April 18, 1933. F. GUETTNER, JR 1,903,761

AUTOMATIC ELECTRIC STARTER FOR INTERNAL COMBUSTION ENGINES

Filed April 14, 1931 2 Sheets-Sheet 1

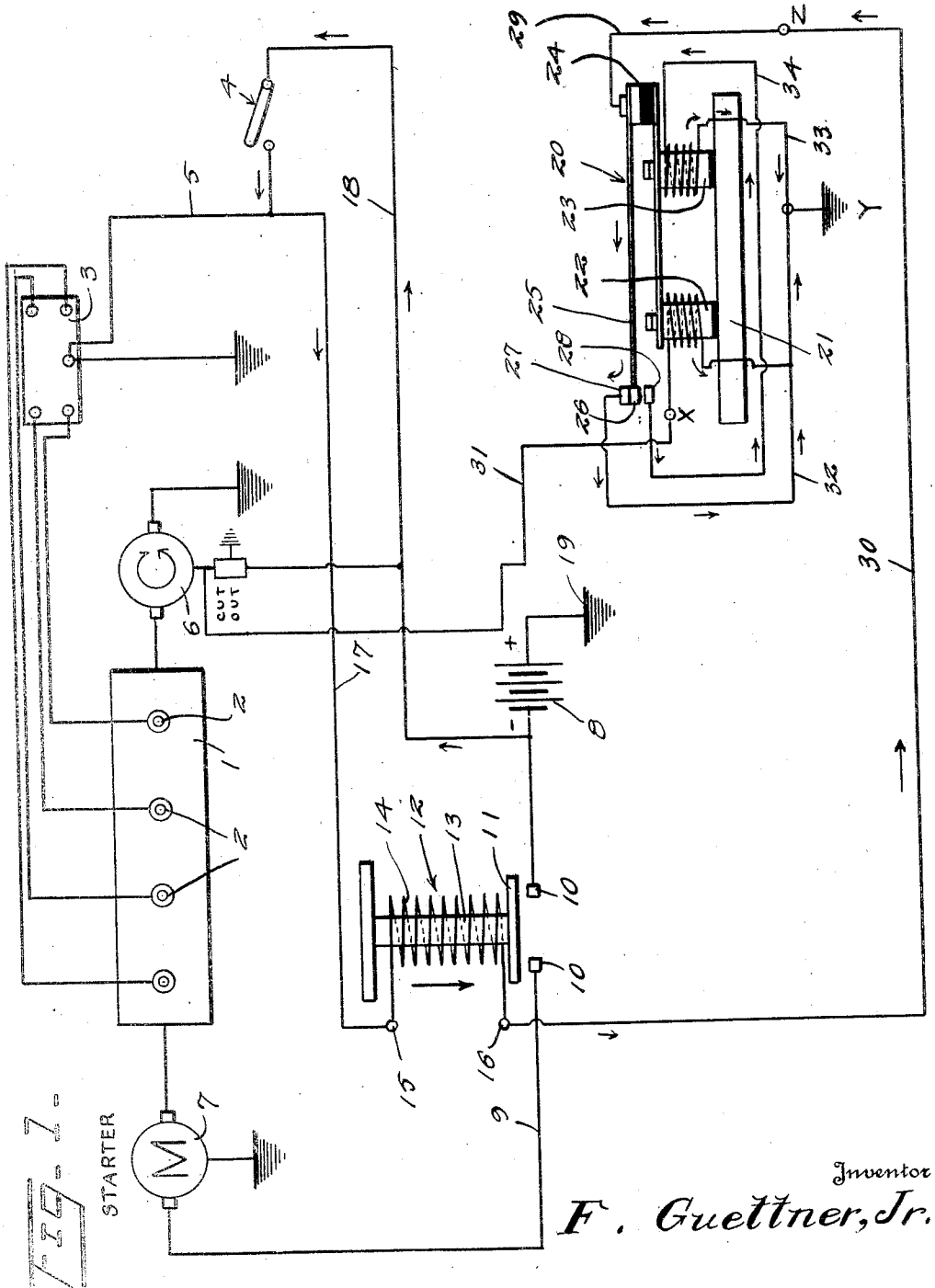


Fig. 1.

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Fig. 2

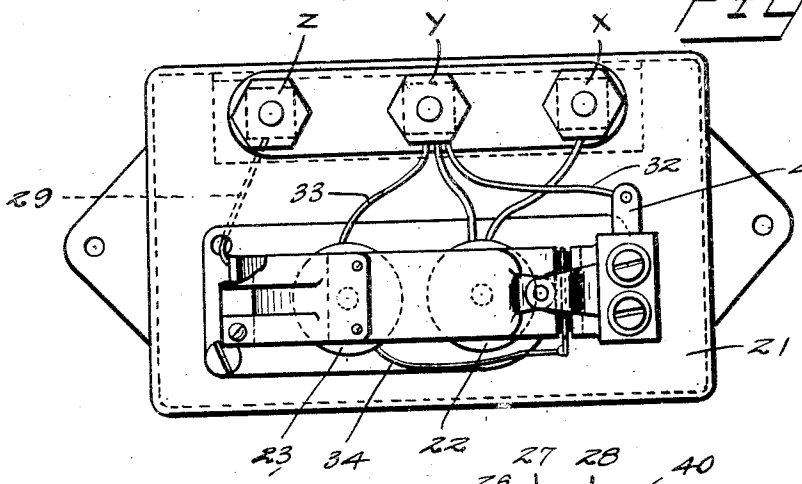


Fig. 3.

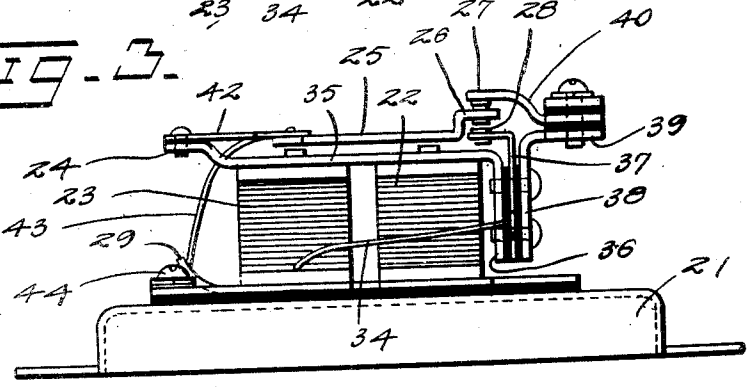


Fig. 4.

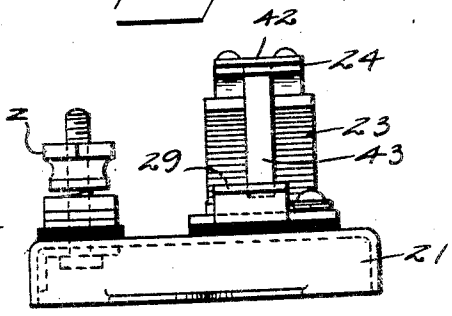
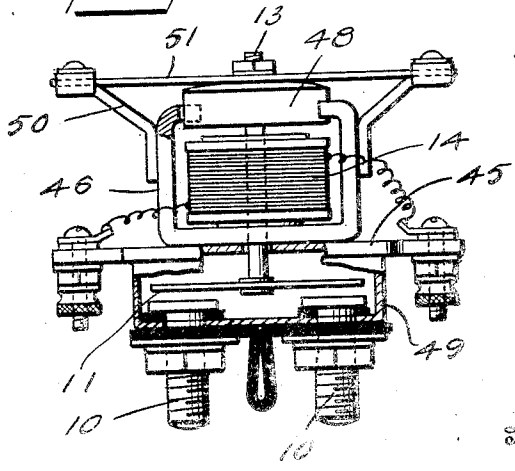


Fig. 5.



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UNITED STATES PATENT OFFICE

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AUTOMATIC ELECTRIC STARTER FOR INTERNAL COMBUSTION ENGINES

Application filed April 14, 1931. Serial No. 530,064.

This invention relates to electric starters for motor vehicles.

The primary object of the present invention is to provide an electric system which forms a part of the normal system of the motor vehicle, and which automatically controls the starting motor of the internal combustion engine in such a manner that upon the closing of the switch of the ignition system the starting motor switch will be automatically closed to start the starting motor and the engine. In the event of the stopping of the engine the ignition switch must first be opened and then again closed in order to operate the system for a second starting of the motor.

A further object of the invention is to provide a starting motor control mechanism which is of simple design and which may be readily and inexpensively installed in a motor vehicle.

The invention will be best understood from a consideration of the following detailed description taken in connection with the accompanying drawings forming part of this specification, with the understanding, however, that the invention is not confined to any strict conformity with the showing of the drawings but may be changed or modified so long as such changes or modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawings:

Figure 1 shows the circuit lay-out for the ignition system of an internal combustion engine and the mechanism embodying the present invention.

Figure 2 is a view in top plan of the automatic control device forming a part of the present invention.

Figure 3 is a view in side elevation of the device shown in Figure 2.

Figure 4 is a view in end elevation of the automatic control device.

Figure 5 is a view, partly in section and partly in elevation of the electric starter switch structure forming a part of the present invention.

Referring now more particularly to the drawings, wherein like numerals of reference indicate corresponding parts throughout the several views, the description will first be confined to the circuit lay-out shown in Figure 1 and later to the details of the two electric control devices shown more particularly in Figures 2 to 5.

In the circuit lay-out the numeral 1 indicates the motor vehicle engine, the spark plugs of which are indicated by the numerals 2. These plugs are connected in the usual manner with a distributor 3, which is connected with one side of the ignition switch 4 by the wire 5.

The engine operated generator is indicated conventionally at 6, while the starting motor for the engine is indicated by the numeral 7. The vehicle battery, which is indicated by the numeral 8, is connected with the starter motor 7 by the wire 9 in which are the usual two spaced contacts 10 which are connected for the starting of the motor 7 by the switch bar 11 of the starter switch, which is here indicated generally by the numeral 12. The present starter switch is of novel construction as the switch bar or blade thereof is carried by a movable core 13 about which is wound a coil 14. The ends of the starter switch coil 14 are connected with the binding posts 15 and 16 and the post 15 has connection with the dead side of the ignition switch, through the medium of the wire 17. The live side of the ignition switch is connected with the negative pole of the battery 8 by the wire 18, the opposite or positive side of the battery being grounded, as at 19, in the usual manner.

Interposed between the generator 6 and the battery 8 is the automatic control device, indicated generally by the numeral 20, which operates as soon as the generator starts to produce a substantial flow of current to cut down the flow of current through the starting switch 12 so that this switch will be opened and the operation of the starter motor discontinued. This device further operates, as will be hereinafter more fully described, to prevent the reclosing of the starter switch 12 in the event that the motor stops.

The automatic control device comprises a

base 21 upon which are mounted the terminal posts X, Y and Z. There are also mounted upon this base 21 the two electro-magnetic coils 22 and 23. Mounted above the cores of these electromagnets 22 and 23, upon the insulated base 24, is an armature 25 having a contact head 26 at its free end which moves between two fixed contacts 27 and 28. The fixed end of the armature is electrically connected with the post Z, by the wire 29, and this post has electrical connection with the post 16 to which one side of the solenoid coil 14 of the starter switch is connected, by the wire 30.

The generator 6 is connected by the wire 31 with one side of the coil of the electromagnet 22 through the terminal post X, while the other side of this coil is connected with the grounded terminal post Y, as illustrated.

The upper contact 27 of the control device is connected with the ground post Y by the wire 32 and this ground post also has connected with it, by the wire 33, one side of the coil of the other electromagnet 23. The other side of the coil of the magnet 23 is connected by the wire 34 with the fixed contact 28.

Referring now to the detailed illustration of the starter switch 12 and the automatic control device 20, it will be seen that certain features are illustrated which are not shown in the diagrammatic illustration of these elements given in the circuit diagram just described.

In connection with the automatic control device 20, it will be seen that the coils 22 and 23, which are mounted upon the base 21, have the tops thereof connected by the bar 35. At one end this bar is turned downwardly, as at 36, and there are secured thereto a pair of vertically disposed members 37 and 38 which are insulated therefrom and from one another. The member 37 is turned inwardly at its upper end and formed to provide the fixed contact 28, this member being electrically connected by the wire 34 with the coil 23, as previously described. The member 38 has its upper end turned outwardly to form a bracket support 39 upon which is mounted the arm 40 which is separated therefrom by a body of insulation, as shown, which has its free end overlying and spaced from the contact 28 and carrying the fixed contact 27. The free end of the armature 25 is, of course, located between these contacts 27 and 28. This arm 40 has the lateral finger 41 to which the ground wire 32 is connected.

The armature 25 is attached to a spring carrier 42, which is secured to the adjacent end of the bar 35 and this carrier has an integral extension 43 which passes downwardly to a contact 44 upon the base of the control device, with which the wire 29 is connected, this wire being coupled with the post Z, which in turn has the wire 30 attached thereto which leads from the coil 14 of the starting switch.

The starting switch comprises a base 45 on which is mounted a frame 46 which surrounds the coil 14. The upper portion of this frame 46 is formed to provide a guide for an armature 48 which is mounted upon the upper end of the movable core 13, previously described.

The lower end of the core 13 passes downwardly through the base 45 into the switch box 49 where it supports the switch arm 11 above the contacts 10.

The frame 46 carries a pair of arms 50 which support the ends of a resilient strap 51 which passes across the coil and armature 48 and has the upper end of the core 13 extended therethrough and secured thereto, as shown. It will thus be seen that when the coil 14 is energized the armature 48 will be drawn downwardly against the tension of the spring strap 51, driving the core 13 downwardly also and positioning the switch arm 11 in contact with and bridging the contacts 10. Upon the de-energization or the cutting down of the flow of current through the coil 14 to the proper degree, the spring strap 51 will return to its normal position and thus lift the armature 48 and the core and switch arm 11 carried thereby.

The operation of the present device is as follows: When the operator of the motor vehicle, in which the engine 1 is placed, desires to start the engine the ignition switch 4 is closed. Current then flows from the battery through the wire 18 past the switch and through the wire 17 to the coil 14, passing onward through the coil, through the wire 30, the armature 25, contact 27 and wire 32 to the ground at the post Y, thus completing a circuit back to the battery 8. The coil 14 being thus energized, the core 13 is shifted to bring the switch arm 11 into position across the contacts 10 thus closing the circuit to the starting motor 7.

When the engine starts, after it has attained sufficient speed to operate the generator 6 at current generating speed, current will flow through the wire 31 to the electromagnet 22 and through the ground connection to the battery.

This charging of the coil of the electromagnet will cause the downward movement of the armature 25, thus breaking contact between the points 26 and 27 and making contact between the points 26 and 28. The current flowing from the coil 14 through the wire 30 is thus made to pass through the armature 25 to and through the wire 34 to the electromagnet 23 and then from there through the wire 33 to the ground post Y. This introduction of the magnet 23 into the circuit in which the starting switch is located, cuts down the flow of current through

the starting coil to such an extent that the energy of this coil is no longer sufficient to overcome the action of the spring 51 to which the core 13 is attached and the starting switch will thus be opened. At the same time, the energized coil 23 will exert an attractive force upon the armature 25 as well as the coil 22 so that should the engine 1 cease to operate from any cause the current flowing through the magnet 23 will continue to hold the armature 25 down even though the magnet 22 has become de-energized. It will thus be seen that in order to again close the starting switch 12, the operator of the machine must open the ignition switch 4 so as to de-energize the magnet 23 and release the armature 25 and then again close the ignition switch so that the full amount of current from the battery will pass through the starting switch coil and directly to the ground.

Having thus described the invention, what is claimed is:

1. In an internal combustion engine starting system, a starting motor, a generator, a storage battery an electrical connection between the battery and the motor, an ignition switch connected at one side with the battery, a normally open switch including a contact bridging arm controlling the electrical connection of the battery with the motor, an electromagnet including a coil and an armature having a core extending through the coil and carrying said arm and having one side of the coil thereof connected with the dead side of the ignition switch and having the other side grounded, a resistance coil, means interposed between the said other side of the first coil and the ground, actuated by the current from the generator, for connecting said resistance coil in series with said first mentioned coil, to reduce the flow of current through the latter to a point where it becomes ineffective to maintain the second mentioned switch closed, and means actuated by current from the generator for operating said connecting means, said resistance coil constituting the coil of an electromagnet which when energized maintains said means operative after the discontinuance of the flow of current from the generator.

2. In an internal combustion engine starting system, an electric motor, a generator, a battery, an electric connection between the battery and the motor, an ignition switch connected at one side with the battery, a switch controlling the flow of current from the battery to the motor and including a movable arm, an electromagnet including a coil and an armature carrying a core loosely extending through the coil, said core carrying said switch arm at one end, electric connecting means between one side of said coil and the dead side of said ignition switch, a second electromagnet having a coil, an electrical connection between one end of the coil of the second magnet and said generator to receive current therefrom the other end of the last coil being grounded, an armature actuated by said second magnet, an electrical connection between one end of said last armature and the other end of said first magnet coil, a contact normally engaged by the other end of said last armature, said contact being grounded, the engagement of said last armature with said contact being broken upon the energization of the second electromagnet, a second contact, and a resistance coil having one side connected with said second contact and having the other side grounded, said second contact being engaged by the last armature when the same is moved by the second electromagnet to place said resistance coil in circuit with the first electromagnet coil, said resistance coil reducing the current flow through the first coil to a degree to make it ineffective to hold said switch arm in operative position.

3. In an internal combustion engine starting system, an electric motor, a generator, a battery, an electric connection between the battery and the motor, an ignition switch connected at one side with the battery, a switch controlling the flow of current from the battery to the motor and including a movable arm, an electromagnet including a coil and an armature carrying a core loosely extending through the coil, said core carrying said switch arm at one end, electric connecting means between one side of said coil and the dead side of said ignition switch, a second electromagnet having a coil, an electrical connection between one end of the coil of the second magnet and said generator to receive current therefrom, the other end of the last coil being grounded, an armature actuated by said second magnet, an electrical connection between one end of said last armature and the other end of said first magnet coil, a contact normally engaged by the other end of said last armature, said contact being grounded, the engagement of said last armature with said contact being broken upon the energization of the second electromagnet, a second contact, and a third electromagnet having a coil and a core and having the core thereof arranged for attracting said last armature and having electrical connection between one end of the coil and said second contact and having the other end of the coil thereof grounded, said third electromagnet having the coil thereof connected through the second mentioned contact with the second armature, when the latter is shifted by the second electromagnet, to place the coil thereof in circuit with the coil of the first magnet, said third electromagnet maintaining control of the second armature after de-energization of the second electromagnet.

4. In an internal combustion engine start-

ting system, a starting motor, a generator, a storage battery, an electrical connection between the battery and the motor, an ignition switch connected at one side with the battery, a normally open electric current conducting line between the battery and the motor and including a pair of spaced contacts, an electro-magnet including a coil and an armature carrying a core, said armature bridging and being designed to connect said contacts and said coil having one side electrically connected with the other side of said switch, a pair of electro-magnet coils disposed in side by side relation, an armature mounted to overlie said pair of coils to be shifted thereby, one end of the last armature being shiftable, a pair of contacts between which the shiftable end of said last armature is located and with one of which it normally contacts, one of said pair of coils having one end electrically connected with the generator and having its other end grounded, the other of the pair of coils being electrically connected at one end with the contact of which the said last armature is normally free and having its other end grounded, a grounded connection with the other of the pair of contacts with which the last armature is normally engaged, and an electrical connection between the said last armature and the other side of the first mentioned magnet coil, the said other one of the pair of coils offering sufficient resistance to the flow of current therethrough from the first magnet coil, when the last armature is attracted by the pair of coils and is engaging the grounded contact to make ineffectual the ability of the first coil to hold the contact bridging arm in operative position.

In testimony whereof I hereunto affix my signature.

FRANK GUETTNER, JR.