May 14, 1957 G. A. MABERRY 2,792,559

PLUG CONNECTOR REVERSING SWITCH

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FIG. 1.

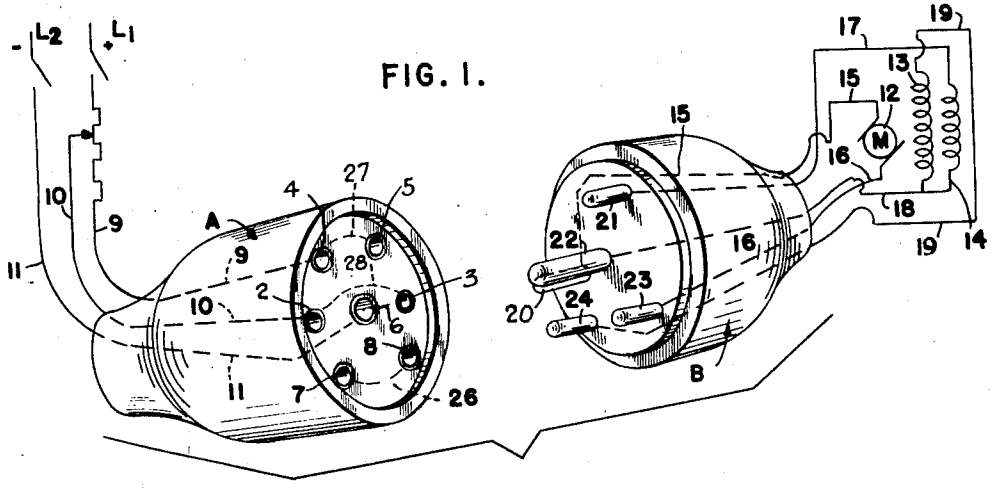


FIG. 2.

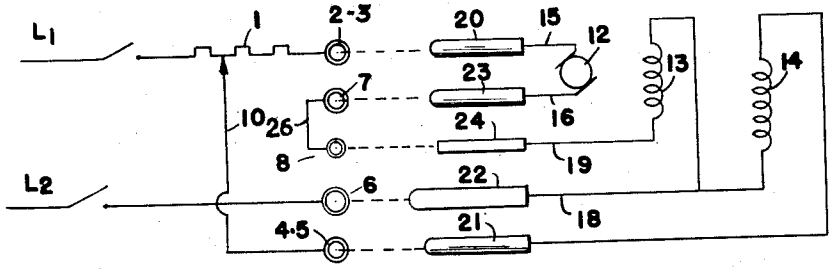
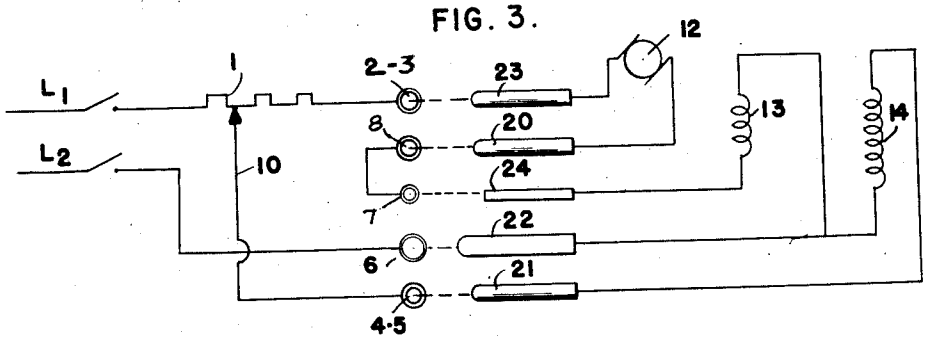


FIG. 3.



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FIG. 4.

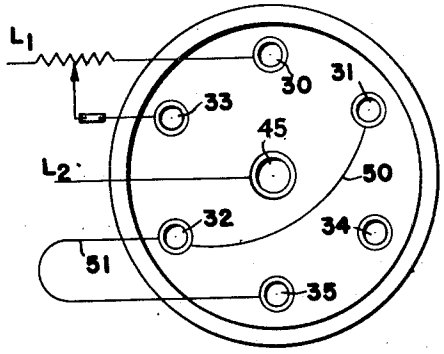


FIG. 5.

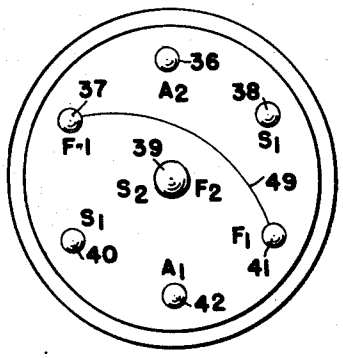


FIG. 5A.

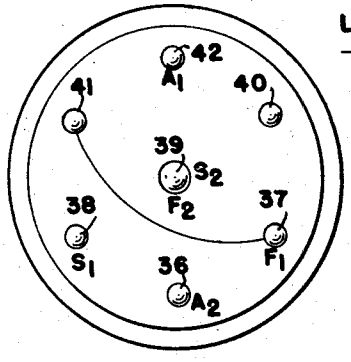
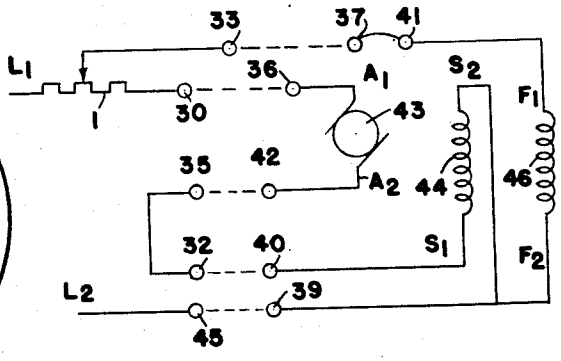


FIG. 6.



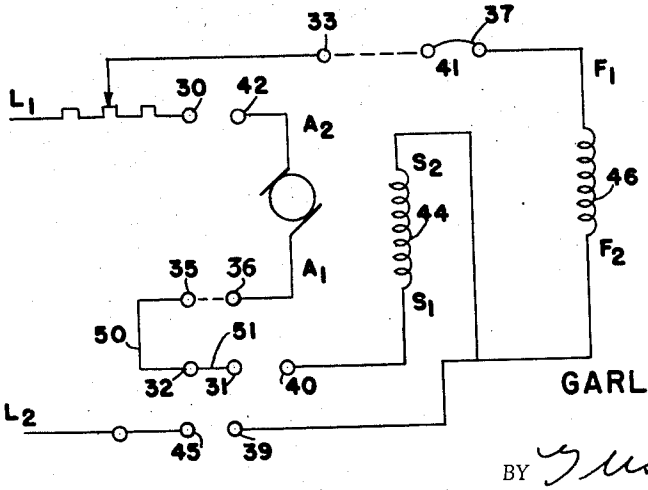


FIG. 7.

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FIG. 8.

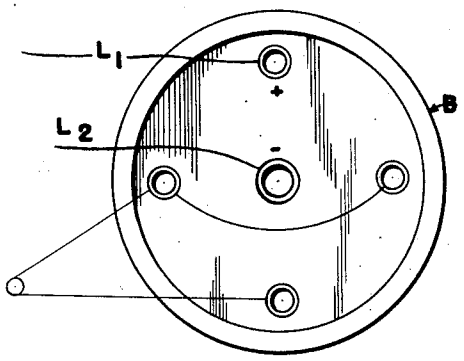


FIG. 9.

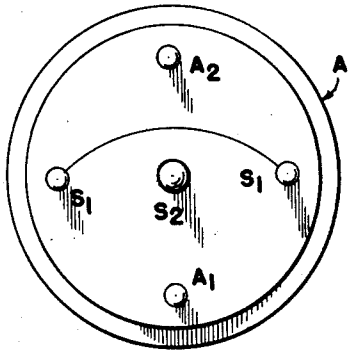


FIG. 9A

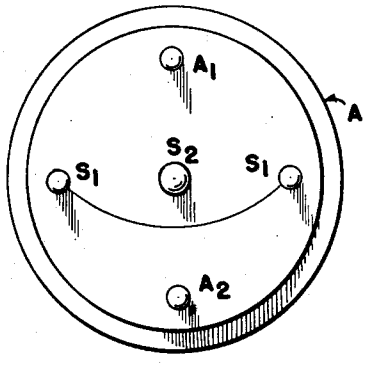


FIG. 10.

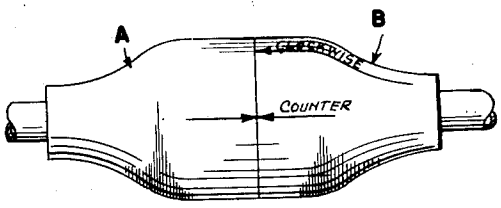
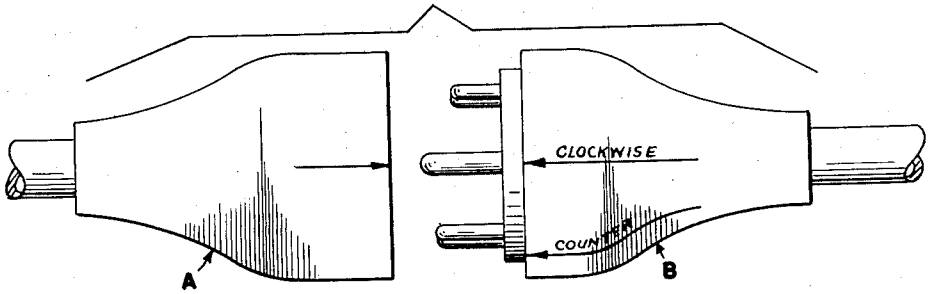


FIG. 11.



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United States Patent Office 2,792,559 Patented May 14, 1957

2,792,559

PLUG CONNECTOR REVERSING SWITCH

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Application March 2, 1953, Serial No. 339,644

1 Claim. (Cl. 339—31)

This invention relates to a push-pull plug connector type of reversing switch and particularly for the reversal of direction of running of a direct current motor, be it series, shunt or compound type.

While it is known to reverse the direction of running of direct current motors it has involved the laborious disconnecting and reconnecting of the various leads to accomplish the purpose. There apparently has been no means for readily, quickly and easily disconnecting the motor completely from the power source and reconnect the same with the same disconnecting plug for it to run in the opposite direction.

An object of the present invention is to provide a water tight reversing switch of the detachable plug type, that is safe and shock proof, fool proof and unaffected by vibration and rough usage.

Another object is to provide a type of plug switch comprising two separable plug members that are polarized so as to be connected in two different positions only so as to give two directions of rotation of a motor.

Another object is to quickly attach a motor to a source of power without the use of separate switches, panel boards, extra terminals or extra manipulations, the switching taking place in the cable portions to the power line.

Another object is to provide the motor reversing connection in detachable, flexible rubber plug parts that seal the electric terminals or contacts from gases, moisture or any foreign matter that could cause a leakage of current across a switch.

These and other objects and features of the invention are pointed out in the following description and shown on the accompanying drawings. The drawings being for the purpose of illustration only, they are not intended to determine the limits of the invention, other embodiments of the invention based on the same principle becoming apparent to those skilled in the field.

In the accompanying drawings:

Fig. 1 is a perspective view of one embodiment of plug connector reversing switch connected to a source of power and to a motor of the compound type.

Fig. 2 is a circuit diagram for the switch when connected together in one position for running of the motor.

Fig. 3 is a circuit diagram for the switch when connected in a second position for reverse running of the motor.

Fig. 4 is a schematic representation of the female plug corresponding to that in Fig. 1, but looking at the terminals from the cable end, the terminals being arranged differently than in Fig. 1.

Figs. 5 and 5A are two schematic representations of a male plug corresponding to that in Fig. 1, looking at the terminals from the end opposite its cable, the terminals arranged to cooperate with those of the female plug part in Fig. 4. The two views are 180° in angular displacement.

Fig. 6 shows the electric circuit for running the compound motor in accordance with the connections shown in Figs. 4 and 5A.

Fig. 7 shows the electric circuit for running the compound motor in accordance with the connection in Figs. 4 and 5, but in a reverse direction of running.

Fig. 8 is a view of a female plug similar to the showing in Figs. 1 and 4, but for connections to a series motor.

Fig. 9 is a view of the male plug cooperating with the plug of Fig. 8 and connected to the series motor.

Fig. 9A is a view of the male plug of Fig. 9 turned 180° for reverse running of the series motor.

Fig. 10 is a view showing the plug connector parts connected together for the motor to run counterclockwise as shown by the indicia.

Fig. 11 shows the same plug parts disassembled.

Referring to the drawings, the device comprises in general a motor circuit including a source of power, a length of cable from the power source leading into a flexible rubber female plug containing various terminals, a male plug which cooperates with the female plug, and of similar flexible rubber construction, one of the plug parts having a lip to overlap the other plug part, a cable integrally formed with the male plug, the cable extending into the motor frame of motor M.

More specifically, Fig. 1 shows a source of power L_1+ and L_2-. The female plug is of a flexible rubber type to withstand distortion and adapted to telescope the complementary plug to seal out moisture, etc. Two wire leads extend from the line, one going directly into the cable therefrom, the other having a resistor **1** in an intermediary portion. A third wire lead constitutes a tap off of the resistor **1** and passes into the cable and to the female plug A.

Seven pin socket terminals are shown in the female plug A six of which are each separated by a 60° angle of arc and designated **2** to **8**. In the plug, sockets **2** and **3** are bridged by a conductor **28** as are also sockets **7** and **8**, the reason being indicated below. Note that pivot pin socket **6** is common and at the center and acts as a center hub of rotations for the plug parts A and B to be connected in one of two positions.

Five pin terminals are in the male plug part B four of which are each separated by a 60° angle of arc. The upper pin **20** is connected by wire **15** to the commutator **12** of the motor M the other end of the commutator brush terminating in pin terminal **23**. Pin **21** leads to one end of the shunt field **14**, the other end of the shunt field **14** being connected to one end of the series field **13** and to the center common pivot pin **22** which may be made longer than others for maintaining the field circuit longer than the armature circuit. The second end of the series field **13** terminates in terminal pin **24**. Pins **20** and **23** may be made shorter than the others to assure a field circuit in the motor M.

The male plug B usually will be suspended from a multiple conductor cable containing all the leads extending outside the motor M.

From outward appearances the connected parts would seem to be the same as for any connected motor. However, this particular detachable plug connector can have either one of its parts rotated just one half of a complete turn and, thus, change the motor connections for reverse running. All that need be done is to separate the plugs and turn just one of the plug parts 60° or one-sixth of a complete 360° turn and then re-insert the plug. Indicators may be placed on the plug parts to show the proper alignment of contacts and direction of armature rotation. Pin sockets **4** and **5** of plug A are not employed in the circuit of Fig. 1 as described.

Fig. 2 shows the circuit when the plug parts are assembled in an alternate position with corresponding degrees of arc. The circuit is as follows:

From L_1 or plus the current passes to resistor 1, socket terminal 2 in female plug A, pin 20 on male plug B, wire 15, armature commutator 12, wire 16, pin 23 on male plug B, socket terminal 7 in female plug A, through a connecting bridge 26 to socket terminal 8, to pin terminal 24 in male plug B to wire 19, series field 13, wire 18 to pin terminal 22, socket terminal 6 and back to L_2 or —. The circuit for the shunt field connection is from L_1 to a tap on resistor 1 to a lead 10 in the cable to socket terminal 4, on female plug plug A, pin terminal 21 to shunt field 14 to wire 18 to pin 22 to socket terminal 6 and back to L_2. Pin sockets 2 and 3 are bridged by jumper wire 27.

These plug elements can be arranged to also match and engage when turned relative to each other 90° from the position shown in Fig. 1. In such case it will be noted from Fig. 3 that the armature connections are reversed. The circuits are as follows: L_1 to resistor 1, socket terminal 2, pin 23, armature 12, pin 20, socket terminals 7 and 8, pin 24, series field 13, pin 22, socket terminal 6 to L_2; also, for the shunt field the circuit is L_1 to resistor tap at 1 wire 10, socket terminal 4 connected to socket terminal 5, pin 21, shunt field 14 to pin 22, socket terminal 6 and back to L_2.

In Fig. 5 the added indicia F_1, and F_2, and S_1, and S_2, A_1, and A_2 refer to the two shunt field ends, series field ends and the armature ends respectively, it being understood the armature includes a commutator. The wires are designated 9 to 11 and 15 to 19.

Figs. 4 to 7 show other embodiments of the plug connection shown in Figs. 1 to 3, wherein these plug parts are turned different ratios of degrees of arc relative to each other for reversing the motor.

The plug parts are designed similar to those in Fig. 1 except for cross connections in the plug parts. In order to make it easier to see the relative positions of the engaging terminals, these figures are shown schematically; Fig. 4 being viewed from the cable end of the female plug and Fig. 5 being viewed from the pin end of the male plug.

In the plug parts, seven terminals are shown in each and the terminals are so arranged that the plugs can be connected in one definite position and only in one other position which is 180° in angular displacement. In the male plug, terminals 37 and 41 leading to one side of the shunt field 46 are bridged together electrically at 49. Numerals 36 to 42 designate the pin terminals to the motor connected plug part while numerals 30 to 35 and 45 refer to the female socket terminals. Socket terminals 31 and 32 for connection to one end of the series field winding 44 are bridged electrically at 50 and together to socket terminal for connection 35 by a loop 51.

The circuit for running the motor in one direction in this modification is as follows: L_1 to resistor 1, socket terminal 30, pin 36 to armature 43, to pin 42, socket terminal 35 to socket terminal 32, pin 40 series field 44, pin 39, socket terminal 45 to L_2; also L_1 through a resistor tap at 1, socket terminal 33, pin 37, shunt field 46, pin 39, socket terminal 45 to L_2. For the shunt field the circuit extends from L_1 to a tap resistor 1, socket terminal 33, pin 37, bridge 49, pin 41 to shunt field 46, pin 39, socket 45 to L_2.

For reverse running of the motor the circuit is L_1 to

resistor 1 to socket terminal 30, pin 42 to armature 43 at other end than before, pin 36, socket terminals 35, 32, 31, pin 40, series field 44 in the same direction as before, pin 39, socket terminal 45 and to L_2. The shunt field is in the same circuit as before. Its circuit is L_1, resistor to port 1, socket terminal 33, pin terminal 37 (with 41), shunt field 46, pin 39 and socket terminal 45 to L_2.

Figs. 8, 9 and 9A illustrate the modification for a series field motor wherein the plug parts are rotated 180° apart to reverse the motor and are shown in schematic form similar to Figs. 4 to 7. In this modification, the male plug A has two pins designated S_1 and bridged together while the female plug B has three socket terminals bridged together, one socket terminal being an idle one for receiving a pin on the male plug. Note the position of the S_1 terminals on the male plug are the same in Figs. 9 and 9A. Also, in both instances terminal S_2 is at the center of the plug. By turning one plug part 180° around the only change made is reversing the armature connections A_1 and A_2. The circuits would be obvious from the above.

In the case of a shunt field motor the only change required with the first two modifications referred to in this specification is the omission of the series field connections. As shown above, reversal of a plug part merely reverses the armature with respect to the field.

The above described plug connector switch eliminates any wrong connection because of size of pin terminals. Any form of pilot may be included in the connector to guide the plug parts in only two interengaging positions. The motor is easily and very quickly connected without necessity of going to some switch board or utilize auxiliary equipment.

While the device has been shown and the structure described in detail, it is obvious that this invention is not to be considered as being limited to the exact form disclosed, and that changes in detail and construction may be made therein within the scope of what is claimed, without departing from the spirit of this invention.

Having described the invention, what is claimed as new is:

A motor reverser comprising one plug part attached to a motor cable, a second plug part attached to a power cable, pin and socket terminals secured in the plug parts, certain of the pin and socket terminals leading to field winding of the motor being longer than the armature terminals in the plug, means for attaching the plug parts in one of two predetermined radial positions; and electrical bridging means for certain of the terminals in at least one of the plug parts.

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