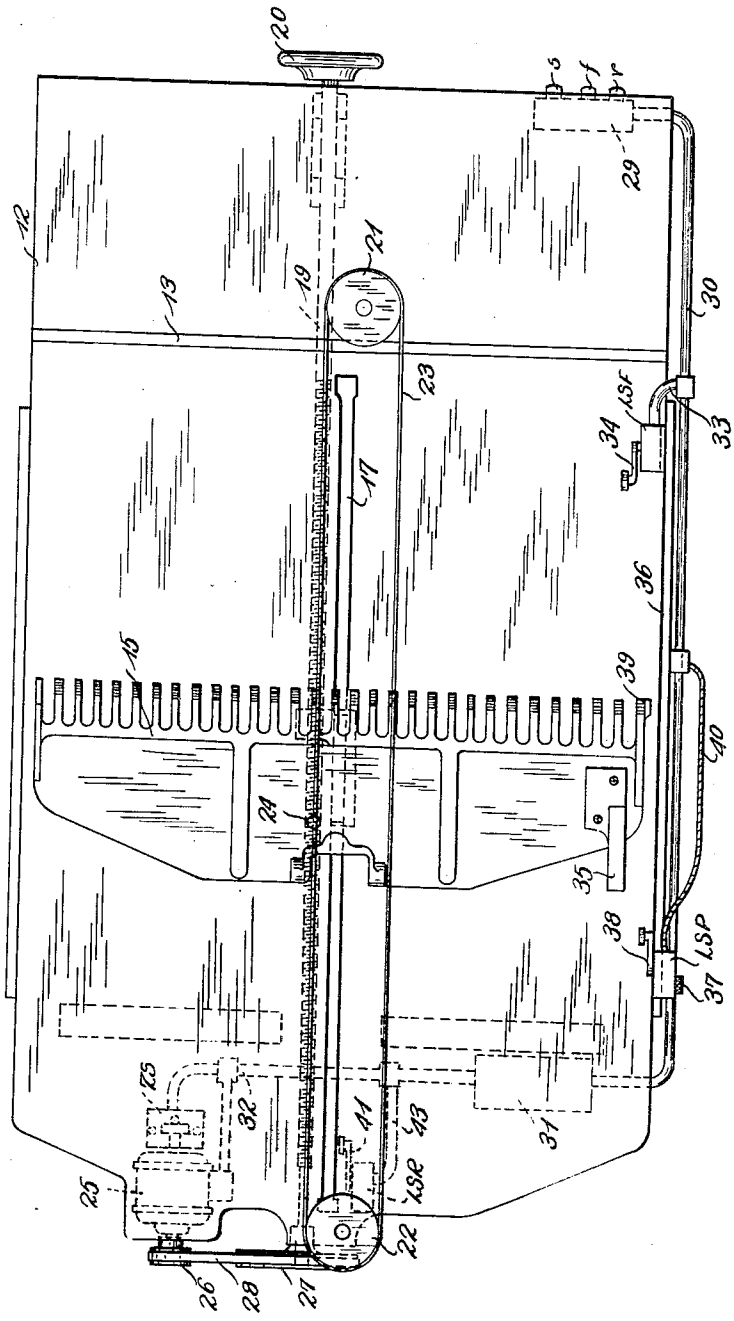
Aug. 27, 1940. W. C. EICKMAN 2,213,068

POWER BACK GAUGE

Filed March 7, 1939 3 Sheets-Sheet 1



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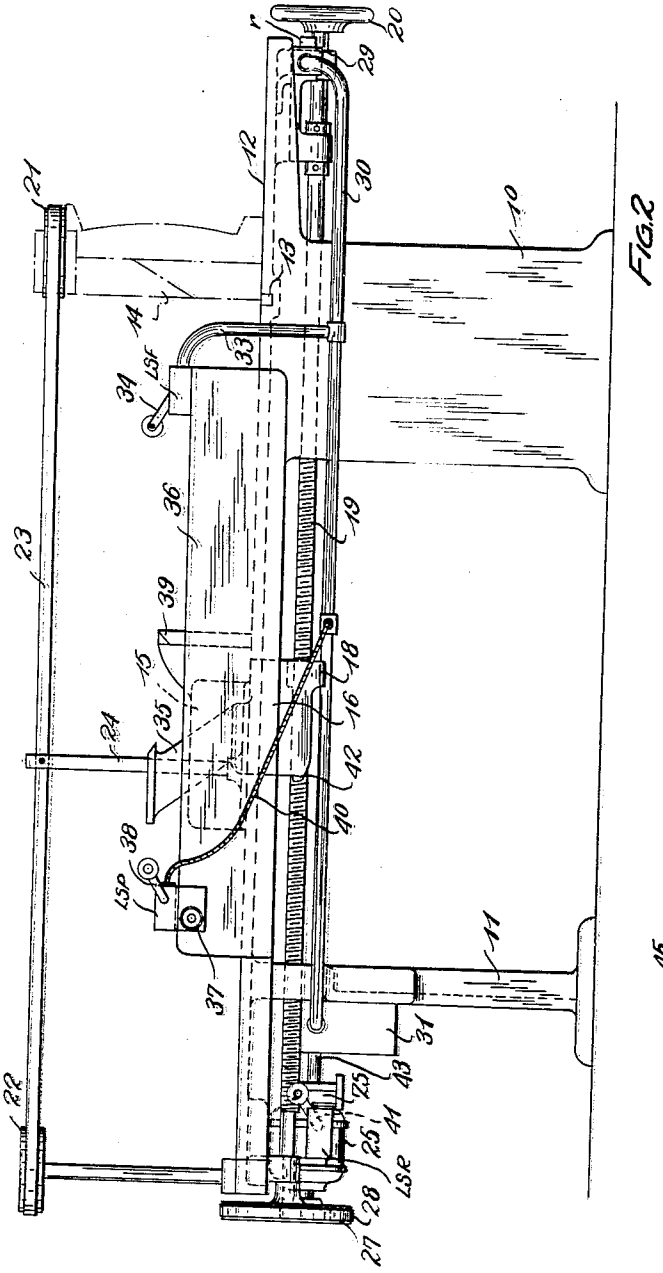


FIG. 2

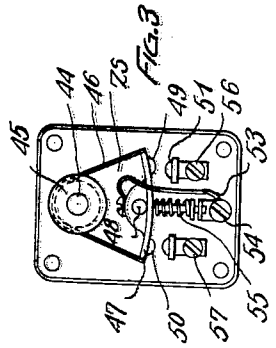


FIG. 3

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Filed March 7, 1939 3 Sheets-Sheet 3

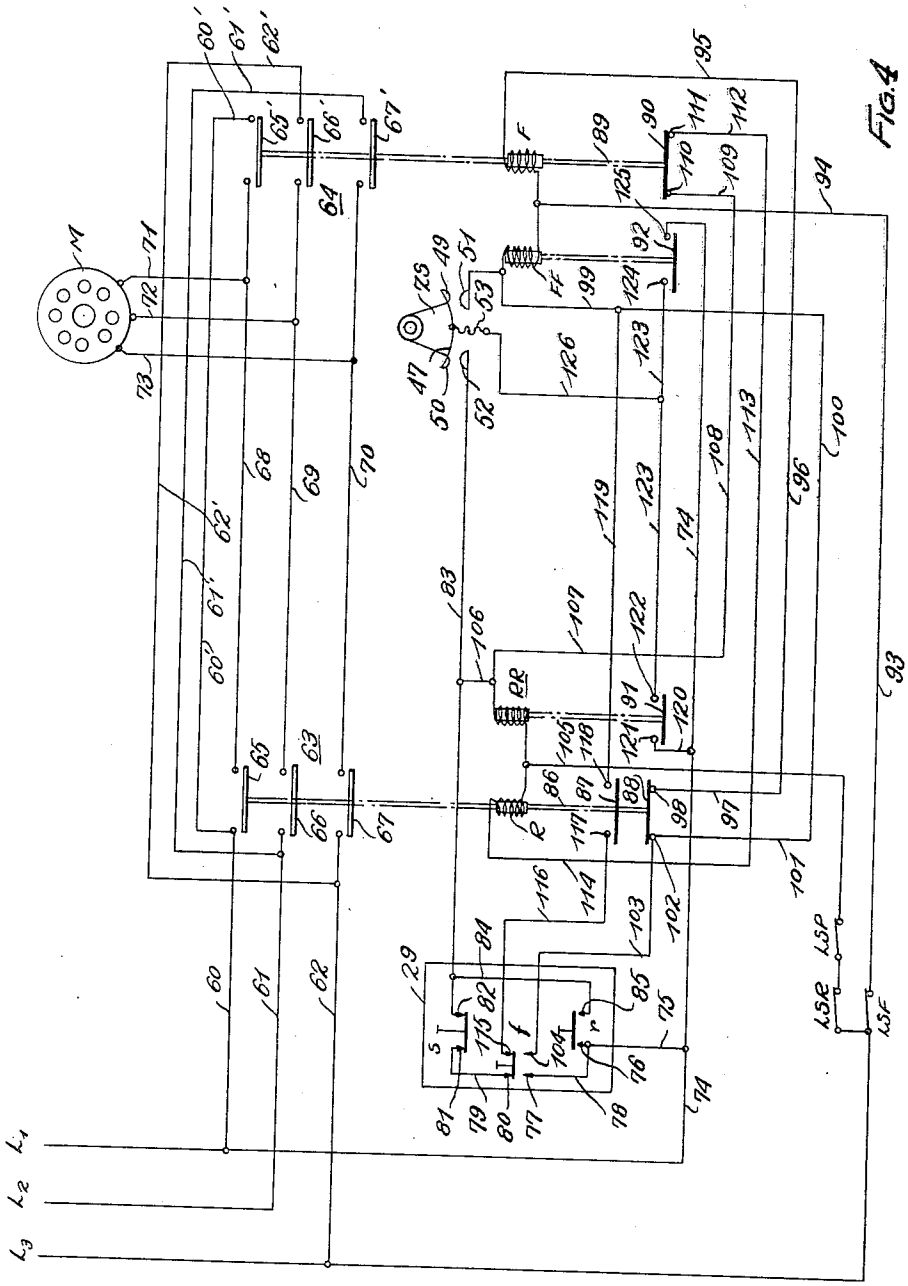


FIG. 4

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2,213,068

POWER BACK GAUGE

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Application March 7, 1939, Serial No. 260,433

8 Claims. (Cl. 164—59)

This invention relates to improvements in power back gauges, that is to say apparatus for controlling the application of power to cause the back gauge of a paper cutter to travel in the forward or rearward direction. In accordance with the present invention the driving motor is stopped quickly by reversing the direction of current flow, so that dynamic braking is utilized, sometimes called plugging the motor, this feature of the invention having the highly important result that no drag is imposed upon the apparatus and the latter is free to be actuated by means of the usual hand wheel. In other words, the operator by pressing the proper switch button can cause the electric motor to advance the back gauge to a position just short of the desired point of cut, stopping the motor and consequently the drive mechanism quickly and positively, after which he may operate the hand wheel to effect the final fine adjustment of the pile up to the cutting line.

I am aware that paper cutters have been equipped with motor drives and braking means therefor to effect a quick stop and prevent coasting, as for example in Lehman Patent 2,133,031, but the automatic application of brakes when the current to the motor is turned off means that the braking effort is present to oppose the actuation of the back gauge by hand for completing the necessary travel up to the point of cut. In order to be effective for quickly stopping the back gauge such braking effort must be substantial, and consequently it becomes quite difficult to operate the hand wheel.

One of the principal objects of the invention therefore is to provide braking for the driving motor without interposing resistance to hand operation of the back gauge.

Another object of the invention is the provision of a novel control system for the forward and reverse circuits to the motor.

A further object is the provision of means for automatically stopping the rearward travel of the back gauge at different selected points forward of the rearmost position, so that considerable time is saved in handling stacks of relatively short sheets.

Other objects and features of novelty will appear as I proceed with the description of that embodiment of the invention which, for the purposes of the present application, I have illustrated in the accompanying drawings, in which

Fig. 1 is a plan view of a paper cutter with the clamp and knife and most of the superstructure removed for the sake of clearness.

Fig. 2 is a side elevational view of the same.

Fig. 3 is a detailed elevational view of a zero speed switch which may be employed in connection with the invention.

Fig. 4 is a wiring diagram showing the control means for the driving motor.

In the drawings I have shown at 10 and 11 supports or legs upon which the table 12 is carried. The cutting stick 13 is mounted in a groove in the table in the conventional manner, the knife being indicated at 14 in Fig. 2. 15 is a back gauge of conventional form which is slidably supported upon the table for movement backward and forward and is provided with a depending plate 16 which projects downwardly through a longitudinal slot 17 in the table and carries an elongated nut 18 that encircles and engages a drive screw 19 also of conventional form journaled underneath the table. At its front end the screw 19 has pinned or otherwise secured thereto a hand wheel 20. As will be obvious the gauge 15 may be fed forward or backward by operation of the hand wheel.

Horizontal pulleys 21 and 22 are mounted on fixed elements of the machine near the front and rear ends thereof. An endless steel tape 23 runs upon the pulleys 21 and 22, being operatively connected with the gauge by means of a post 24 which is mounted in the gauge and is attached to the tape. The latter has a length scale engraved thereupon and is employed in the usual manner to indicate the position of the gauge, this being particularly advantageous upon a machine equipped with a driving motor because of the relatively rapid movement of the gauge in such machines.

The power drive for feed screw 19 is taken from an electric motor 25 carried upon the under side of the table and connected with the screw by means of pulleys 26 and 27 pinned to the motor shaft and feed screw respectively and a flexible belt 28. The motor is reversible and is accordingly capable of turning the screw in either direction so as to operate the gauge either forwardly or backwardly. Hand controls for the motor are contained in a switch box 29 at the front end of the machine convenient to the operator and comprise push button switches *r*, *f* and *s*. The *f* switch inaugurates and maintains forward movement of the back gauge so long as the switch button is depressed. Forward movement is usually by steps corresponding to the work travel that is necessary to bring the pile into position for the different lines of cut. The *r* switch inaugurates rearward travel, but directly after it has been depressed the operator may

remove his finger from the *r* switch and the rearward travel will continue until interrupted automatically as hereinafter explained or until the operator presses the *s* button which stops rearward travel immediately.

From the switch box 29 a conduit 30 extends rearwardly to a relay panel 31 supported upon the under side of the table. From the panel 29 another conduit 32 leads to the motor. From the main conduit 30 a branch conduit 33 leads to a front limit switch LSF provided with an arm 34 that is adapted to be engaged and actuated by an arm 35 mounted on the back gauge. A second limit switch LSP may be termed a portable limit switch since it is adjustable upon a fixed part of the machine, preferably upon one of the side gauges 36. A clamping screw 37 is provided for holding the switch in any selected position. This switch has an operating arm 38 that is adapted to be engaged by an upstanding plate 39 on the back gauge during the rearward movement of the latter. A flexible cable 40 carries the conductors for switch LSP from the main conduit 30 to the switch. A third limit switch LSR provided with an operating arm 41 is mounted beneath the table at the rear of the machine. The arm 41 is adapted to be engaged by a depending extension 42 on the nut 18 to stop rearward travel in the event that the limit switch LSP is not in use. The switch LSR is connected with the conduit 32 by a branch conduit 43.

Motor 25 has a double-ended shaft. The switch ZS known as a zero speed switch is operatively connected with one end of the shaft. This switch is illustrated somewhat in detail in Fig. 3 of the drawings. In that figure the motor shaft is shown at 44. It is provided with a pulley 45 over which extends a flexible belt 46 that is attached at its ends to a rock arm 47 pivotally connected with a support at 48. When the motor shaft rotates clockwise or anti-clockwise the arm 47 tilts to the right or to the left, as the case may be, and electric contact buttons 49 or 50 engage fixed contact buttons 51 or 52 respectively. A flexible conductor 53 connects rock arm 47 with a binding post 54, and a spring detent 55 tends to hold the arm 47 in the central position illustrated. Contacts 51 and 52 are electrically connected with binding posts 56 and 57 respectively. The friction between pulley 45 and belt 46 is relatively light and does not cause rapid wear, and if the belt should break the spring detent will return the switch to the middle or off position.

Referring now to Fig. 4, L_1, L_2 and L_3 represent line wires from which conductors 60, 61 and 62 lead to terminals of a magnetic contactor 63, further conductors 60', 61' and 62' leading to terminals of another magnetic contactor 64. Each of these contactors has three cross arms, those of contactor 63 being numbered 65, 66 and 67, while those of contactor 64 are numbered 65', 66' and 67', respectively.

It will be noted that the conductors 60 and 60' both lead to the upper cross arms of the two contactors. The conductors 61 and 62 however lead to the middle and lower arms 66 and 67 respectively of contactor 63, while conductors 61' and 62' have the reverse arrangement, that is to say they lead respectively to the lower and middle arms 67' and 66' of contactor 64. Corresponding terminals of the two contactors are connected by conductors 68, 69 and 70, and from these conductors leads 71, 72 and 73 extend to the motor M.

Switch box 29 is connected with line wire L_1 via conductors 74 and 75 which lead to lower contacts 76 and 77 for the reverse and forward push button switches *r* and *f* respectively, the connection between contacts 76 and 77 being by way of a short conductor 78. Another short conductor 79 connects an upper contact 80 for switch *f* with an upper contact 81 of the stop push button switch *s*. The other contact 82 of the latter switch is connected by a conductor 83 with the contact 52 of the ZS switch and a short conductor 84 joins conductor 83 with the remaining contact 85 of the push button switch *r*.

R and F are relay coils which when energized one at a time serve to raise the magnetic contactors 63 and 64 and cause the cross arms thereof to engage the corresponding terminals. The coil R also operates a relay armature 86 with cross arms 87 and 88. Coil F operates a relay armature 89 with the cross arm 90.

RR and FF are auxiliary relay coils, the armatures of which each have a single cross arm 91 and 92 respectively. From line wire L_3 there extends a conductor 93 within which is interposed limit switch LSF and a conductor 94 which leads to the two coils F and FF. From the opposite end of coil F conductors 95, 96 and 97 lead to a contact 98 normally engaged by cross arm 88, and from coil FF conductors 99, 100 and 101 lead to the other contact 102 for armature cross arm 88, while from this contact a conductor 103 leads to point 104 of push button switch *f*.

The lower ends of coils R and RR are connected together and a conductor 105 extends therefrom to line wire L_3 through limit switches LSP and LSR. The upper end of coil RR is connected by a short conductor 106 with conductor 83 and by other conductors 107, 108 and 109 with a contact 110 of relay 89, 90. The other contact 111 is connected by conductors 112, 113 and 114 with the upper end of coil R.

The remaining upper contact 115 of push button switch *f* is connected by a conductor 116 with a contact 117 located above the normal position of cross arm 87 on relay 86. The other contact 118 for the same arm is joined by a conductor 119 with conductor 99. A short conductor 120 extends from conductor 74 to a contact 121 located above the normal position of relay arm 91, and the other contact 122 of this relay is joined by a conductor 123 to a contact 124 for relay 92, the other contact 125 being connected directly with conductor 74. From conductor 123 a conductor 126 extends upwardly to and is electrically joined with flexible conductor 53 of the ZS switch.

The operation of the system embodies the following procedure: in order to move the back gauge forward from an idle position in which the control apparatus is in the condition illustrated in Fig. 4, the operator pushes in button *f* to electrically join contacts 77 and 104. Relay coil F is thereby energized through the following circuit: from line wire L_1 through conductors 74, 75 and 78, across contacts 77 and 104, then through conductor 103, cross arm 88 and conductors 97, 96 and 95 to coil F and back through conductors 94 and 93 to line wire L_3. Simultaneously coil FF is energized because of current passing as before through the contacts of switch button *f* and conductor 103 through conductors 101, 100 and 99 to coil FF and back to line wire L_3 through conductors 94 and 93. The energization of coil F raises the magnetic contactor 64 thereby completing circuits from the line wires L_1, L_2 and L_3 to the motor M to drive the latter

in the direction to cause forward travel of the back gauge.

The rotation of the motor in a forward direction swings the rock arm 47 of the zero speed switch ZS in the anti-clockwise direction, bringing the contacts 50 and 52 into engagement. A circuit is then set up from line wire L_1 through conductor 74, across cross arm 92, then in the raised position, through conductors 126 and 53 to the switch ZS and by way of contacts 50 and 52 and conductors 83 and 106 to coil RR and back through conductor 105, and limit switches LSP and LSR to line wire L_3. This raises cross arm 91 and seals in coil RR by way of conductors 74 and 120, relay 91, conductors 123, 126 and 53, switch ZS, conductors 83 and 106 to the coil, and back through conductor 105 and limit switches LSP and LSR to line wire L_3. The motor continues to run the back gauge forward so long as the operator continues to depress push button *f*, but when he lifts his finger the circuit through coil F is broken and magnetic contactor 64 falls. At the same time relay cross arm 90 falls to make connection across the contacts 110 and 111 whereupon a circuit is set up through reverse relay coil R as follows: through conductors 74 and 120, cross arm 91, conductors 123, 126 and 53, switch ZS, conductors 83, 106, 107, 108 and 109, cross arm 90 and conductors 112, 113 and 114 to coil R, and back through conductor 105 and limit switches LSP and LSR to the line L_3. Magnetic contactor 63 is thereby raised and current from the line is supplied to the motor M, tending to cause rotation in the opposite direction, or clockwise as viewed in Fig. 4. The motor therefore comes to a quick stop and begins to reverse, but the first movement in that direction causes the rock arm 47 to swing clockwise, opening the circuit through coil R at the contacts 50, 52. All parts of the system are therefore returned to the condition illustrated in the drawings.

If the operator should hold the button *f* depressed until the back gauge too nearly approaches the knife of the machine, switch LSF would be opened, cutting out coil F but not coil R. Current reversal would therefore occur as before and the back gauge would come to a quick stop.

When the back gauge is at the forward end of its travel and the operator desires to return it in order that a new pile of sheets may be arranged on the table, the operator momentarily depresses push button *r*. Circuits are then set up through coils R and RR, first from line wire L_1 through conductors 74 and 75, switch *r*, conductors 84, 83, 106, 107, 108 and 109, cross arm 90, conductors 112, 113 and 114 to coil R and back through conductor 105, and limit switches LSP and LSR to line wire L_3, also from conductor 83 through conductor 106 to coil RR and back through conductor 105 and limit switches LSP and LSR to the line. This raises magnetic contactor 63 and sets up current flow in the motor causing it to turn in a clockwise direction as viewed in Fig. 4, and bringing ZS switch contacts 49 and 51 into engagement.

The raising of the cross arm 91 sets up a circuit through FF by way of conductors 74 and 120, cross arm 91, conductors 123, 126, and 53, contacts 49 and 51 of switch ZS, thence to coil FF and back through conductors 94 and 93 to line wire L_3. The coil FF seals itself via conductor 74, cross arm 92, conductors 123, 126 and 53 and switch ZS to coil FF, and back through conductors 94 and 93 to the line. Auxiliary circuits through coils R and RR are then set up, first from line wire L_1 through conductors 74 and 120, cross arm 91, conductors 123, 126 and 53, switch ZS, conductors 99 and 119, cross arm 87 and conductor 116, across the upper contacts of push button switch *f*, through conductor 79 and push button switch *s*, through conductors 83, 106 to coil RR and also through conductors 107, 108 and 109, across cross arm 90, and through conductors 112, 113 and 114 to coil R and back through conductor 105, and limit switches LSP and LSR to line wire L_3. Hence after momentary depression of reverse push button *r* the latter may be released and the rearward movement of the back gauge will continue through the auxiliary circuit until the latter circuit is opened on account of the opening of one of the limit switches LSP or LSR. When this occurs coils R and RR are deenergized, but the coil FF continues to be energized. A circuit is then set up through coil F via conductor 74, cross arm 92, conductors 123, 126 and 53, switch ZS, conductors 99, 100 and 101, cross arm 88, conductors 97, 96 and 95 to coil F, and back through conductors 94 and 93 to the line. Magnetic contactor 64 is thereby raised and current flows through the motor M in a direction to oppose its motion at the time, thereby bringing it to a quick stop, whereupon the circuit is broken at the switch ZS.

In case the operator desires to interrupt the reverse movement of the back gauge before it is stopped by a limit switch, he depresses push button *s* which breaks the auxiliary or parallel circuit previously described, so that a stop is effected in the same manner as before.

It is also possible for the operator to stop rearward motion of the back gauge and inaugurate forward motion immediately by depressing the forward push button *f*, which by reason of breaking the auxiliary or parallel circuit at the push button results in plugging the motor to a stop and instantly starting it forward.

In practice the forward and reverse magnetic contactors 64 and 63 are mechanically interlocked to prevent any possibility of short-circuiting across the line.

Having thus described my invention, I claim:

1. In a paper cutter, the combination of a table, a back gauge movable thereover, a drive for said back gauge, a hand wheel for operating said drive, an electric motor also operatively connected with said drive, means for conducting current to said motor, and means for reversing the current connections to the motor to effect a quick stop, whereby the hand wheel may be turned thereafter without drag other than the load imposed by the resistance to movement of the back gauge itself.

2. In a paper cutter, the combination of a table, a back gauge movable thereover, a screw feed for said back gauge operable in either direction, an endless tape scale operatively connected with said gauge and movable lengthwise of the table for indicating the position of the gauge, a hand wheel for operating said screw feed, an electric motor also operatively connected with said screw feed, means for conducting current to said motor, and means for reversing the current connections to the motor to effect a quick stop, whereby the hand wheel may be turned thereafter without drag other than the load imposed by the resistance to movement of the back gauge itself.

3. In a paper cutter, a table, a side gauge affixed to the table, a back gauge slidable over

the surface of the table to advance the work to cutting position, a drive for said back gauge, an electric motor operatively associated with said drive, and a limit switch mounted on said side gauge for adjustment lengthwise thereof adapted to be actuated by a reverse travel of the back gauge, whereby the rearward travel of the back gauge may be automatically terminated at any one of a plurality of different points.

4. In a paper cutter, a table, a side gauge affixed to the table, a back gauge slidable over the surface of the table to advance the work to cutting position, a drive for said back gauge, an electric motor operatively associated with said drive, a control for said motor comprising means for inaugurating a rearward travel of the back gauge, and a limit switch mounted on said side gauge for adjustment lengthwise thereof adapted to be actuated by a rearward travel of the back gauge, whereby the rearward travel of the back gauge may be automatically terminated at any one of a plurality of different points.

5. In a paper cutter, a table, a back gauge slidable over the surface of the table to advance the work to cutting position, a drive for said back guage adapted to move the same rearwardly when a series of cuts have been completed, an electric motor operatively associated with said drive, a limit switch carried by a fixed part of the machine, said switch being adjustable to assume a plurality of different positions lengthwise of the direction of travel of the work and adapted to be actuated by the rearward movement of the back gauge, whereby the rearward travel of the back gauge may be automatically terminated at any one of a plurality of different points.

6. In a paper cutter, the combination of a table, a back gauge movable thereover, a drive for said back gauge, a hand wheel for operating said drive, an electric motor also operatively connected with said drive, means for conducting current to said motor, means for reversing the current connections to the motor to effect a quick stop, and a zero speed switch operatively associated with said motor for opening the motor circuit at the instant the motor shaft begins to turn in a reverse direction, whereby the hand wheel may be turned thereafter without drag other than the load imposed by the resistance to movement of the back gauge itself.

7. In a paper cutter, the combination of a table, a back gauge movable thereover, a drive for said back gauge, an electric motor operatively connected with said back gauge drive, a relay adapted to complete connections for energizing said motor to effect rearward travel of the back gauge, a hand switch for momentarily energizing said relay, a parallel circuit through said relay, a switch actuated by the rotation of the motor shaft for closing said parallel circuit, and means for opening said parallel ciricuit when said gauge reaches a predetermined point in its rearward travel.

8. In a paper cutter, a reversible electric motor, a forward relay and a reverse relay controlling the circuits to said motor to cause rotation thereof in the forward and reverse directions respectively, a switch in the circuit of each relay arranged to be opened by the energization of the other relay, a zero speed switch operatively associated with the shaft of said motor arranged to make contacts in the circuit for the forward relay when the reverse relay is energized and to make contacts in the circuit for the reverse relay when the forward relay is energized, whereby when the circuit for either relay is opened that for the other relay is automatically closed and remains closed until the motor shaft ceases to rotate and the zero speed switch opens.

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