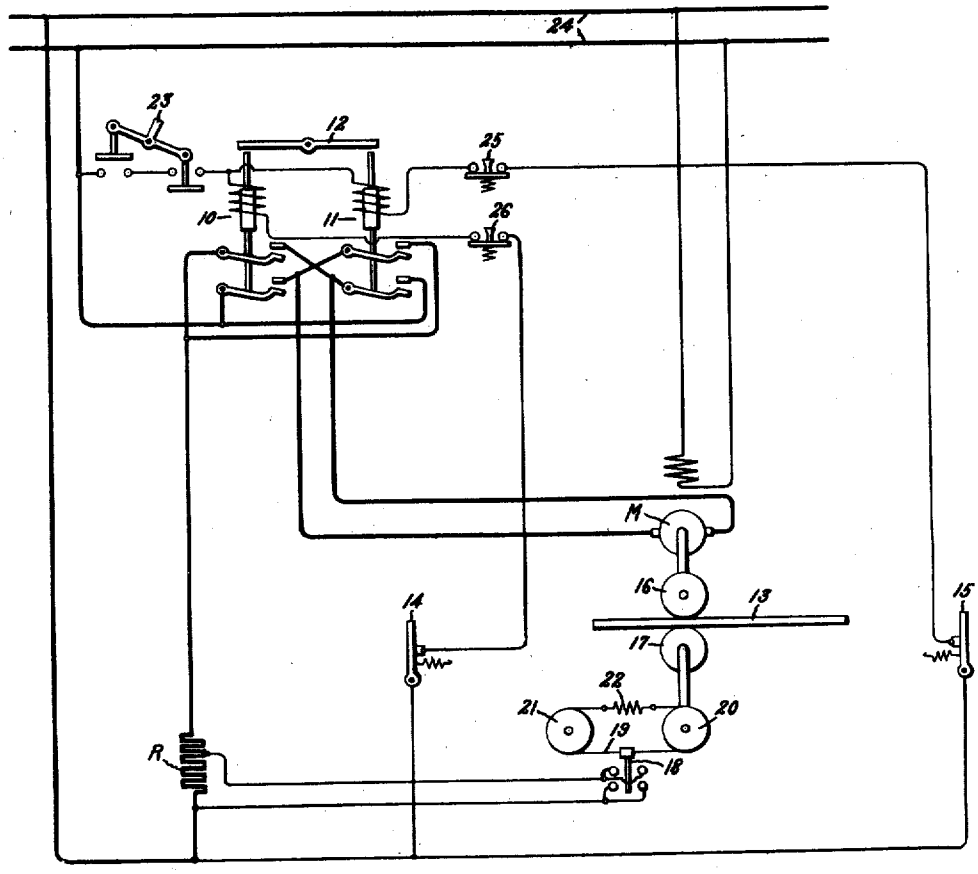
W. L. MERRILL.

AUTOMATIC REVERSING CONTROL.

APPLICATION FILED OCT. 14, 1921.

1,425,890. Patented Aug. 15, 1922.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC REVERSING CONTROL.

1,425,890. Specification of Letters Patent. Patented Aug. 15, 1922.

Application filed October 14, 1921. Serial No. 507,732.

To all whom it may concern:

Be it known that I, WILBUR L. MERRILL, a citizen of the United States, residing at Schenectady, in the county of Schenectady, State of New York, have invented certain new and useful Improvements in Automatic Reversing Controls, of which the following is a specification.

My invention relates to an improved automatic reversing control arrangement for controlling the electric driving motor of a machine which is intended to be periodically reversed, and the invention is directed to the provision of a very simple and reliable control of that nature.

It is customary to provide a pair of electro-magnetic reversing switches for controlling the direction of operation of an electric driving motor and to control the energization of these switches by limit switches operated at the predetermined limits of travel of the machine. It is also customary to interlock the reversing switches so that only one can be closed at a time. The usual arrangement is one in which only the reversing switch which is closed is energized, so that to provide a control whereby the reversing switches are alternately closed to periodically reverse the motor at the limits of operation has involved complications in the wiring.

In accordance with my invention, the reversing switches are arranged so that only one can be closed at a time, but they are normally energized so that all that is necessary to reverse the motor at a limit of operation is to temporarily deenergize the reversing switch which is closed, thereby permitting the other reversing switch to close. The reenergization of the first reversing switch produces no result until the motor operates to its other limit. The limit switches for controlling the reversing switches may therefore be normally closed, and only one is temporarily opened at each limit of operation.

My invention also provides a simplified manual control whereby the operator may select the initial direction of operation and whereby he may at any time interrupt the automatic operation of the machine and direct it manually as he desires.

While my invention is illustrated in connection with the drive of a pasteboard or cardboard finishing machine since it has a particular application thereto, the invention is not necessarily limited to such an application. For a better understanding of the invention, reference is had to the accompanying drawing wherein I have shown an embodiment of my invention in the control of a reversible cardboard finishing machine which is driven by the electric motor M. The armature circuit of this electric motor is adapted to be periodically reversed by the alternate closing of the electromagnetic reversing switches or contactors 10 and 11. The contactor 10 is provided for connecting the motor to operate in the forward direction, and the contactor 11 is provided for connecting the motor to operate in the reversed direction. These reversing switches are arranged so that only one of the switches can be closed at one time, and to that end the pivoted mechanical interlock 12 is provided between the switches, so that when one of the switches is closed, the other will be mechanically held open even though its winding is energized.

The windings of these reversing switches are connected so as to be normally energized during the operation of the motor between its limits of travel, and the arrangement is such that when the motor has operated the machine so that the article 13 operated upon by the machine comes into engagement with the limit switch 14, the forward contactor 10 is temporarily deenergized, and the reverse contactor 11 is thereby permitted to close. When the article 13, which may be a piece of cardboard operated upon by the machine, makes engagement with the limit switch 15, the winding of the contactor 11 is deenergized, and the contactor 10 is permitted to close to thereby reverse the motor and the machine at the limit of operation. The limit switches 14 and 15 may be mounted so as to be adjustable with respect to the rolls 16 and 17 of the machine, so that the machine may be adjusted to take care of different lengths of cardboard. The arrangement is such that after the limit switches are once adjusted and the equipment started, the machine will be periodically reversed at its limits of travel until the operator deenergizes the driving motor.

The resistor R is included in the motor armature circuit for limiting the rush of current at starting and upon reversing, and this resistor is controlled by means of what

may be termed a "string relay." This relay comprises a contact member 18 movable back and forth between two sets of stationary contacts, at each of which a portion of the resistor is short circuited. The switch member 18 is carried by a string 19 which is passed over the pulley 20 connected to the roll 17 and also over the pulley 21 which is arranged to be free running. The two ends of the string are connected by means of a spring 22, so that when the switch member 18 makes engagement with either one of its sets of contacts, the spring 22 is lengthened throughout the operation of the machine until a limit of travel is reached. When the equipment is stopped and reversed, the switch member 18 is brought into engagement with its other set of contacts to thereby again short circuit the portion of the resistor R. Between the intervals of operation in one direction and operation in the other direction, the resistor R is temporarily included in the motor circuit so as to limit the rush of current taken by the motor upon reversal.

As thus constructed and arranged, the operation of my invention is as follows: In order to start the equipment, the manually operated start and stop control switch 23 is operated so as to close its contacts and thereby energize the windings of the reversing switches 10 and 11 from the source of supply 24. If it is desired to start the equipment in the forward direction, the normally closed push button 25 in the coil circuit of the reverse contactor 11 will be depressed by the operator, thereby deenergizing the winding of this contactor and permitting the forward contactor 10 to close. The push button 25 may be then released to energize the winding of the reverse contactor 11. Inasmuch as the forward contactor has closed, the mechanical interlock 12 will prevent the reverse contactor 11 from closing even though its winding is energized. The motor will be connected to the source of supply 24 through the resistor R, but as soon as the equipment has operated for a short interval, the switch member 18 of the string relay will be operated so as to make engagement with its right hand set of stationary contacts and thereby short circuit a portion of the resistor. The initial rush of current at starting is thereby protected against, and the motor is permitted to accelerate to substantially full operating speed after the machine has started. If it is desired to start the equipment in the reverse direction instead of in the forward direction, the normally closed push button 26 will be temporarily depressed so as to permit the contactor 11 to first close.

When the left hand end of the cardboard 13 has been advanced so as to be brought into engagement with the normally closed limit switch 14, the contactor 10 will be temporarily deenergized and will thus open. Because of the fact that the energization of the reverse contactor 11 is maintained, this contactor will immediately close and thereby reverse the direction of current supplied to the motor armature. The contact member 18 of the string relay will be permitted to break engagement with its right hand stationary contacts and thereby reintroduce the protective resistance R in the motor circuit for an interval. An interval after the machine has begun operation in the return direction, the limit switch 14 is permitted to close so as to thereby reenergize the winding of the forward contactor 10, and the switch member 18 of the string relay is brought into engagement with its left hand set of stationary contacts to again short circuit the portion of the protective resistor R. When the right hand end of the cardboard 13 is brought into engagement with the normally closed limit switch 15, this limit switch is opened, thereby deenergizing the reverse contactor 11 and permitting the forward contactor 10 to close. The protective resistor R is again included in the motor circuit during the interval of reversal, and is automatically cut out again when the equipment has reversed.

It will be observed from the above that the periodic and automatic reversal of the machine will continue until the operator desires that the equipment shall stop. In order to stop the equipment at any time, the manually operated control switch 23 will be returned to the position shown in the drawing, thereby deenergizing both the contactors 10 and 11 and disconnecting the motor armature from the source of supply. While the equipment is operating, if the operator desires to effect the automatic reversal of the equipment before a limit of travel has been reached, he will temporarily depress the push button 26 if the machine is being operated in the forward direction, or depress push button 25 if the machine is operating in the reverse direction. If the push button 26 is temporarily depressed while the machine is being operated in the forward direction, the equipment is automatically reversed the same as if a limit of travel had been reached. The same is true of the effect of operating the push button 25 when the equipment is operating in the reverse direction.

It will be apparent from the above that my arrangement has obvious desirable features of simplicity. The limit switches 14 and 15 may be of the normally closed type, and no complicated interlocking need be provided to insure that the automatic reversal of the equipment will be effected as desired.

In accordance with the provisions of the

patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. The combination with a reversible electric motor operable in each direction between predetermined limits, a pair of alternately closed normally energized electromagnetic reversing switches for controlling the direction of operation of said motor, means for preventing either of said switches from closing while the other is closed, and means whereby at each limit of operation of the motor the reversing switch which is closed is temporarily deenergized to permit the other reversing switch to close and thereby reverse the motor and then energized when the motor is reversed so as to close when the said other reversing switch is temporarily deenergized at the other limit of operation.

2. The combination with a reversible electric motor, of means for automatically reversing the motor at predetermined limits of travel, comprising a pair of alternately closed normally energized electromagnetic reversing switches for controlling the direction of operation of the motor, means for preventing either of said switches from closing while the other switch is closed, a pair of normally closed limit switches connected to be opened responsively to the operation of the motor, each of said limit switches controlling one of the said reversing switches, and connections whereby the said reversing switches are alternately temporarily deenergized by the temporary opening of a corresponding limit switch at each limit of operation of the motor.

3. The combination with a machine, an article operated upon by the machine, an electric motor for driving the machine in a forward and a reverse direction, a pair of normally energized electromagnetic reversing switches, adapted to be alternately closed, means for preventing either of said switches from closing while the other switch is closed, limit switch mechanism operated by the said article for controlling the said reversing switches, and connections whereby the said reversing switches are alternately temporarily deenergized to periodically reverse the motor as the limit switch mechanism is operated by the said article at each limit of operation of the machine.

4. The combination with a machine and an electric motor connected thereto for driving the same in a forward and in a reverse direction, of an article operated upon by the machine, a pair of alternately closed normally energized electromagnetic reversing switches for controlling the direction of operation of said motor, a mechanical connection between the said switches for preventing either switch from closing while the other is closed, a pair of normally closed limit switches operated by the said article, each of said limit switches controlling one of the said reversing switches, and connections whereby the said reversing switches are alternately temporarily deenergized to periodically reverse the motor as a limit switch is operated by the article at each limit of operation of the machine.

5. The combination with a machine and an electric motor connected thereto for driving the same in a forward and in a reverse direction between predetermined limits of operation, a pair of alternately closed electromagnetic reversing switches for controlling the direction of operation of said motor, a mechanical connection between said reversing switches for preventing either switch from closing while the other is closed, manually operated switch mechanism for simultaneously energizing the said reversing switches, manually operated switch mechanism for temporarily deenergizing one of the reversing switches to permit the other reversing switch to close, and means whereby at each limit of operation of the machine the reversing switch which is closed is temporarily deenergized to permit the other reversing switch to close and thereby reverse the motor, and then energized when the motor is reversed so as to close when the said other reversing switch is temporarily deenergized at the other limit of operation.

In witness whereof, I have hereunto set my hand this 13th day of October, 1921.

WILBUR L. MERRILL.