Dec. 15, 1925. 1,565,854

J. HASSELBRING, JR

STARTER FOR INTERNAL COMBUSTION ENGINES

Filed Nov. 29, 1921

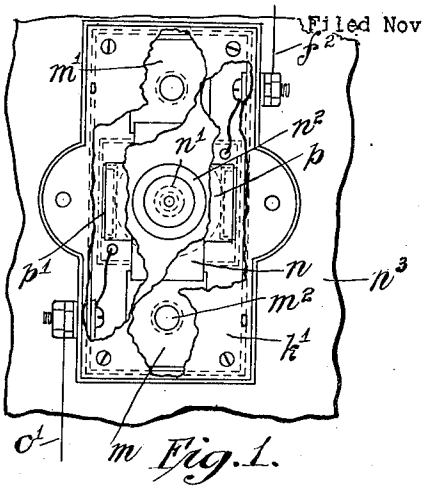


Fig. 1.

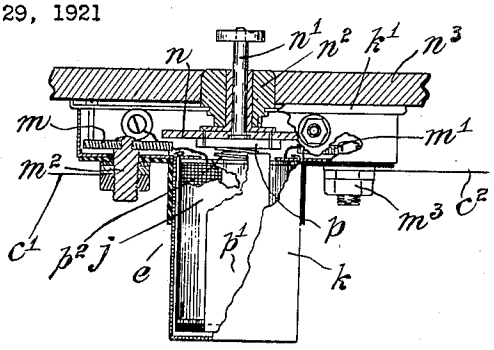


Fig. 2.

Fig. 3.

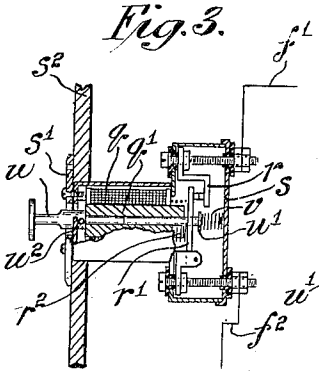


Fig. 5.

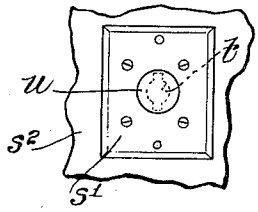


Fig. 4.

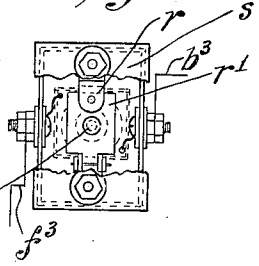
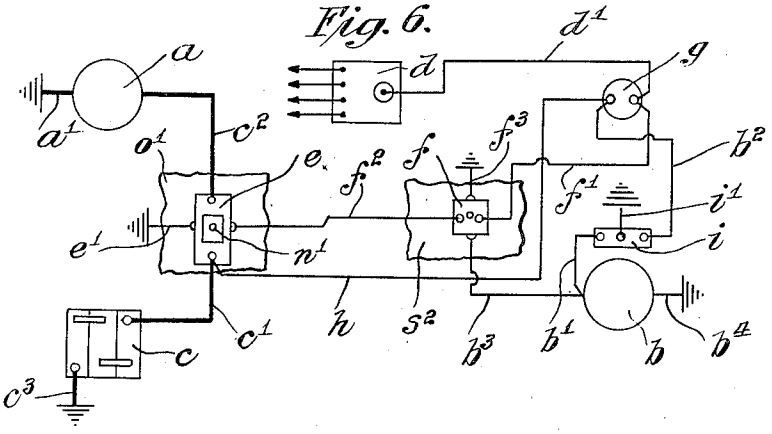


Fig. 6.



John Hasselbring, Jr. INVENTOR

BY Frank P. Wentworth

his ATTORNEY.

Patented Dec. 15, 1925.

1,565,854

UNITED STATES PATENT OFFICE.

JOHN HASSELBRING, JR., OF FARMINGDALE, NEW YORK.

STARTER FOR INTERNAL-COMBUSTION ENGINES.

Application filed November 29, 1921. Serial No. 518,542.

To all whom it may concern:

Be it known that I, JOHN HASSELBRING, Jr., a citizen of the United States, residing at Farmingdale, in the county of Nassau and State of New York, have invented certain new and useful Improvements in Starters for Internal-Combustion Engines, of which the following is a specification, reference being had therein to the accompanying drawings, which form a part thereof.

My invention relates to starters for internal combustion engines, and more particularly to an electric starter adapted for use upon automobiles.

In starters for internal combustion engines as now commonly used upon automobiles, it is the practice to provide a direct connection between an electric battery, usually a secondary battery, and a starting motor adapted to be connected with the crank shaft of an internal combustion engine, this electrical connection having arranged in the length thereof, a manually operative make and break mechanism, usually controlled by a foot plunger. The circuit to the starting motor is entirely independent of the circuit to the ignition system of the engine, thus requiring the closing of two independent circuits in order to permit the starting of the engine under the control of the starting motor.

I have heretofore devised a starter which is so constructed as to cause a simultaneous closing of the circuits to the ignition system and to the starting motor by means of a single manually operative switch, the starter being so constructed that when the engine has come to speed under its own power, the circuit to the starting motor will be automatically interrupted and will remain open so long as the engine is running, but will be closed automatically in the event of the slowing down of the engine or its stalling, thus serving to apply the power of the starting motor to the engine and preventing the complete stalling thereof, or ensuring the re-starting thereof in the event of such stalling thereof.

A starter embodying my invention includes a normally open circuit to the starting motor including therein a make and break mechanism, one member of which constitutes the armature of an electromagnet, which is the primary circuit controller in the starter and is connected in multiple with said make and break mechanism and said battery, and a secondary circuit controller for the circuit to said magnet, having arranged therein a normally closed make and break mechanism, one of the members of which constitutes the armature of an electromagnet, which constitutes a secondary circuit controller for interrupting the circuit to the primary controller and is arranged in circuit with a generator, driven from the internal combustion engine, means being provided whereby in the event of the failure of said primary circuit controller, the make and break mechanism in the circuit from the battery to the starting motor may be manually closed.

My present invention relates to a further development in the type of starter above referred to, whereby in the event of the generator being out of order, the automatically acting mechanisms of my starter may be so set manually as to prevent possible exhaustion of the battery or injury thereto through short-circuiting thereof. The manually operative mechanism for thus interrupting the circuit may also be used, if desired, to prevent the automatic application of power to the engine through the starting motor, after the engine has once been started, or permit only a manual control of the battery circuit to the starting motor.

A starter embodying my present invention is, therefore, so constructed that power may be applied to the starting motor simultaneously with, and through the same switch mechanism used in, the closing of the circuit to the ignition system of the automobile; or said starter may be made entirely inoperative through the interruption of the circuit to the primary control by a manually operative device; or in the event of the failure of either or both controls, by the manual actuation of the make and break mechanism in the circuit from the battery to the starting motor. It is apparent, therefore, that a starter embodying the present invention affords adequate safeguards to ensure, or prevent, the application of the power from the storage battery

to the starting motor in the event of a failure of any of the parts of the mechanism, there always being within the power of the driver of an automobile, recourse to the hand crank for starting the engine in the event of failure of the starting motor, without likelihood of disarrangement of, or injury to, the constituent parts of the starter mechanism.

To facilitate the convenient application and use of the starter of my present invention, I so construct the secondary control as to permit its being mounted upon the instrument board of an automobile, and so construct and arrange the primary control as to permit it to be arranged under the floor board of an automobile so as to be conveniently accessible to the foot of the driver.

The invention consists primarily in a starter for internal combustion engines embodying therein a motor adapted to be operatively connected with an engine shaft, a generator driven from the engine, an electric battery, electrical connections whereby said battery may be placed in circuit with said motor, a normally open make and break mechanism in said circuit, a primary controller operative upon said make and break mechanism, consisting of a magnet, electrical connections whereby said magnet is placed in circuit with said battery, and a normally closed make and break mechanism arranged in said circuit, a secondary circuit controller consisting of an electromagnet operative upon said last named make and break mechanism, and electrical connections whereby said magnet is placed in circuit with said generator, a manually operative switch mechanism adapted to simultaneously close the circuit to the ignition system of an engine and to said primary controller, whereby the closing of said manually operative switch will energize said primary controller to cause the closing of the circuit to said starting motor, and when the engine is operating under its own power, said generator will energize the magnet of said secondary controller to interrupt the circuit to the magnet of said primary controller, and cause the circuit to said motor to be interrupted, and manually operative means whereby the make and break mechanism in the circuit to said motor may be actuated independently of said controllers; and in such other novel features of construction and combination of parts as are hereinafter set forth and described, and more particularly pointed out in the claims hereto appended.

Referring to the drawings,

Fig. 1 is a plan view of the primary controller mechanism and the make and break mechanism actuated thereby, the top casing thereof being broken away;

Fig. 2 is a vertical view of said controller partly in section and partly broken away;

Fig. 3 is a view partly in section of the secondary controller mechanism;

Fig. 4 is a bottom plan view thereof with a portion of the top plate broken away;

Fig. 5 is a top plan view thereof; and

Fig. 6 is a diagrammatic showing of the electrical conditions in and about a starter embodying my invention.

Like letters refer to like parts throughout the several views.

In the accompanying drawings, I have not shown the gas engine nor the details of construction thereof and of the starting motor by which power is transmitted from the motor to the engine, since this construction is old and well known in the art and its details are immaterial to my present invention.

In the embodiment of my invention shown in the drawings, reference being had particularly to Fig. 6, I have shown conventionally at a, a starting motor adapted to be connected in any desired manner with the shaft of an internal combustion engine, and at b a generator which may be driven from said engine in any desired manner. The power for the motor a is derived from a suitable electric battery, such as the secondary or storage battery illustrated at c, which battery is also adapted to supply current for the ignition system, illustrated conventionally at d, of an internal combustion engine.

The battery c is in electrical connection with the motor a by means of the wires c'—c^2, having arranged therein a make and break mechanism, to be more fully described hereinafter, the battery c having a ground connection c^3 and the motor a having a ground connection a', said make and break mechanism being under the electrical control of a primary controller mechanism e, the circuit to which is normally closed by a secondary controller f. At g I have shown a manually operative switch electrically connected with the battery c through the wire c' and the wire h, one terminal of said switch being connected through the wire d' with the ignition system d, and the other terminal being in electrical connection with the primary controller e through the wires f'—f^2 having in the length thereof a make and break mechanism actuated by the secondary controller f.

The primary controller e has a ground connection e', while the secondary controller f has a ground connection f^3. The generator b is in circuit with the ignition system d and the storage battery c through the wires b'—b^2, the ordinary cutout i having the ground connection i', and the switch g. Said generator is also electrically connected

with the secondary controller f by the wire b^3, and has a ground connection b^4.

The foregoing mechanism relates broadly to the characteristics of a starting mechanism of the type to which my invention relates, said invention relating more particularly to the detailed construction of the primary controller e and of the secondary controller f by means of which the former may be actuated entirely independently of the latter, and the latter may be made inoperative as to the former, so as to interrupt the circuit thereto from the battery c, to prevent short-circuiting of said battery, to prevent automatic functioning of the starter, or to permit the starter to be manually controlled while ensuring an automatic interruption of the circuit to the motor a.

For convenience in the use of the primary and the secondary controllers, said mechanisms and their appurtenances are made in entirely independent units, the former being adapted to be mounted beneath the flooring of a car and exposed through an opening therein, and the latter being adapted to be mounted upon the instrument board of a car where it is conveniently accessible to the hand of the driver.

The detailed construction of the primary controller, which will first be described, is such as to cause a normally open circuit from the battery c to the motor a, this controller being in the form of an electromagnet placed in circuit with said battery through the secondary controller f, the switch g and the wires heretofore described, so that with the closing of the circuit by the switch g, said magnet will be energized to actuate said make and break mechanism to close the circuit to said motor, said make and break mechanism, however, being so constructed and arranged that, if desired, the circuit from said battery to said motor may be closed entirely independently of said primary controller and said secondary controller.

The primary controller e consists of an electromagnet j carried in a suitable housing k having a top plate k'. Within said housing are opposed spaced contacts m—m', one of which as m, is in electrical connection with the battery c by means of the wire c' and the binding post m^2; and the other as m' is in electrical connection with the motor a through the wire c^2 leading from the binding post m^3. Mounted adjacent the terminals m—m' is a bridge contact n carrying a foot plunger n' mounted in a suitable bushing n^2, the top of which is substantially flush with the car flooring n^3. Carried by the bridge contact n is an armature p extending across the core of the magnet j and the tops of the yoke p' connected with the opposite ends of the magnet core to afford a substantially closed circuit for the magnetic flux. While the bridge contact n is preferably of a low resistance metal as copper, the armature p and yoke p' are preferably formed of steel, or iron, to increase the effect of the traction of the magnet j.

Acting against the armature p is a spring p^2 normally disengaging the bridge contact n from the contacts m—m'. By this construction it will be apparent that while with the energizing of the magnet j, the bridge contact n will be engaged with the spaced contacts m—m' against the tension of the spring p^2, said bridge contact member may also be engaged with said contacts by pressure applied manually to the plunger n', so that while normally, as will more fully appear hereinafter, the actuation of the make and break mechanism m—m'—n will be entirely automatic, said mechanism may also be manually actuated so as to permit the closing of the circuit from the battery c to the motor a entirely independently of said magnet j.

The secondary controller consists of an electromagnet q having a hollow core q', said magnet being in constant electrical connection with the generator b through the wire b^3 so as to cause the energizing of this magnet at all times while the generator is producing current. Acted upon by said magnet is a make and break mechanism consisting of a fixed contact member r and a movable contact member r', the latter being arranged within the magnetic field of the magnet q and being acted upon by a spring r^2 encircling the projecting end of said core, engaging said contact member r' and normally forcing it into engagement with the contact r. Said contact members r and r' are provided with platinum points, as shown.

One of these members, as r', is in electrical connection with the primary controller magnet j, while the other contact, as r, is in electrical connection with the battery c through the wires f' and h and the switch g.

Said contacts and said magnet are enclosed in a suitable casing s from which the electrically charged parts are properly insulated, said casing being provided with an escutcheon plate s' by means of which the secondary controller unit may be attached to the instrument board s^2 of an automobile.

The top of the casing s has a winged opening indicated in dotted lines in Fig. 5 at p, in the top thereof. Passing therethrough and through the hollow core q' is a plunger u having an enlarged head u' adapted to operatively engage the movable contact member r' and impart movement thereto against the tension of the spring r^2. Said plunger is acted upon by a spring v of greater strength than the spring r^2 and hav-

ing a normal tendency to engage the enlarged head u' of said plunger u with the contact member r' and disengage said contact member from the contact member r.

The spring v is normally held under tension so as to make the plunger u inoperative as to the contact r' by means of the pins u^2 engaged with the under side of the top of the casing s adjacent the winged opening t therein.

The operation of the herein described mechanism is substantially as follows:—

By making the primary controller unit and the secondary controller unit entirely independent one of the other, the former may be readily mounted beneath the floor board of an automobile adjacent the driver's seat, while the latter may be mounted at a conveniently accessible point upon the instrument board of an automobile, there being a single wire connection f^2 between the two units.

Under normal conditions the plunger u will be forced inwardly of the casing s so as to disengage the enlargement u' thereof from the movable contact member r', this relation of parts being maintained through the engagement of the pins u^2 with the under side of the top plate of the casing s.

When the parts are in this position, the circuit to the battery c is normally closed at all times when the switch g is closed, so that the primary controller magnet j will be energized simultaneously with the closing of the switch g.

When an engine is at rest, the spring p^2 will hold the bridge contact member n out of engagement with the contacts m—m', thus maintaining an open circuit from the battery c to the motor a. Instantly, however, with the closing of the circuit to the primary controller through the make and break mechanism actuated by the secondary controller, and the switch g, the traction of the magnet j will cause contact of the contact member n with the contact members m—m', thus closing the circuit from the battery c to the motor a, applying power to the internal combustion engine, and continuing to apply power thereto until the engine has come to speed.

As the engine comes to speed, current will be generated by the generator b, thus energizing the secondary controller magnet q, the traction of which magnet will act upon the movable contact member r', and move it out of electrical engagement with the fixed contact member r and thus interrupt the circuit to the primary controller magnet j, and permitting the spring p^2 to move the contact n away from the contacts m—m' and thus interrupt the circuit from the battery c to the motor a.

It will thus be observed that at all times, except when it is necessary to apply power to the engine by the motor a, the circuit from the battery c to said motor is interrupted, but that so long as the parts are in the relation shown in the drawings, the stoppage of the engine from any cause excepting the opening of the switch g, will immediately cause the closing of the circuit from said battery c to said motor a through the contacts m—m'—n in the manner above described.

It will also be observed that the interval during which said motor a is operative upon the engine is determined solely by the functioning of the engine and of the generator b.

If, for any reason, the circuit to the magnet j of the primary controller is interrupted, it is merely necessary for the driver to depress the plunger n', and thus manually engage the bridge contact n with the contacts m—m', thus closing the circuit to the motor a through the manual actuation of the make and break mechanism arranged in said circuit.

Under some conditions, as when a generator is not functioning properly, it is essential to interrupt the circuit to the primary controller independently of the secondary controller in order to interrupt the circuit from the battery c to the motor a. Under such conditions it is merely necessary for the driver to turn the plunger u slightly so as to permit the pins u^2 to pass through the winged opening t, whereupon the spring v will engage the enlarged head u' of the plunger u with the movable contact member r' and move this contact member out of engagement with the fixed contact member r, thus placing the interruption of the circuit to the magnet j under manual control.

Said plunger u may also be used to manually control the circuit to the magnet j as when it is desired to avoid the automatic application of power to the engine by the motor a to prevent stalling of the engine after it has once been started, or to make the starter inoperative while an engine is idling.

The wiring arrangement shown in Fig. 6, is such that the current from the ignition system may be either drawn from the battery c or supplied from the generator b, and that said generator will function in the usual manner in recharging the battery c while the engine is running.

In the mechanism herein described, the relation of parts is such that power may be applied to the engine through the motor a entirely automatically with the closing of the switch g through the primary and secondary controller mechanisms and the parts appurtenant thereto, and that the circuit to said motor will be interrupted automatically through the functioning of the secondary controller mechanism; or by using the plunger u after the switch g has been closed,

the application of power by the motor *a* will be semi-automatic to the extent that the closing of the circuit through the primary and the secondary controllers may be accomplished by means of the plunger *u*, while the interruption of said circuit will be entirely automatic through the functioning of the secondary controller magnet *q*; or the circuit may be closed through the contacts *n'—m—m'* entirely independently of said primary and said secondary controllers through the medium of the plunger *n'*.

In this manner the engine may be started in three distinct manners through one and the same starter mechanism, thus affording adequate safeguards against such a disarrangement of parts in the starter mechanism as might tend to make the use of this mechanism impossible.

It is not my intention to limit the invention to the precise details of construction shown in the accompanying drawings, it being apparent that such may be varied without departing from the spirit and scope of the invention.

Having described the invention, what I claim as new and desire to have protected by Letters Patent, is:—

1. A starter for internal combustion engines embodying therein a motor adapted to be operatively connected with an engine shaft, a generator driven from the engine, an electric battery, electrical connections whereby said battery may be placed in circuit with said motor, a normally open make and break mechanism in said circuit, a primary controller operative upon said make and break mechanism, consisting of a magnet, electrical connections whereby said magnet is placed in circuit with said battery, and a normally closed make and break mechanism arranged in said circuit, a secondary circuit controller consisting of an electromagnet operative upon said last named make and break mechanism, and electrical connections whereby said magnet is placed in circuit with said generator, a manually operative switch mechanism adapted to simultaneously close the circuit to the ignition system of an engine and to said primary controller, whereby the closing of said manually operative switch will energize said primary controller to cause the closing of the circuit to said starting motor, and when the engine is operating under its own power, said generator will energize the magnet of said secondary controller to interrupt the circuit to the magnet of said primary controller, and cause the circuit to said motor to be interrupted, and manually operative means whereby the make and break mechanism in the circuit to said motor may be actuated independently of said controllers.

2. A starter for internal combustion engines embodying therein a motor adapted to be operatively connected with an engine shaft, a generator driven from the engine, an electric battery, electrical connections whereby said battery may be placed in circuit with said motor, a normally open make and break mechanism in said circuit, a primary controller operative upon said make and break mechanism, consisting of a magnet, electrical connections whereby said magnet is placed in circuit with said battery, and a normally closed make and break mechanism arranged in said circuit, a secondary circuit controller consisting of an electromagnet operative upon said last named make and break mechanism, and electrical connections whereby said magnet is placed in circuit with said generator, a manually operative switch mechanism adapted to simultaneously close the circuit to the ignition system of an engine and to said primary controller, whereby the closing of said manually operative switch will energize said primary controller to cause the closing of the circuit to said starting motor, and when the engine is operating under its own power, said generator will energize the magnet of said secondary controller to interrupt the circuit to the magnet of said primary controller, and cause the circuit to said motor to be interrupted, and manually operative means whereby the make and break mechanism arranged in the circuit to the magnet of said primary controller may be actuated independently of the secondary controller magnet to interrupt the circuit to said primary controller magnet.

3. A starter for internal combustion engines embodying therein a motor adapted to be operatively connected with an engine shaft, a generator driven from the engine, an electric battery, electrical connections whereby said battery may be placed in circuit with said motor, a normally open make and break mechanism in said circuit, a primary controller operative upon said make and break mechanism, consisting of a magnet, electrical connections whereby said magnet is placed in circuit with said battery, and a normally closed make and break mechanism arranged in said circuit, a secondary circuit controller consisting of an electromagnet operative upon said last named make and break mechanism, and electrical connections whereby said magnet is placed in circuit with said generator, a manually operative switch mechanism adapted to simultaneously close the circuit to the ignition system of an engine and to said primary controller, whereby the closing of said manually operative switch will energize said primary controller to cause the closing of the circuit to said starting motor, and when the engine is operating under its own power, said generator will energize

the magnet of said secondary controller to interrupt the circuit to the magnet of said primary controller, and cause the circuit to said motor to be interrupted, manually operative means whereby the make and break mechanism in the circuit to said motor may be actuated independently of said controllers, and manually operative means whereby the make and break mechanism arranged in the circuit to the magnet of said primary controller may be actuated independently of the secondary controller magnet to interrupt the circuit to said primary controller magnet.

4. A starter for internal combustion engines embodying therein a motor adapted to be operatively connected with an engine shaft, a generator driven from the engine, an electric battery, spaced contacts, one of which is electrically connected with said battery and the other of which is electrically connected with said motor, a bridge contact to close the circuit through said last named contacts, an electromagnet adapted to impart movement to said movable contact in one direction, a spring adapted to normally disengage said movable contact from said spaced contacts, electrical connections whereby said magnet is placed in circuit with said battery, and a normally closed make and break mechanism arranged in said circuit, a secondary circuit controller consisting of an electromagnet operative upon said last named make and break mechanism, and electrical connections whereby said magnet is placed in circuit with said generator, a manually operative switch mechanism adapted to simultaneously close the circuit to the ignition system of an engine and to said primary controller, whereby the closing of said manually operative switch will energize said primary controller to cause the closing of the circuit to said starting motor, and when the engine is operating under its own power, said generator will energize the magnet of said secondary controller to interrupt the circuit to the magnet of said primary controller, and cause the circuit to said motor to be interrupted, and a plunger carried by said movable contact adapted to project through the flooring of an automobile, whereby said movable contact may be engaged with said spaced contacts against the tension of said spring to close the circuit to said motor independently of said controllers.

5. A starter for internal combustion engines embodying therein a motor adapted to be operatively connected with an engine shaft, a generator driven from the engine, an electric battery, spaced contacts, one of which is electrically connected with said battery and the other of which is electrically connected with said motor, a bridge contact to close the circuit through said last named contacts, an electromagnet adapted to impart movement to said movable contact in one direction, a pole yoke carried by said magnet, terminating adjacent said movable contact, an armature carried by said movable contact in operative relation to said yoke, said movable contact being of a metal of low resistance, and said armature and said yoke being of iron or steel, a spring adapted to normally disengage said movable contact from said spaced contacts, electrical connections whereby said magnet is placed in circuit with said battery, and a normally closed make and break mechanism arranged in said circuit, a secondary circuit controller consisting of an electromagnet operative upon said last named make and break mechanism, and electrical connections whereby said magnet is placed in circuit with said generator, a manually operative switch mechanism adapted to simultaneously close the circuit to the ignition system of an engine and to said primary controller, whereby the closing of said manually operative switch will energize said primary controller to cause the closing of the circuit to said starting motor, and when the engine is operating under its own power, said generator will energize the magnet of said secondary controller to interrupt the circuit to the magnet of said primary controller, and cause the circuit to said motor to be interrupted, and a plunger carried by said movable contact adapted to project through the flooring of an automobile, whereby said movable contact may be engaged with said spaced contacts against the tension of said spring to close the circuit to said motor independently of said controllers.

6. A starter for internal combustion engines embodying therein a motor adapted to be operatively connected with an engine shaft, a generator driven from the engine, an electric battery, electrical connections whereby said battery may be placed in circuit with said motor, a normally open make and break mechanism in said circuit, a primary controller operative upon said make and break mechanism, consisting of a magnet, electrical connections whereby said magnet is placed in circuit with said battery, a fixed contact, a movable contact cooperating therewith, a secondary circuit controller consisting of an electromagnet having a core, operative upon said movable contact, a spring normally engaging said movable contact and forcing it into engagement with said fixed contact, and electrical connections whereby said magnet is placed in circuit with said generator, a manually operative switch mechanism adapted to simultaneously close the circuit to the ignition system of an engine and to said primary controller, whereby the closing of said manually operative switch will energize said

primary controller to cause the closing of the circuit to said starting motor, and when the engine is operating under its own power, said generator will energize the magnet of said secondary controller to interrupt the circuit to the magnet of said primary controller, and cause the circuit to said motor to be interrupted, and a reciprocatory member adapted to engage said movable contact and disengage it from said fixed contact, whereby the circuit to the magnet of said primary controller may be interrupted independently of said secondary controller magnet.

7. A starter for internal combustion engines embodying therein a motor adapted to be operatively connected with an engine shaft, a generator driven from the engine, an electric battery, electrical connections whereby said battery may be placed in circuit with said motor, a normally open make and break mechanism in said circuit, a primary controller operative upon said make and break mechanism, consisting of a magnet, electrical connections whereby said magnet is placed in circuit with said battery, a fixed contact, a movable contact co-operating therewith, a secondary circuit controller consisting of an electromagnet having a hollow core, operative upon said movable contact, a spring normally engaging said movable contact and forcing it into engagement with said fixed contact, and electrical connections whereby said magnet is placed in circuit with said generator, a manually operative switch mechanism adapted to simultaneously close the circuit to the ignition system of an engine and to said primary controller, whereby the closing of said manually operative switch will energize said primary controller to cause the closing of the circuit to said starting motor, and when the engine is operating under its own power, said generator will energize the magnet of said secondary controller to interrupt the circuit to the magnet of said primary controller, and cause the circuit to said motor to be interrupted, a manually operative plunger mounted in said hollow core and passing through said movable contact, an enlargement thereon adapted to engage said contact on the side thereof away from said spring, a spring acting upon said plunger having a normal tendency to impart movement thereto to disengage said movable contact from said fixed contact, and means whereby said plunger may be held out of engagement with said movable contact, or be permitted to move same out of engagement with said fixed contact, whereby the circuit to said primary controller magnet may be opened independently of said secondary controller magnet.

8. A starter for internal combustion engines embodying therein a motor adapted to be operatively connected with an engine shaft, a generator driven from the engine, an electric battery, spaced contacts, one of which is electrically connected with said battery and the other of which is electrically connected with said motor, a bridge contact to close the circuit through said last named contacts, an electromagnet adapted to impart movement to said movable contact in one direction, a spring adapted to normally disengage said movable contact from said spaced contacts, electrical connections whereby said magnet is placed in circuit with said battery, a fixed contact, a movable contact co-operating therewith, a secondary circuit controller consisting of an electromagnet having a hollow core, operative upon said movable contact, a spring normally engaging said movable contact and forcing it into engagement with said fixed contact, and electrical connections whereby said magnet is placed in circuit with said generator, a manually operative switch mechanism adapted to simultaneously close the circuit to the ignition system of an engine and to said primary controller, whereby the closing of said manually operative switch will energize said primary controller to cause the closing of the circuit to said starting motor, and when the engine is operating under its own power, said generator will energize the magnet of said secondary controller to interrupt the circuit to the magnet of said primary controller, and cause the circuit to said motor to be interrupted, a manually operative plunger mounted in said hollow core and passing through said movable contact, an enlargement thereon adapted to engage said contact on the side thereof away from said spring, a spring acting upon said plunger having a normal tendency to impart movement thereto to disengage said movable contact from said fixed contact, means whereby said plunger may be held out of engagement with said movable contact, or be permitted to move same out of engagement with said fixed contact, whereby the circuit to said primary controller magnet may be opened independently of said secondary controller magnet, and a plunger carried by said movable contact adapted to project through the flooring of an automobile, whereby said movable contact may be engaged with said spaced contacts against the tension of said spring to close the circuit to said motor independently of said controllers.

In witness whereof I have hereunto affixed my signature this 22nd day of November, 1921.

JOHN HASSELBRING, JR.