H. K. SANDELL.

AUTOMATIC REVERSING SWITCH.

APPLICATION FILED SEPT. 12, 1916.

1,305,013.

Patented May 27, 1919.

2 SHEETS—SHEET 1.

Fig. 1.

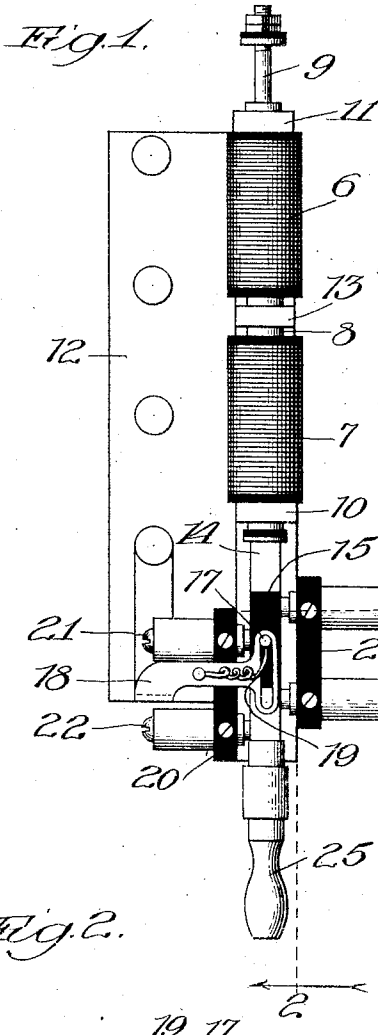


Fig. 3.

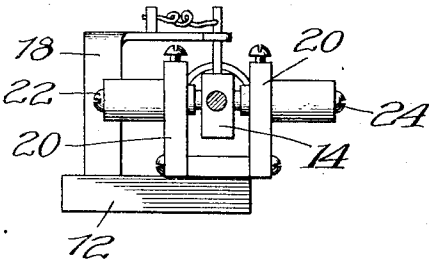


Fig. 4.

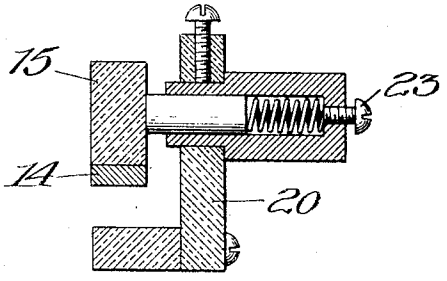
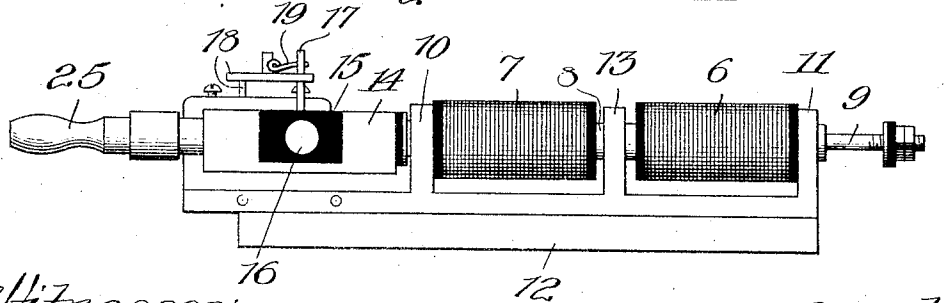


Fig. 2.



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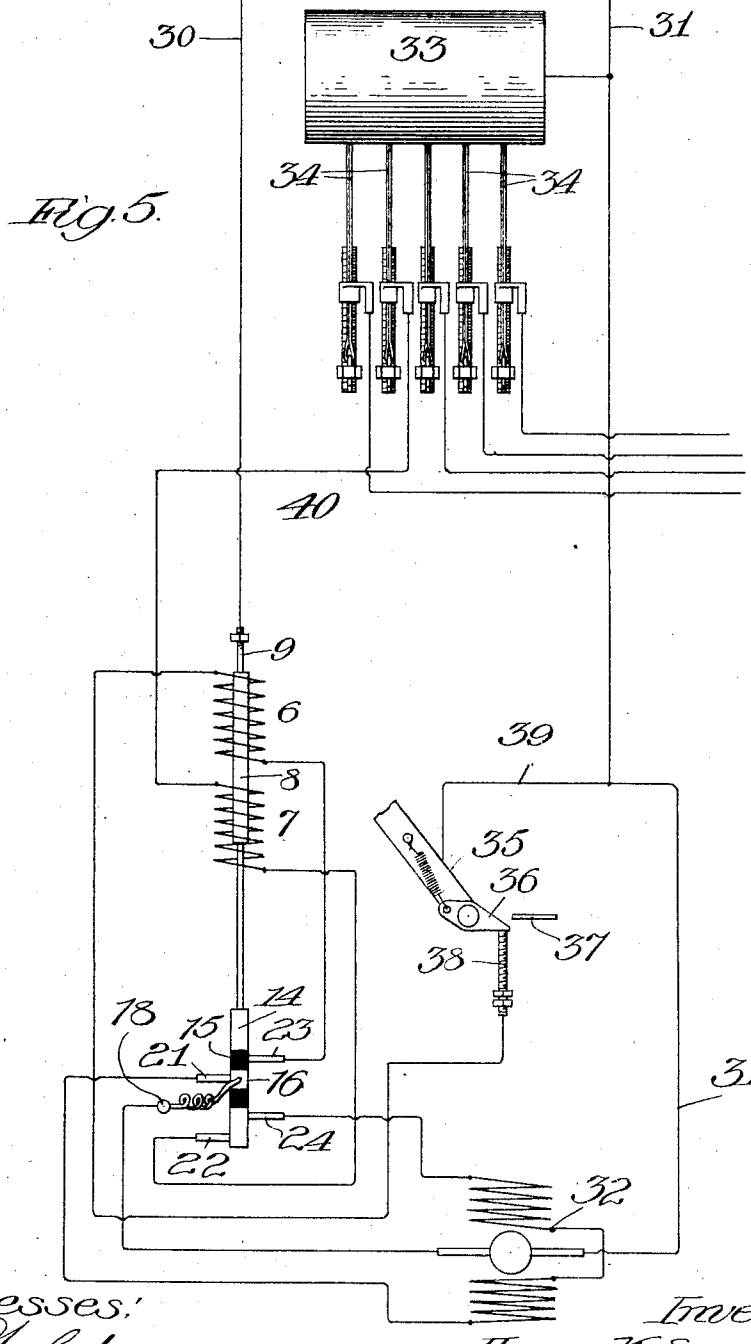
2 SHEETS—SHEET 2.

Fig. 5.



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UNITED STATES PATENT OFFICE.

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AUTOMATIC REVERSING-SWITCH.

1,305,013. Specification of Letters Patent. Patented May 27, 1919.

Original application filed December 22, 1914, Serial No. 877,846. Divided and this application filed September 12, 1916. Serial No. 119,657.

To all whom it may concern:

Be it known that I, HENRY K. SANDELL, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Automatic Reversing-Switches, of which the following is a specification.

My invention relates to certain new and useful improvements in reversing switches designed to be actuated automatically. More particularly, my present invention is designed for use in connection with music-sheet feeders, to accomplish the automatic reversal of the driving motor of such a device.

The invention will be fully understood from the following detailed description of a specific embodiment thereof, taken in connection with the accompanying drawings, in which:—

Figure 1 is a plan view of my improved switch; Fig. 2 is a side elevation thereof with two of the brushes removed to the right of the line 2 in Fig. 1; Fig. 3 is a section on the line 3 of Fig. 1; Fig. 4 is a section on the line 4 of Fig. 1, and Fig. 5 is a diagrammatic view showing the electrical connections of the switch as the latter is applied to the control of the music-sheet driving-motor in a mechanical musical instrument.

Referring more particularly to the mechanical construction of the device as illustrated in Figs. 1 to 4, there is shown a base-plate 12 carrying a pair of alined solenoid coils 6 and 7 through which passes a solenoid core 8 mounted upon the non-magnetic conductor rod 9 which extends from end to end and through the bores of the two solenoids, this bar being adapted to travel horizontally in slide-bearings 10, 11, at the outer ends of the two coils. An intermediate bearing 13 may be used for supporting the core 8 between the opposed faces of the coils.

That end of the rod 9 which projects beyond the coil 7 carries a switch-bar 14 of rectangular cross-section and having an insulating block 15 let into a notch or recess extending inwardly from its upper face. In the center of the block 15 there is mounted a conductor button 16 from which a conductor pin 17 extends upwardly to travel in a slot in the overhanging arm of a bracket 18 mounted on the base 12. To insure electrical connections between the pin 17 and the bracket 18, a flexible conductor 19 may be employed.

On either face of the switch-bar 14 the base 12 carries a brush-supporting bracket 20, the two brackets being offset from one another longitudinally of the switch, as shown in Fig. 1. Each of the brackets 20 carries two brush holders in which are mounted spring-held brushes designated 21, 22, 23 and 24. The mechanical construction is completed by a handle 25 which may be attached to the outer end of the rod 9 beyond the switch-bar 14.

In Fig. 5, I have illustrated my automatic reversing switch forming a part of the motor control of a music-sheet feeding-motor of the type shown and described in my co-pending application, Serial No. 877,846, filed December 22, 1914, of which application the present application is a division.

The electrical connections comprise the line-circuit wires 30 and 31, the motor designated as a whole by 32, and the contact devices interposed between these elements. In the particular example chosen, the contact devices comprise a metallic cylinder 33 in operative relation with which there are arranged brushes 34 which contact with the cylinder under certain predetermined conditions, as for example, through the perforations of a music-roll or music-sheet.

A second contact device is shown as an arm 35 carrying a pivoted contact finger 36 which, upon a certain predetermined motion of the arm, is designed to snap off of an abutment 37 to engage a contact screw 38.

The line-wire 30 is connected to the solenoid or plunger rod 9, while the line-wire 31 is grounded to the roller 33, and beyond the latter is connected to one brush of the motor 32, the other brush of the motor being connected with the bracket 18 and through the latter with the contact button 16 of the switch-bar. The two contact devices through which the operation of the reverse switch and by the latter the direction of rotation of the motor is controlled, are each interposed in shunt circuits, the contact 36, 38 being interposed in a shunt 39 extending between the line-wire 31 and the brush 23 and including the solenoid coil 6, while the con-

tact 33, 34, is interposed in a shunt 40 extending between the line-wire 31 and the brush 22 and including the solenoid coil 7. The fields of the motor 32 which, as will later appear, are illustrated as series fields, are interposed between the brushes 21, 24.

Assuming that the motor is turning and the line-circuit is closed, the shunt circuit 40 being open between the brush 34 connected therewith and the arm 33, it will be seen that the motor will receive current through the line 31, bracket 18, contact 16, brush 21, thence through the fields to the brush 24 and through the contact of the latter with the switch-bar 14 to the line-wire 30. Although the contacts 36, 38, are in engagement, the shunt 39 will be open by reason of the fact that the brush 23 which forms one terminal thereof rests upon the insulating block 15. It having been assumed that the contact of the shunt 40 was open at 33, 34, it will therefore be seen that neither of the solenoid coils 6 nor 7 will be energized. Assuming that at some time during the operation of the motor in the direction and under the conditions last described, and before it is designed to have the motor reversed, the shunt 39 is opened between the contacts 36, 38. It will be noted that this opening of the shunt 39 at the point mentioned will have no effect upon the system, the shunt being already open at 23. It is therefore immaterial at what time the arm 35 be actuated, so long as it is moved before the automatic reversal is to take place.

When such automatic reversal is to take place the shunt circuit 40 will be closed between the contacts 33, 34, and the full line voltage will thereby become effective to energize the solenoid coil 7. By the action of the latter, the core 8 will be drawn downwardly as viewed in Fig. 5, the magnetic power of the coil 7 being so great as to draw out the solenoid with a quick movement sufficient to throw the latter to its extreme position. By this movement of the solenoid plunger the switch-bar 15 will be correspondingly shifted downwardly as viewed in Fig. 5 until the brush 22 bears upon the insulating block 15. By the movement of the switch-bar therefore the energizing circuit of the solenoid 7 is automatically opened, the solenoid and its connecting parts having sufficient inertia to carry them to the extreme open position after the circuit of the coil has been broken. By this same movement of the switch bar 14 the brush 24 will be caused to contact with the button 16, while the brush 23 will ride onto the surface of the switch-bar and make contact through the latter with the brush 21. By this rearrangement of the connections the field of the motor 32 becomes energized in the opposite sense to cause the automatic reversal of the motor. The shunt circuit 39 is now closed between the brushes 21, 23, being open only at the contact 36, 38, so that when the latter is engaged the solenoid coil 6 will be energized to throw the switch-bar back into the position shown in the drawing, the shunt 39 being automatically opened between the brushes 21, 23, by this shifting movement.

Briefly, therefore, the electrical system comprises a service line having a motor therein, one winding of which is connected through a reversing switch, and a pair of shunt circuits each energizing a solenoid coil for the operation of the reversing switch, each solenoid being controllable by a separate reversing contact and the switch including connections by which the solenoid circuits themselves are alternately opened and closed by the reversing movement. In addition to its function as a means for reversing the motor, therefore, the reversing switch acts as a selector to cut out one of its own energizing circuits and to close its other energizing circuit. Although, there is normally no current used by the switch-controlling mechanism, the latter is always in readiness to operate by the engagement of the reversing contacts.

While in the foregoing specification I have described in considerable detail one specific embodiment of my reversing switch, and specific means for actuating the reversing contacts which energize the switch, it is to be understood that this description and the drawing accompanying the same is illustrative only and for the purpose of making clear the nature and objects of the invention and that I do not regard the invention as limited to the specific construction shown or described, nor to any feature thereof, except in so far as such limitations are included within the terms of the following claims in which it is my intention to claim all novelty inherent in my invention as broadly as is permissible in view of the prior art.

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

1. A reverse switch comprising a base-block, a pair of alining solenoid coils mounted on the base-block, an electrically conducting solenoid core movable within the said coils, one end of said core being connected with one pole of a source of current, a switch-bar connected with the said core and reciprocable thereby, contact brushes carried by said base and bearing constantly against the said switch-bar, connections between some of said contact brushes and said solenoid coils on one side of the latter and between the other pole and solenoids on the opposite side.

2. A reverse switch comprising a base-block, a pair of alined solenoid coils mounted on the base-block, an electrically conducting solenoid core movable within the said

coils, one end of said core being connected with one pole of a source of current, a conducting switch-bar connected with said core and reciprocable thereby, contact brushes carried by said base and bearing against said switch-bar, connections between some of said contact brushes and said solenoid coils on one side of the latter, and between the other pole and the opposite side of the solenoids, and means for interrupting said last named connections at predetermined times.

3. A reverse switch comprising a base-block, a pair of alined solenoid coils mounted on the base-block, an electrically conducting solenoid core movable within the said coils, one end of said core being connected with one pole of a source of current, a conducting switch-bar connected with said core and reciprocable thereby, contact brushes carried by said base and bearing against said switch-bar, connections between some of said contact brushes and said solenoid coils on one side of the latter and between the other pole and the opposite side of the solenoids, means for interrupting said last named connections at predetermined times, and contact devices actuated by movement of the switch bar for reversing the polarity of a line to be controlled.

HENRY K. SANDELL.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."