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STARTING MOTOR SWITCH

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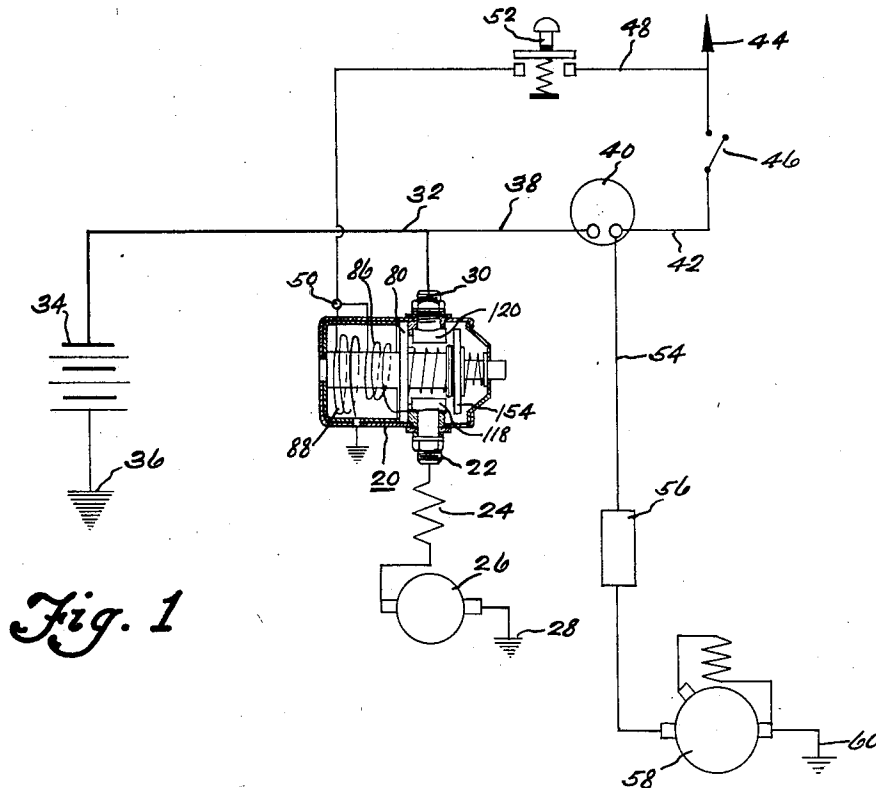


Fig. 1

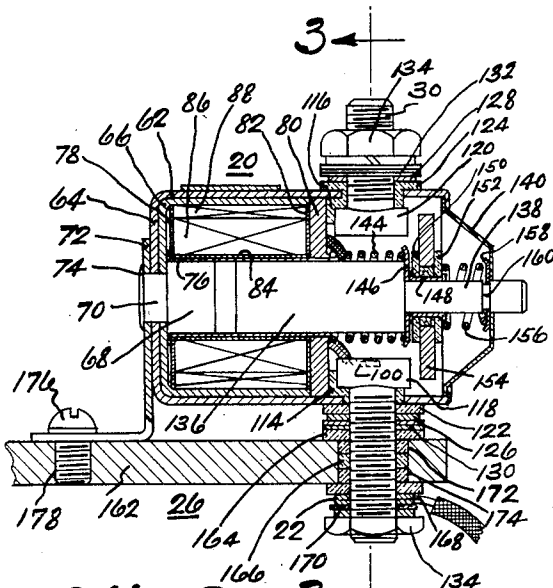


Fig. 2

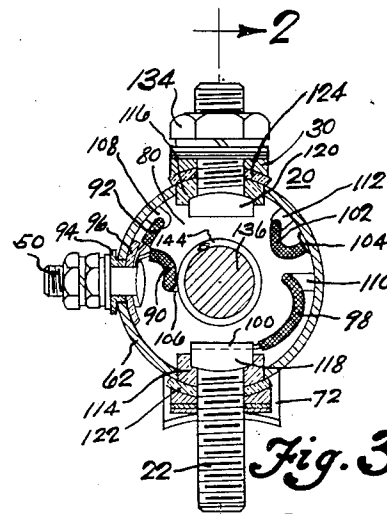


Fig. 3

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STARTING MOTOR SWITCH

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10 Claims. (Cl. 200—87)

This invention relates to starting motor switches and is directed particularly to the type of electromagnetic switch to be mounted on the frame of a starting motor.

5 It is one of the objects of this invention to provide a simplified and efficient mounting for the switch. This object has been accomplished by utilizing one of the starting motor switch contacts of the electromagnetic device as a supporting stud that may be passed through the frame of the starting motor and thence be electrically connected with the windings of the said starting motor.

Another object of the invention is to provide 15 an electromagnetic starting motor switch that will be thoroughly efficient, and that will consume the minimum amount of energy. This object has been accomplished by forming the windings of the electromagnet into a pair of superimposed layers of windings in parallel and so connecting them into the starting motor circuit as to accomplish the by-passing of one winding and the maintenance of only one of the windings in circuit directly after the starting motor contacts have been closed.

A further object of the invention is to simplify the electrical connections of the circuits through the electromagnetic switch device. This object has been accomplished by connecting one of the 30 windings with one of the switch contacts, by grounding the other winding upon the enclosing casing and by providing a common current supply terminal for both windings, and thence providing a grounding connector for the casing.

A further object of this invention is to simplify the electromagnetic structures of the type disclosed. This has been accomplished by providing a casing assembly including a magnet cup with a grounding connector and a shouldered core member, which core member passes through each of the three and holds them together. A second subassembly is formed comprising a spool member, which insulatingly carries a pair of magnet windings disposable within the magnet cup 45 and about the core member and which are retained in place by an annular pole piece, snugly fitting within the casing and held in place by insulators each supporting a switch contact. A third subassembly comprising an armature insulatingly and yieldingly supporting a movable contact is axially supported within the case by a closure member.

A further object is to provide an electromagnetic starting motor switch adapted to be at 55 least semi-automatic and that will consume the

minimum amount of current when inserted in a starting motor circuit of the type illustrated. This has been accomplished by dividing the windings of the electromagnet into two sections which are connected in parallel and joined to a common terminal, and each section having its opposite end connected severally as disclosed. One of the sections constituting the holding or retaining coil has its opposite end grounded to the enclosing casing and thence to the frame 10 of the structure to be controlled, and the other section has its other end of the coil connected to the battery terminal of a starting motor device, both of said windings being connectible in parallel with a source of energy, whereby both 15 will be energized to act upon the armature to close the starting motor circuit, and whereby the larger of said winding will be substantially shunted from the circuit upon closure of the starting motor contacts.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred embodiment of one form of the present invention is clearly shown. 25

In the drawing:

Fig. 1 is a diagrammatic illustration of a starting motor circuit into which the instant device may be connected.

Fig. 2 is a longitudinal sectional view of the 30 instant electromagnetic starting motor switch and its mounting upon the frame of the starting motor.

Fig. 3 is a transverse sectional view of the starting motor switch substantially as indicated 35 by the line and arrows 3—3 of Fig. 2.

With particular reference to the drawing 20 indicates the improved electromagnetic starting motor switch having a combined switch contact and starting motor battery terminal post 22, 40 connectible to the field winding 24 of a starting motor 26 that is eventually grounded at 28. A combined switch contact and battery terminal 30 is also provided by the electromagnetic switch 20 and is adapted to be connected by a lead 32 with 45 a battery 34, which in turn has a ground connection at 36. Branching off from the conductor 32 is a lead 38 joining an ammeter 40 that is provided with a lead 42 having communication with an ignition coil, not shown, but indicated by the arrow 44, which communication is controlled by the usual switch 46. Between the ignition coil 44 and the switch 46 a lead 48 is taken off that communicates with a terminal post 50 carried by the electromagnetic structure, and that is de- 55

signed to control circuits therethrough by the agency of the controller switch 52, all of which is illustrated in Fig. 1. From the instrument side of the ammeter 40 another lead 54 is taken off that communicates with the generator cutout device 56 that controls the output of the generator 58 grounded at 68, whereby the battery 34 may be reconditioned upon operation of the automotive engine to supply the needs of the starting motor 26 and its electromagnetic switch 20.

The electromagnetic switch 20, when considered in detail comprises a casing 62 substantially tubular in formation but providing the bottom or closed end member 64 and within which is telescopically fixed a magnet cup 66 by means of a shouldered core member 68 whose shank 70 passes through the bottom walls of the casing and cup, the end of the case member being peened over or otherwise secured against a grounding connector 72 as indicated at 74. Within this subassembly a winding subassembly is disposed which comprises a nonmagnetic sleeve or tube 76 at one end of which is secured a dielectric head member 78, and supporting at the other end an annular pole piece 80 against the inner side of which is disposed a dielectric head member 82 so that there is provided a spool structure the bottom and side walls of which are lined by the dielectric members, the dielectric head members being initially held in separation by nonconducting or dielectric tube 84. Within this spool member is disposed an inner winding 86 superimposed by, or circumferentially embraced by, an outer winding 88, and both of which windings have leads 90 and 92 respectively electrically joined to the terminal member 50 hereinbefore mentioned and which terminal is insulatingly supported by the members 94 and 96 from the casing 62. The outside lead 98 of the inside coil is electrically connected to the switch contact 22 as is indicated at 100, and the outside lead 102 of the outside coil is grounded upon the casing 62 as indicated at 104. To make provision for the leads 90, 92, 98 and 102 the pole piece 80 is notched appropriately as at 106, 108, 110 and 112 so that these leads may be brought to the contact or terminal compartment of the casing where the various connections may be made.

As illustrated in the drawing the casing 62 provides apertures in the side walls for mounting of the combined switch contacts and terminal members 22 and 30, and this is accomplished by providing insulators 114 and 116 disposed in large apertures of the casing which have passages therethrough and recesses for receiving the non-rounded heads 118 and 120 of the members 22 and 30 respectively. After these terminal members are passed through the insulators 114 and 116 they are threaded with insulating washers 122 and 124 that are followed by plain metallic washers 126 and 128 held in place by one or more lock washers 130 and 132 and subsequently provided with the usual terminal nuts 134. The insulators 114 and 116 are of such extent that their portions within the casing are disposed against the pole piece 80 and thus retain it and the windings it supports against the bottom wall 64 of the casing.

An armature 136 is mounted for movement within the magnetic structure and has fixed thereto or included therewith a reduced end or pilot 138, and which is guided in its movement by the aperture in a head or closure member 140 secured within the end of the casing 62. Means are provided for maintaining the armature 136 in a retracted position which includes a compres-

sion spring 144 disposed against the pole piece 80 and engaging a cupped washer 146 carried by the pilot 138. The pilot 138 also carries a sleeve 148 that has its ends turned over against a pair of insulators 150 and 152 that insulatingly support a movable contact member 154 which upon actuation is engageable with the end faces of the heads 118 and 120 of the aforesaid switch contacts. This movable contact 154 is loosely carried by the pilot 138 and insulated therefrom by the members 150 and 152, it being maintained against the shoulder, or against the end of the armature 136 by means of a spring 156 disposed against the insulator 152 and engaging a cup-like C-washer 158 retained in an annular groove 160 provided by the pilot 138.

Means are provided for mounting this electromagnetic switch upon the frame member 162 of the starting motor 26, that includes the combined switch contact and terminal member 22 hereinbefore referred to. The member 22 is of sufficient length to pass through the frame member 162 in addition to insulators 164 and 166 along with a terminal member 168 and the necessary clamp washers 170, so that the starting motor lead 168 from the field winding 24 may be connected therewith. In following this practice the aperture 172 in the frame member 162 is sufficiently large to receive the insulating means 174 so that the terminal member 22 will in no way make electrical contact with the frame member 162.

For the purpose of completing the ground connection of the holding coil 88 the grounding connector 72 that is secured in metallic contact with the casing 62 is maintained in conductive relation with respect to the frame member 162 by means of a screw 176 driven into the frame member 162 as at 178. The grounding connector 72 incidentally adds somewhat to the support of the switch device upon the frame member, but it is deemed sufficient that the support shall obtain primarily from the combined switch contact and terminal member 22 that has its head member 118 disposed within the casing member 62 and its shank portion passing through the insulator, washers and starting motor frame where the member 22 cooperates with the terminal nut 134 to draw the members closely into engagement and to hold the parts firmly in position.

A structure of this kind when inserted in the electrical circuit of a starting motor system is operable upon closure of the switch 52 to close the starting motor circuit from the battery 34 through the lead 32, members 22, 154 and 30, to the winding 24 of the starting motor. On the initial closure of the switch member 52 energy from the battery 34 is led to the terminal member 50 and thence divides with a portion of the energy traversing both of the coils 86 and 88 which together are sufficient in strength to actuate the armature 136 thereby drawing the movable contact 154 into engagement with the members 118 and 120. When this is accomplished a much shorter path and one of less resistance will be established between the battery 34 and the starting motor 26, and since the coil 86 has connection with a terminal member 118 closure of these contacts will by-pass or shunt out the same.

The remaining branch of the electromagnetic windings, or in other words the holding coil 88 will not be shunted out by bridging of the conductors 118 and 120 but will be maintained in circuit so long as the switch 52 is closed. The wind-

ing 88 is of sufficient strength when energized to hold the armature 136 in its attracted position, so that the contacts 118 and 120 will be maintained in their bridged relation by the member 154. Since the holding coil 88 is sufficient to retain the armature 136 in the attracted position, and the coil 86 is by-passed or shunted out when the bridging relation of the starting motor contact obtains the electromagnetic switch will not draw unduly upon the energy source but a minimum of battery current will be drawn. As soon as the controlling switch 52 is released so that the electromagnetic circuit is opened, the armature assembly will return to its retracted position by reason of the spring 144, carrying with it the movable contact 154, and under those conditions no current energy will be drawn by the electromagnetic switch.

The contact assembly carried by the armature and pilot is of such design that the member 154 will wobble thereon sufficiently to engage both of the contact members 118 and 120, or in other words will hunt its proper position. The additional spring 156 carried by the pilot permits further movement of the armature 136 even after the contact 154 has been moved into engagement with the switch contacts 118 and 120, yet is of such resistance to compression as to preclude actual engagement between the armature 136 and the core member 68. This also provides for a cushioning action of the armature and contact when actuated.

While the form of embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. An electromagnetic starting motor switch adapted to be mounted upon the frame of the starting motor, comprising in combination, a cup-like casing providing a substantially closed end, magnet windings secured adjacent the closed end of said casing, a plurality of circuit terminals with insulators carried by the casing, two of said circuit terminals forming switch contacts, means including some of said circuit terminal insulators for maintaining the windings against the bottom of said cup, and an armature assembly including a movable contact for bridging two of said circuit terminals, a grounding connector secured to said casing, and means including one of said circuit terminals and said grounding connector for mounting said electromagnetic switch upon the starting motor frame so that the axis of the casing is substantially parallel to the axis of the frame.

2. An electromagnetic starting motor switch adapted to be mounted directly upon the frame of a starting motor, comprising in combination, a casing having two borings disposed opposite each other and at right angles to the axis of the casing, windings for an electromagnet secured within the casing and one of said windings being grounded upon the casing, a pair of starting motor switch terminals extending through the borings and insulatingly supported by the casing, a movable contact assembly adapted to bridge the said switch terminals, and means including one of said switch terminals for rigidly mounting said magnetic switch upon the frame of the starting motor so that the lead connections to and between the electromagnet and the starting motor may be as short as possible.

3. An electromagnetic starting motor switch

comprising in combination, a tubular casing having a closed end, magnet windings disposed against the closed end of the casing, switch terminals insulatingly supported by the opposite end of the casing, an armature and contact assembly movable to engage said switch contacts, and an L-shaped bracket for grounding said casing and for supporting said electromagnetic switch upon the frame so that the axis of the casing is substantially parallel to the axis of the frame of the starting motor, said switch supporting means including one of said switch terminals.

4. An electromagnetic switch for starting motors comprising in combination, a tubular casing having a closed end, a magnet winding assembly secured in the closed end half of the casing, starting motor circuit terminals insulatingly carried by the open end half of the casing and arranged diametrically opposite each other, a movable contact assembly and an end closure for the casing for guiding said movable contact assembly, means for mounting said electromagnetic switch so that the axis of the electromagnetic switch is substantially parallel with the axis of the frame of the starting motor, said means including one of said starting motor circuit terminals.

5. An electromagnetic switch adapted to be mounted upon the frame member of an electrical device that it is designed to control, the combination comprising, a casing, magnet windings, an armature assembly to be actuated by the windings, a movable contact carried by the armature assembly, a pair of switch terminals located diametrically opposite each other and carried by and extending through the casing and adapted to be engaged by the movable contact within the casing, circuit terminals provided for said windings, and means for securing said switch structure to the frame member of said electrical device, said last means including one of said switch terminals that makes connection with the said device.

6. An electromagnetic starting motor switch comprising in combination, a casing, switch contacts carried by the casing and insulated therefrom, a movable contact, an electromagnet for actuating said movable contact comprising, an inner winding and an outer winding, a terminal member carried by the casing insulated therefrom and having a common connection with both of said windings, means connecting the inner winding to one of said switch contacts, means grounding the outer winding to the casing, means for supporting said magnetic switch about an axis parallel to the axis of the frame of a device to be controlled, said last means including one of said switch contacts, and means for grounding the casing upon the frame of said device comprising an angular bracket secured to the casing.

7. An electromagnetic starting motor switch comprising in combination, a tubular casing with a closed end, a magnetic cup fitting within the casing, said casing and cup having their bottom members adjacent and being apertured coaxially thereof, the grounding connector and a shouldered core member securing said casing, cup and grounding connector into a single sub-assembly, a winding sub-assembly disposed within the cup and comprising a pair of windings in parallel, a pole piece engaging the cup member and dividing the casing into a magnet compartment and a terminal compartment, a battery terminal and switch contact carried by the casing and disposed in the terminal compartment, a starting motor terminal and switch contact carried by the casing

and having a portion thereof disposed in the terminal compartment, a movable contact and armature assembly actuatable by both of said windings for bridging said switch contacts, and means for supporting said switch upon the frame of the starting motor including said starting motor terminal and grounding connector so that the axis of the switch is substantially parallel to the axis of the frame.

8. An electromagnetic starting motor switch comprising in combination, a casing, switch contacts carried by the casing and insulated therefrom, a movable contact, an electromagnet for actuating said movable contact comprising, an inner winding and an outer winding, a terminal member carried by the casing insulated therefrom and having a common connection with both of said windings, means connecting the inner winding to one of said switch contacts, means grounding the outer winding to the casing, means for energizing both windings to actuate the movable contact, whereby said inner winding will be shunted out, means for supporting said magnetic switch so that the axis of the switch is substantially parallel to the axis of the frame of a device to be controlled, said last means including one of said switch contacts, and means for grounding the casing upon the frame of said device comprising an angular bracket secured to the casing.

9. An electromagnetic starting motor switch comprising in combination, a tubular casing with a closed end, a magnetic cup fitting within the casing, said casing and cup having their bottom members adjacent and being apertured coaxially thereof, the grounding connector and a shouldered core member securing said casing, cup and grounding connector into a single sub-assembly,

a winding sub-assembly disposed within the cup and comprising a pair of windings in parallel, a pole piece engaging the cup member and dividing the casing into a magnet compartment and a terminal compartment, a battery terminal and switch contact extending through the casing at equally spaced intervals and disposed in the terminal compartment, a starting motor terminal and switch contact carried by the casing and having a portion thereof disposed in the terminal compartment, a movable contact and armature assembly actuatable by both of said windings for bridging said switch contacts, a third terminal carried by the casing to which both windings have a connection, means for short circuiting one of said windings upon actuation of said movable contact, and means for supporting said switch upon the frame of the starting motor including said starting motor terminal and grounding connector so that the axis of the switch is substantially parallel to the axis of the frame of the starting motor.

10. In a starting motor having an electromagnetic switch for controlling circuits therethrough the combination comprising, a cup-like casing enclosing the magnet, a plurality of circuit terminals supported by the casing and accessible from the exterior thereof, a grounding strap for the casing, and means for mounting the magnet upon the starting motor including the grounding strap and one of said circuit terminals so that the axis of the switch is parallel to the axis of the starting motor whereby the electrical connections between the electromagnet and the starting motor may be as short as possible.

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