it is not energised is represented in these diagrams by a black triangle.

The motors MRS and MRI illustrated in FIGURE 6 may be supplied either with single-phase alternating current or with direct current, as will hereinafter be described, by the control 646 of the reversing device CK02, one of a third reversing device CO07 and of a first interrupting member CP02. Finally, a second interrupting member CN06, shown in FIGURE 6, completes the control circuit of the motors MRS and MRI and enables them to be supplied with direct current from +48-volts. The selective supply of the motors MRS and MRI with alternating or direct current is controlled by means of two selecting relays CT6 and CT7.

When the circuits controlling the feed of the ribbon are in the inoperative state, three relays HO4, HO5 and HO6 (FIGURE 6) are not energised. A capacitor C601 of 600 microfarads is maintained charged at 48 volts through a normalising relay CH06 and a resistor R223. A relay current is the contact CH07 which is energised at the same time maintains its contact CH07 closed. Owing to the fact that the relay HO5 is not energised, its contact CH05 is maintained in the "off" position. As long as the manual contact C3 shown in FIGURE 4 is not closed by the lever 224 of the speed-changing device CV, three relays MO5, NO5 and OO5 remain unenergised. In this case, the con-

tact CN05 (FIGURE 6) of the relay NO5 is maintained in the "off" position and thus produces the energisation of the relay CT6. The relay CT6 which is energised changes over its contacts CT61 and CT62, which then supply the inductor MRS of the upper motor with single-phase 220-volts alternating current supplied by two terminals 228 MN. The upper motor then rotates, but the inductor MRI of the lower motor is not supplied with alternating current owing to the fact that the relay CT7 (unenergised) maintains its contacts CT71 and CT72 in the "off" position. On the other hand, the inductor MRI of the lower motor cannot be supplied from +48-volts through a resistor R18 of low value owing to the fact that the contact CN06 is in the "off" position and that a relay NO4 (FIGURE 4), which is not energised as long as the contact C30 is maintained open, maintains its contact CN06 open. FIGURE 5 shows that, under these conditions, a relay MO5 (FIGURE 4) which is not energised owing to the fact that the contact C30 is open, maintains its contact CM06 open. Consequently, three relays MO7, MO8 and MO9 (FIGURE 5) are not energised, and in particular the contact CM07 of the relay MO7 remains open. Since, as has been seen in the foregoing, the relay OO5 is not energised, its contact CO05 remains open and does not permit energisation of two relays EO1 and EO2. Therefore, the contacts C101 and C102 remain open. The clutches WS and WI cannot be supplied with direct current from +48-volts since the contacts CM07 and CE02 are open. As a result of this, the ribbon support rollers are unaffected by the movements of the motors.

Manual control of the ribbon feed.—It may be essential to feed the ribbon either in order to obtain uniform quality of the printing from the outset or in order to tension the ribbon after it has been placed in position. As will hereinafter be seen, the feed is effected by operation of a push button TR shown in FIGURE 4. If the unoperated position, this button TR energises a relay NO7 through its contact CTR.

If the ribbon employed is not a total-transfer dry ribbon, the lever 224 of the speed-changing device CV is brought to the position corresponding to the drive of the shaft 223 at low speed and thus closes the contact C3 of the reversing device CK02 (FIGURE 4). The relays MO5, NO5 and OO5 are then energised, whereby the contacts CM05 and CO05 are closed, and the contact CN05 is reversed (FIGURES 4, 5 and 6). The closing of the contact CO05 results in energisation of the relays EO1 and EO2. The contacts C101 and C102 then close, so that direct current on the one hand to the clutch WI through the closed contact CE02 and on the other hand to the clutch WS through the closed contacts CE02 and CE01 and the contact CO07 in the "off" position. On the other hand, the relay CT6 can no longer be energised owing to reversal of the contact CN05. The contacts CT61 and CT62 then fall back and the inductors of the motors MRS and MRI then receive direct current through the contact CN05, the contact CH05 maintained in the "off" position and the resistor R18. If, at this instant, the push button TR (FIGURE 4) is depressed for a prolonged period in order to reverse the contact CTR, the relay NO7 is de-energised and then changes over its contact CN07 (FIGURE 5) in order to energise two relays PO2 and KO3. The contact CPO2 closes and the direct current which then flows from +48-volts through the contacts CE02, CE01, CO07 and CPO2 energises the relay GO2. A switch relay GO2 momentarily has no effect on the feed of the ribbon. The energised relay KO3 opens its contact CK03, thus bringing two relays BO4 and BO5 into the unoperated condition should they have been energised by the closing of the contact CO03 of a relay BG3. Moreover, reversal of the contact CTR brings three relays HO5, NO5 and OO6 (FIGURE 4) into the unoperated condition should they have been energised by closing of the contact
CJ03 of the relay JO3. Finally, reversal of the contact CTR results in energisation of the relay HO3 (FIGURE 4), since the contact CM05 has already been closed by closing of the contact C3. The relay HO3 then reverses its contact CJ03 (FIGURE 6). The relays HO4 and HO5 are temporarily energised through the reversed contact CJ03, and are maintained energised by closing of the contact CJ04, the contact CJ07 having already been closed by the energised relay HO3. The energised relay HO3 reverses its contact CJ05. Since the relay NO5 has already been energised by closing of the contact C3, a direct current passes through the contacts CN05, CH05, CJ05 and energises the relay CT6, which changes over its contacts CT61 and CT62, which then supply 220-volts current to the inductor of the motor MSS. In addition, reversal of the contact CH05 interrupts the direct-current supply to the inductor of the motor MRL. Under these conditions, the motor MRS rotates and drives the shaft 222 at a speed of three revolutions per minute, as also the upper support roller 103, since the clutch WS is firmly engaged by the direct current. As long as the push button TR is maintained in the depressed position, the ribbon is driven by the motor MRS and in turn drives the (un supplied) motor MRL through the lower support roller 104 and the clutch WI, which is firmly engaged by the direct current. The direct current through the clutch WI constitutes a resisting torque sufficient in practice to ensure an appropriate tension of the ribbon.

When the push button TR for the manual control of the movement of the ribbon is released, the contact CTR returns to its "off" position and the relay HO5 is no longer energised. The relay NO5 is then opened, the contact CH03 (FIGURES 4 and 6) falls back and the relay HO6, which is then energised through the contacts CH07, CH04 and CH03, opens its contact CH06. From this instant, HO7 is energised only by the discharge of the capacitor C601, through the resistor R225. The useful discharge of the capacitor lasts about two seconds. Thereafter, owing to the fact that the relay HO7 is no longer energised, the contact CH07 opens and the relays HO4, HO5 and HO6 are brought into the unoperated state. The contact CH04 falls back and the capacitor C601 is again charged through the contacts CH04 and CH03. The contact CH05 also falls back and, since the relay CT6 is no longer energised, the contacts CT61 and CT62 fall back into the "off" position. The inductors of the motors MRS and MRL are then supplied with direct current through the contacts CN05, CH05 and the resistor R18. This arrangement has the object of strongly braking the motors in order to maintain the ribbon in the tensioned state and thus to avoid smudging of the printing paper. In addition, energisation of the relay NO7 results in the change-over of the contact CN07 (FIGURE 5) and desenergises the relays PO2 and KO3. The contact CPO2 opens, whereby energisation of the relay GO2 is interrupted, while the contact CK03 returns to its "off" position.

On the other hand, if the ribbon employed is a total-transfer dry ribbon, the feed of the ribbon takes place in the following manner. The lever 224 of the speed-changing device CV is brought to the position corresponding to the drive of the shaft 222 at high speed and thus closes the contact C30 (FIGURE 4). The relays MO6 and NO6 are then energised, whereby the contacts CMO6 (FIGURE 5) and CN06 (FIGURE 6) are closed. Closing of the contact CMO6 results in energising the relays MO7, MO8 and MO9 which, in turn, close their contacts CM07, CM08 and CM09. Since the contacts CM07 and CM08 are closed, the clutch WI receives direct current from --445-volts through the contacts CM07, CM08 and KO2 and through a resistor R7. The function of the resistor R7 is to limit the direct current flowing through the direct current control which, in the described example, emanate from the paper feed control circuits and are transmitted to the ribbon feed control circuits through a line CSP (FIGURES 4 and 5) to limit the direct current of each line of characters on the paper, i.e. at intervals of time of 20 milli-seconds in the case of the machine being described.
In cases where the ribbon employed is not a total-transfer dry ribbon, the contact C3 is closed by the lever 224 of the speed-changing device CV, whereby the relays M05, N05 and O05 are energised. As described in the foregoing, closing of the contact C005 of the energised relay O05 results in energisation of the relays E01 and E02 which, in turn, close their contacts CE01 and CE02. Consequently, the clutches WS and WI are supplied with direct current, as has already been explained. Energisation of the relay N05 gives rise to the energising of the capacitor CN05, which then ceases to energise the relay CT6. Finally, the contact CM05 is closed owing to energisation of the relay MO5. The relay NO7 is energised because the contact CTR is in the “off” position, and consequently the relays PO2 and KO3 (FIGURE 5) cannot be energised, since the contact CNO7 is in the “on” position. Consequently, the contact CP02 is open, the relay GO2 is not energised and the contact CK02 is open. The feed pulses are systematically applied to a relay KO8 (FIGURE 4) which closes a contact CK08, whereby a relay JO8 is energised and then opens a contact CJ08. The contact CM05 already being closed, it follows that the relay H03 is then energised and reverses its contact CH03. Since the control pulses transmitted through the line CSP may be of short duration, a capacitor C15 connected in parallel with the relay JO8 through a resistor R221 prolongs by about 60 milliseconds the closing time of the contact CJ08. During this time, the relay HO6, which is normally energised through the “off” contact CH03, can no longer be energised and the capacitor C601 can be recharged through the “off” contact CH03. Since the relay NO5 is energised and the contact CH03 has been changed over, the current which is then flowing through O05 is discharged by depression of the push button TR in the case of the use of a ribbon other than a total-transfer dry ribbon. This cycle has already been described and for this reason it will merely be recalled that the motor MRS is supplied with alternating current at 220 volts while the motor MRI is not supplied. It will also be recalled that the clutches WS and WI are firmly held in engagement and that the period of the useful discharge current of the capacitor C601 through the resistor R223 is about two seconds. Thus, as long as control pulses are transmitted to the relay KO8, the drive of the ribbon is continuous. Since the pulses are transmitted at time intervals of 200 milliseconds.

If, on the other hand, the ribbon employed is a total-transfer dry ribbon, the lever 224 of the speed-changing device CV is so positioned that the contact C30 is closed. Under these conditions, the relays MO6 and NO6 are energised, while the relays MO8 and NO8 are not energised, as has already been explained, the contact CN05 is then in the “off” position and the contact CN06 is closed, which results in a supply of 220-volt alternating current to the motor MRS, while the motor MRI is supplied with direct current. It will also be recalled that closing of the contact CM06 results in closing of the contacts CM07, CM08 and CM09. A direct current can then be supplied through the contacts CM07, CM08, CK02 and the resistor R7 to the clutch WI, which can then slip since it is only weakly engaged. The relay GO2, which is energised through the contacts CMO7, CMO8, O05 and the contact PO2, and the relays PO2 and KO3 are not energised, while the relay KO1, which is energised through the contacts CN07, CM09 and CPO3 closes its contact CKO1. As before, the feed pulses are applied to the relay KO8, but, since the contact CG02 is now closed, these pulses are also applied to a symbol of description. The said pulses arrive at a relay FO4 (FIGURE 5), which closes its contact CF04, as also at a delay element D55. It should be noted that the contact CM05 is open and that consequently the pulses applied to the relay KO8 can no longer energise the relay HI03. During the brief instant when the contact CF04 is closed, a direct current energises the relay FO3 and charges a capacitor C701 through the contacts CN07, CM09, CPO4 and a diode D1. The energised relay FO3 changes over its contact CF03, whereby the relay KO1 de-energised. The capacitor C701, which is connected in parallel with the relay FO3 through a resistor R11, extends by 35 milliseconds the time during which the contact CPO3 is changed over. During this time, the de-energised relay KO1 opens its contact CK01, the energised relay KO3 opens its contact CK03 and the energised relay KO2 closes its contact CP02, whereby the clutch WS is energised. Opening of the contact CK01 prevents stop pulses which come from the feed monitoring device previously described with reference to FIGURE 1 from the transmitter to a relay BO1 through the amplifying device AMP. The motor MR5, which is supplied with current at 220 volts, then drives the ribbon, which remains tensioned owing to the slight braking action exerted by the motor MRI, through the clutch WI. At the end of 35 milliseconds, the de-energised relay FO3 changes over its contact CPO3 into the “off” position, whereby the relay KO1 is again energised and the relays PO2 and KO3 de-energised. The contacts CK01 and CK03 are then closed, while the contact CP02 is opened and de-energises the clutches WS. The motor MR5, which is still supplied with current at 220 volts, is then disengaged from the upper support roller and ceases to drive the ribbon. The motor MRI, which is still supplied with direct current, continues to brake the ribbon slightly through the clutch WI, which slips. The ribbon is thus maintained in the tensioned condition. If at this instant a stop pulse coming from the feed control device is transmitted to the relay BO1 through the amplifying device AMP and the contact CP02, which is now closed, closes, whereby the relays KO2 and BO3 are energised. The pulse which energises the relay BO1 for a very brief time is also transmitted through a diode D2 to a capacitor C702. The capacitor C702, which is connected in parallel with the relay BO1 through a resistor R12, extends by 15 milliseconds the time during which the contact CBO1 is closed. During this time, the energised relay BO3 closes its contact CBO3. The contacts CK03 and CB02 being closed, the relays BO4 and BO5 are energised. The relay BO4 then closes its contact CBO4 and thus establishes a holding circuit for the relays BO4 and BO5. The energised relay BO5 reverses its contact CB05. During the time when the contact CB01 is closed, the energised relay KO2 reverses its contact CK02. The clutch WI, which then receives an intense direct current, is firmly engaged. The motor MRI, which is thus firmly engaged with the lower support roller, strongly brakes the ribbon and rapidly stops it. The non-return device ensures an appropriate tension of the ribbon while stationary. The stopping is substantially obtained before the relay BO1, which is de-energised at the end of 15 milliseconds, opens its contact CBO1. The relays KO2 and BO3 are then de-energised and the contact CK02 returns to its “off” position. It will be appreciated from the explanations just given that, from the instant when a feed pulse is applied to the relay FO4, the ribbon is driven for 35 milliseconds by the motor MRS, and that it thereafter ceases to be driven. If, at the end of these 35 milliseconds, a stop pulse is applied to the relay BO1, the relay BO3 is reversed and the ribbon is stopped. It is to be noted that this time of 35 milliseconds corresponds to a linear displacement of the ribbon of the order of 3.15 millimetres. Since the height of the characters printed on the paper does not exceed 2.7 millimetres, this displacement is sufficient to prevent the inked portion of the ribbon which is then not required, from coming into contact with characters from interfering with that portion of the ribbon which has been used in the preceding striking action. Consequently, during these 35 milliseconds, the contact CK01 remains open so as to prevent a stop pulse from energising the relay BO1 and thus initiating the premature stoppage of the movement of the ribbon. However, the ribbon must be stopped at the instant of the printing. The continuous
drive of a total-transfer dry ribbon moved at a linear speed of the order of 9 centimetres per second would result mainly in an excessive consumption of the ribbon. Consequently, having regard to the characteristics of the machine, the ribbon must be moved only for an interval of time which does not exceed 70 milliseconds. Owing to the fact that the time necessary for stopping the ribbon is of the order of 10 to 15 milliseconds, it is essential that the stop pulse which emanates from the feed monitoring device be applied to the relay BO1 at the latest 50 milliseconds after the application of a feed pulse to the relay FO4. This necessity is met by an appropriate positioning of the slots in the disc 213 of the feed monitoring device. Thus, during normal operation, as long as feed pulses are transmitted to the relay FO4 at intervals of time of 200 milliseconds, the ribbon is periodically moved step-by-step.

Monitoring of the ribbon feed.—The monitoring of the effective feed of the ribbon is carried out with the aid of the feed monitoring device, which sends ribbon stop pulses to the relay BO1 through the amplifying device AMP and the contact CKO1. The monitoring is effected only when the ribbon employed is a total-transfer dry ribbon. In other cases, the contact CKO1 remains open, since the only contact C30 does not enable, in particular, the relay MO9 to be energised, and consequently the relay KO1 is not energised. The appropriate relay dry ribbon moves by friction during its movement the roller 112, on the end of which is mounted the slotted disc 213. When a feed pulse is applied to the relay FO4, the ribbon is driven for 35 milliseconds, as has been seen in the foregoing, thereafter ceases to be driven and is finally stopped by a stop pulse, which is applied to the relay BO1. This stop pulse, which emanates from the feed monitoring device, can be applied to the relay BO1 only after the instant when the ribbon ceases to be driven, but during normal operation it must not be sent after the 15 milliseconds which precede this instant, in order that the ribbon may be actually stationary at the instant when the striking is resumed. The feed control pulse which energises the relay FO4 is also applied to the delay element D55, at the output of which it appears with a delay of 55 milliseconds. A contact CB05 controlled by the relay BO5 then transmits it either to a feed incident signalling device DSI or to relay BO2 and to a delay element D15. If a stop pulse reaches the relay BO1 at the latest 50 milliseconds after the application of a feed control pulse to the relay FO4, the coil CB01 closes and thus energises the relays KO2 and BO3. On closing, the contact CB03 establishes the holding of the relays BO2 and BO5. Consequently, the contact CB05 is changed over before the feed control pulse, delayed by 55 milliseconds, is set up at the output of the element D55. This delayed pulse is then transmitted on the one hand to the delay element D15 and on the other hand to the relay BO2, which is energised and opens its contact CB02. The relays BO4 and BO5 are no longer energised and the contact CB04 breaks the holding circuit of these relays, while the contact CB05 returns to the “off” position. During this time, the pulse transmitted to the element D15 is delayed by 15 milliseconds, which is the maximum time after which the ribbon is stopped, in order to set up an end-of-feed signal FAR for the ribbon, which signal is in turn utilised to initiate the resumption of the striking. If, on the other hand, a stop pulse reaches the relay BO1 after the 50 milliseconds following the application of a feed control pulse to the relay FO4, for example, caused by the upper roller being insufficiently tensioned and therefore does not sufficiently drive the roller 112, or if no stop pulse reaches the relay BO1, either because the feed monitoring device is defective or because the ribbon is torn or broken, the contact CB05 cannot be reversed before the feed control pulse, delayed by 55 milliseconds, is set up at the output of the element D55. This delayed pulse is then transmitted to the feed incident signalling device DSI. Resumption of the striking cannot be initiated and consequently the feed control pulses, which are normally transmitted at the end of the printing of each line, cease to be sent.

Reversing drive of the ribbon.—As has already been explained, any ribbon which is not a total-transfer dry ribbon can perform a series of travels in alternate directions. Such a ribbon is then provided, near to its ends, with bars 193 and 199, shown in FIGURE 1, which are so arranged as to close, respectively, an electric contact circuit of the relay BO1 which is the end of the ribbon on the upper roller and an electric contact C11 which detects the end of the ribbon on the lower roller. If, for example, the contact C11 is closed as a result of the end of the ribbon on the lower roller, a relay JO3, mounted as indicated in FIGURE 4, is energised and closes its contacts C43. The contacts CTR and CJO2 being in the “off” position, the relays JO4, JO5 and O06 are then energised. The relay JO4 establishes at +48-volts, through its contact CJO4, a holding circuit for itself and for the relays JO5 and O06. It is worthwhile recalling here that the relay NO5 (FIGURE 4) is energised as a result of the closing of the contact C3 and that the relay HOS (FIGURE 6) is continuously energised, provided that control pulses are transmitted to the relay K08. FIGURE 4 then shows that, owing to the energisation of the relay JO5, the contact CJO5 is reversed, and that a direct current consequently energises the aforementioned total-transfer dry ribbon CHOS and CJO5. The relay CT6 closes to be energised and returns its contacts CT61 and CT62 into the “off” position, whereby the supply of alternating current to the motor MRS is interrupted. The energised relay CT7 brings its contacts CT71 and CT72 into the “on” position for supplying alternating current to the motor MIRI. It will be noted that the inductor of the motor MRS cannot be supplied with direct current because the relay HOS is energised and the contact CNO6 is open. Moreover, FIGURE 5 shows that, as a result of the energisation of the relay O06, the contact O06 closes and permits the energisation of the two relays O08 and O07. The contact CCO8 is changed over, and produces no action because the contacts CM07, CM08 and CPO2 are open. The energised relay O07 changes over its contact CCO7. The clutch WS then receives direct current from +48-volts through the coil CCO1, which is directly by the motor MIRI. The function of the resistor R6 is to limit the direct current with which the clutch WS is supplied to an appropriate value for obtaining slippage of this clutch. On the other hand, the clutch WI is firmly engaged by the direct current coming from +48-volts through the contact CCO2. Consequently, the relay WI, O04 and BO5 is driven by the motor MIRI through the clutch WI, and drives in turn the upper support roller. The slipping of the clutch WS enables the ribbon to be driven, and ensures sufficient braking to maintain the ribbon in the tensioned condition, since the motor MRS remains at standstill, as also does the irreversible speed-changing device. When the contact CIS consequently detects the end of the ribbon on the upper roller, a relay JO2 shown in FIGURE 4 is energised and opens its contact CJO2. The relays JO4, JO5 and O06 are no longer energised, so that, on the one hand, the contact CJO5 changes over into the “off” position, and on the other hand the contacts O06 and CCO6 are opened. The relay CT6 is again energised, thus enabling the motor MRS to be supplied with alternating current, while the motor MIRI is not supplied. In addition, the relays O08 and O07, which are de-energised owing to the opening of the clutch WS, cause the ribbon to be pulled by the ribbons CNO5 and CCO7 into the “off” position. The clutches WS and WI are again firmly engaged and the ribbon is then wound on to the upper roller.

If, on the other hand, the ribbon which is employed is a total-transfer dry ribbon, it must undergo any reversal of the ribbon movement which is explained. The ribbon is moved step-by-step and thus wound on to the upper roller, and it is provided with a bar 199 which, at
the end of the ribbon, then closes the electric contact CII. By a cycle similar to that already described, the relay JO3 is energised and closes its contact CJO3, whereby the three relays JO3, JO4 and OO6 are energised. The main- tenance of the energisation of these three relays is effected by the relay JO4. The contact CO06 of the energised relay OO6 closes and thus energises the relays OO8 and OO7. It will in addition be recalled that in the case of the use of a total-transfer dry ribbon the contacts CMO7 and CMO8 are the ones which complete the circuit of the energised relay OO7 does not result in any action, because the contacts CE01 and CE02 are open. The energisation of the relay OO8 brings about the change-over of the contact CO08. A direct current coming from +48-volts is then applied through the contacts CM07 and CO08 to an end-of-ribbon signalling device SFR which thus signals that the ribbon must be changed. At the same time, the clutch WS ceases to be energised owing to the change-over of the contact CO08, and the relay GO2 is de-energised. The motor MRS then ceases to drive the ribbon. The de-energised relay GO2 opens its contact CGO2 and thus prevents the feed pulses from being applied to the relay FO4. Under these conditions, the restarting of the machine with a new ribbon can take place only after the push button TR has been depressed, whereby the holding of the relays JO5, JO4 and OO6 will be terminated and consequently the contact CO08 will change over to the "off" position.

Although the description and the accompanying drawings relate only to a preferred embodiment of the invention, it is to be understood that various modifications, additions and substitutions which do not depart from the scope of the claims may be applied, depending upon the circumstances and applications, without the principle of the invention being changed. More particularly, the relay circuit diagram given by way of example may be completely or partly replaced by any other equivalent electric circuit utilising transistors, cryotron, electron tubes or similar elements.

The characteristic points of the invention will be more clearly apparent from the following claims.

I claim:

1. In a system for moving an inked ribbon in a printing mechanism, in either of two opposite directions, the combination comprising a first and a second driving roller, an inked ribbon whose two ends are each fixed to one of the said rollers, driving means for driving each roller separately in one direction and comprising for each roller an electric induction motor mechanically coupled to the said roller through an electromagnetic clutch, a speed-changing device disposed between the motor for driving the first roller and the clutch associated with the said roller for effecting the drive of the said roller at one of two different speeds, in dependence upon a previous manual positioning of the said device, an alternating-current source, a direct-current source, and switching means for controlling the supply of current to the motors and to the clutches, the said switching means being controlled in dependence upon the manual positioning of the speed-changing device in such manner that, when the said device is brought into a first position, the clutch connected to the direct-current source for transmitting a maximum torque, the inductor of the motor of the first roller is connected to the alternating-current source for driving the said roller at reduced speed through the associated clutch, and the clutch of the second roller is connected to the direct-current source for permitting maximum mechanical coupling between the second roller and the motor associated therewith in order to create on the second roller driven by the ribbon an opposed torque which ensures the tensioning of the said ribbon.

2. The combination according to claim 1, wherein the said switching means comprise a first control relay adapted to be energised or not energised by a direct-current source and adapted to actuate a make-and-break contact whose centre blade is connected to said direct-current source when the speed-changing device is brought into the second position, and two selecting relays each of which is adapted to actuate a make-and-break contact associated with the inductor winding of one of the said motors, in each of the make-and-break contacts of a selecting relay, the centre blade is connected to a terminal of the associated inductor winding, the make blade being connected to a terminal of the said alternating-current source and the break blade is connected to a common conductor, which conductor is connected to the break blade of the make-and-break contact of the first control relay, the make blade of the said contact being connected to the centre blade of the reversing contact for supplying direct current to either one of the selecting relays, so that when the speed-changing device is brought into the second position the aforesaid make-and-break contacts are positioned, when the said first control relay is maintained in the energised condition, to permit the supply of alternating current to the inductor of one of the motors, while, when the first control relay ceases to be energised, the aforesaid make-and-break contacts are positioned to pass a direct current through the inductors of the two motors so as to brake the armatures of the two motors.

3. The combination according to claim 2, wherein, in order to enable the ribbon to be wound on to the second roller, when the speed-changing device is brought into the second position, the switching means comprise a second and a third control relay which are adapted to be excited with direct current when the winding of the ribbon on to the first roller has been completed, the third control relay being adapted to actuate a second reversing contact whose centre blade is connected to a direct-current source when the speed-changing device is brought into the second position, the break blade being connected to a terminal of the clutch associated with the first roller, the make blade being connected to a terminal of the aforesaid resistance to the clutch associated with the first roller, the strength of the said current being such as to cause the said clutch to slip and to ensure appropriate tensioning of the ribbon.

4. The combination according to claim 1, wherein the switching means comprises a group of control relays comprising a first and a second relay adapted to be energised with direct current when the speed-changing device is brought into the first position, and a synchronising circuit designed to effect the periodic energisation of the second of the said group of control relays, the first of the said group of control relays being adapted to be energised with direct current when the interrupting contact disposed between a direct-current source and a terminal of the inductor of the motor of
the second roller, the second of the said group of control relays being adapted to actuate a second interrupting contact arranged to supply direct current to the clutch associated with the first roller, so that when the speed-changing device is brought into the first position the said second interrupting contact periodically closes under the control of the synchronising circuit in order periodically to supply direct current to the clutch associated with the first roller and to permit the periodic driving of the said roller by the corresponding driving motor.

5. The combination according to claim 4, wherein, for obtaining a step-by-step feed of the ribbon when the speed-changing device is brought into the first position, the switching means comprises a current control relay adapted to actuate a make-and-break contact whose centre blade is connected to a direct-current source, when the speed-changing device is brought into the first position, the make blade of the said contact being connected to a supply terminal of the clutch associated with the second roller, and the break blade of the said contact being connected to the said supply terminal through a relatively high resistance, a ribbon feed monitoring device being provided to supply stop signals to the current control relay, in response to the feed of the said ribbon and through an interrupter controlled by the synchronising circuit, so that during the intervals of time when the ribbon ceases to be driven by the motor associated with the first roller the current control relay is energised in response to the despatch of a stop signal transmitted by the feed monitoring device and changes over its contact to enable the clutch associated with the second roller to be supplied with strong direct current in order to enable a maximum mechanical coupling to be set up between the second roller and the associated driving motor and thus to ensure a strong braking.

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