July 6, 1926. 1,591,037

J. HASSELBRING, JR

STARTER FOR INTERNAL COMBUSTION ENGINES

Filed June 12, 1922

Fig. 1.

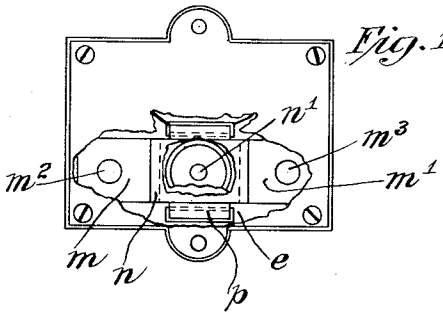



Fig. 2.

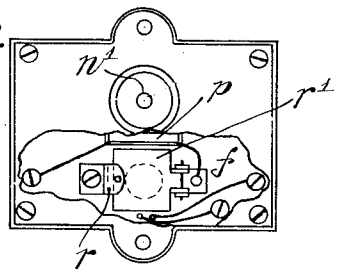



Fig. 3.

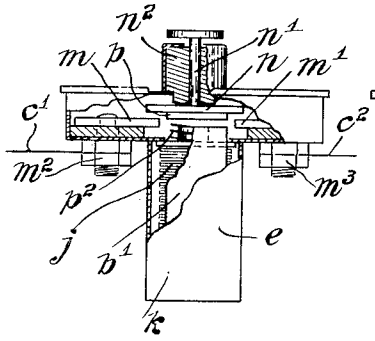



Fig. 4.

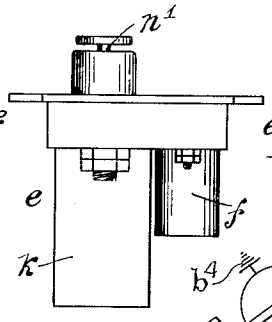



Fig. 5.

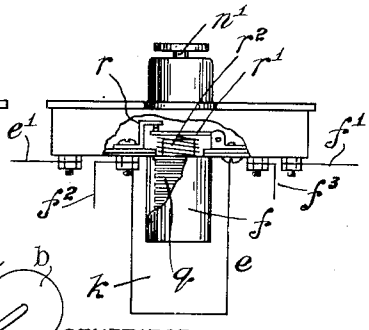



Fig. 6

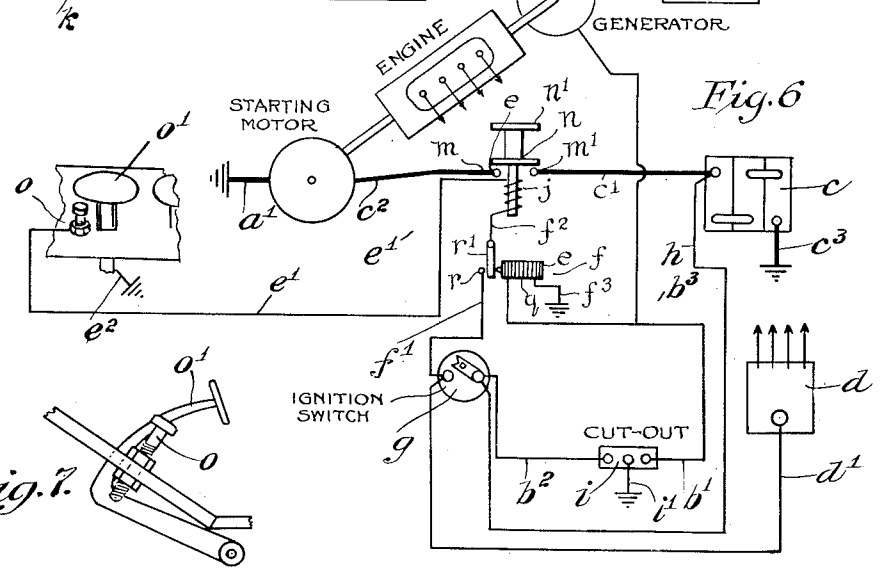



Fig. 7.




John Hasselbring, Jr INVENTOR

BY Frank P. Wentworth

his ATTORNEY

Patented July 6, 1926. 1,591,037

# UNITED STATES PATENT OFFICE.

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

## STARTER FOR INTERNAL-COMBUSTION ENGINES.

Application filed June 12, 1922. Serial No. 567,827.

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

I have heretofore devised a starter for internal combustion engines, which is described in my co-pending application filed April 23rd 1921, Serial No. 463,943, wherein the circuit between an electric battery, either primary or secondary, and the starting motor, has arranged therein a normally open make and break mechanism or switch, one contact of which is arranged within the field of an electromagnet. This magnet is wired in multiple with the ignition system of an automobile, so that said make and break mechanism will be automatically closed at the same time as the circuit to the ignition system is closed, and by the switch used in closing the circuit to said ignition system. This mechanism is also provided with an electromagnet in circuit with the generator in the system, a normally closed make and break mechanism, one contact of which is within the field of said generator magnet, being arranged in the circuit to said first named electromagnet, thus causing an automatic interruption in the circuit to the starting motor immediately upon the engine coming up to a speed which will actuate the generator, and causing an automatic closing of the circuit to the starting motor upon the stalling of the engine, or a reduction in its speed which will cause the generator to stop functioning.

With the type of starter above described, the mere closing of the ignition system switch will cause the circuit to the starting motor to be closed and the circuit although maintained open while the generator is functioning, will be automatically closed at any time that the generator ceases to function, and cause instantaneous application of power to the starting motor.

With some drivers, particularly those who are first beginning to drive an automobile, the type of starter above referred to, is found objectionable owing to the fact that the clutch controlling the power to the engine may remain set as the circuit to the starting motor is closed, thus causing some difficulties in the proper starting of the engine. With a skilled driver, however, no difficulty of this kind will be experienced as he will instinctively release the clutch when applying the starting power or when shifting gears.

With the above conditions in mind, I have provided a starter of the type above referred to, the parts of which are so constructed and arranged, that the circuit to the starting motor cannot be closed until the clutch pedal has been depressed to release the clutch. The starter of my present invention has all of the characteristics of the starter above referred to, so far as the actuation of the make and break mechanism for closing the circuit from the battery to the starting motor by the switch to the ignition system, and for automatically interrupting the circuit to said magnet by the generator current, are concerned, the last named characteristic being relied upon to prevent the closing of the circuit to the starting motor while the engine is running, even though the operator may depress the clutch pedal to release the clutch.

The starter of my invention is also so constructed that the circuit from the storage battery to the starting motor may be manually closed independently of the electrically actuating mechanism provided for this purpose.

The invention consists in the novel features of construction and combination of parts 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 controller mechanism with a portion of the casing broken away to disclose the primary controller;

Fig. 2 is a similar view with a portion of the casing broken away to disclose the secondary controller;

Fig. 3 is a front view of the controller mechanism with portions thereof broken away to disclose the primary controller mechanism and the make and break mechanism in the circuit between the battery and the starting motor;

Fig. 4 is a side view of the controller mechanism;

Fig. 5 is a rear view of the controller mechanism with a portion of the casing broken away to disclose the secondary controller and the switch actuated thereby;

Fig. 6 is a diagrammatic view showing the electrical conditions about the starter; and

Fig. 7 is a detail view illustrating the construction by which the clutch pedal is utilized for closing the circuit to the primary controller magnet.

Like letters refer to like parts throughout the several views.

In the embodiment of my invention shown in the drawings, reference being had particularly to Fig. 6, the starter of my invention includes therein an electric motor *a* of the usual or any desired construction adapted to be connected with the engine shaft in the usual or any desired manner; a generator *b* driven from the internal combustion engine in the usual manner, and a secondary or storage battery *c* adapted to be placed in circuit with the motor *a* in a manner which will be more fully described hereinafter, the battery *c* when starting an engine also supplying current to the usual ignition system of the engine indicated at *d*.

A make and break mechanism arranged in the circuit from the battery *c* to the motor *a* is adapted to be closed by a primary controller *e*, the circuit to said controller including therein a make and break mechanism adapted to be actuated by a secondary controller *f*.

The circuit from the battery *c* to the primary controller *e* and to the ignition system *d* is controlled by an ordinary manually operative switch *g*, one terminal of which is in electrical connection with the battery *c* through the lead *h*, and the other terminal of which is in electrical connection through the lead *d'* with the ignition system, and through the lead *f'* with the primary controller *e*, so that the actuation of a single switch will result in the establishment of electrical conditions which will permit the actuation of said ignition system and of said primary controller.

The generator *b* is in electrical connection through the wires $b'$—$b^2$, the ordinary cut-out *i* grounded at *i'*, and the switch *g*, with the ignition system *d*, and the battery *c*, so as to permit the recharging of the battery from the generator and the use of the generator current for ignition purposes.

The primary controller *e* includes therein an electromagnet *j* of any desired or approved construction inclosed in the protecting housing *k*. Mounted in but insulated from the main casing supporting the housing *k* and from each other, are two spaced contacts *m* and *m'* adapted to be engaged by a bridge contact *n* arranged within the magnetic field of the magnet *j*. Said bridge contact *n* is preferably of copper and carries a steel armature *p* which is situated adjacent one end of the core of the magnet *j*, and the arms of a yoke *p'* connected with the other end of said core, a spring $p^2$ encircling said core acting to normally force said contact *n* away from the contacts *m*—*m'*.

The contact *m* is provided with a binding post $m^2$ with which the wire *c'* leading from the battery *c* is connected, while the other contact *m'* has a binding post $m^3$ with which the wire $c^2$ leading to the motor *a* is connected.

The bridge contact *n* is provided with a stem *n'* projecting through a suitable insulating bushing $n^2$ passing through the flooring of a car, so as to permit the contact *n* to be engaged with the contacts *m*—*m'* by the depression thereof against the tension of the spring $p^2$ by the foot of the driver through the medium of the stem *n'*.

One terminal of the magnet *j* is connected with the battery *c* through the wire *h*, switch *g*, wire *f'*, the make and break mechanism of the secondary controller, and the wire $f^2$, while the other terminal of said magnet is grounded through the wire *e'* and a normally open make and break mechanism adapted to be closed through the actuation of the clutch pedal for releasing the clutch. Preferably this make and break mechanism consists of an adjustable contact *o* adjacent the clutch pedal *o'*, said contact being so set that when the clutch pedal is depressed for releasing the clutch, it will engage said contact *o* only after the clutch is released and thus complete a ground connection for the winding of the magnet *j* at $e^2$ Fig. 6.

While the contact *o* and the clutch pedal *o'* will prevent the energizing of the magnet *e* except when the clutch is released, the secondary controller is provided for the purpose of ensuring the de-energizing of said magnet when the motor comes up to that speed sufficient to make the generator *b* operative, irrespective of the position of said clutch pedal.

This secondary controller *f* includes therein an electromagnet *q*, one terminal of which is in electrical connection through the wire $b^3$ with the generator *b* and the other terminal of which is connected with ground at $f^3$. The generator itself is grounded at $b^4$.

Actuated by the magnet *q* is a make and break mechanism consisting of a fixed contact *r* in electrical connection through the wire $f^2$ with one terminal of the magnet *j* and a movable armature contact *r'* in electrical connection through the wire *f'* and the switch *g* with the battery *c*. The spring $r^2$ has a normal tendency to engage the contacts *r*—*r'*, thus maintaining a normally closed circuit from the battery *c* to the magnet *j* so far as the secondary controller is concerned, although the make and break mechanism consisting of the contact *o* and

the clutch pedal $o'$ will prevent the completion of the circuit until the pedal $o'$ is depressed and the engine clutch is released.

The ground connection for the motor $a$, the battery $c$ and the generator $b$ are shown (Fig. 6) respectively at $a'$, $c^3$ and $b^4$.

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

While an engine is idle, the bridge contact $n$ will be held by the spring $p^2$ out of engagement with the contacts $m$—$m'$ and the movable contact $r'$ will be engaged with the fixed contact $r$ by the spring $r^2$, thus maintaining a normally open circuit from the battery $c$ to the motor $a$, and a normally closed circuit between the switch $g$ and the magnet $j$. Since the clutch pedal $o'$ is normally elevated, there will be a gap between it and the contact $o$ so that even when the switch $g$ is closed, the magnet $j$ will not be energized until the clutch pedal has been depressed to an extent to release the clutch, and engage the pedal $o'$ with the contact $o$.

When it is desired to start the engine, it is merely necessary to close the switch $g$, thus establishing a condition whereupon with the turning of the engine the ignition system will function, and upon the depression of the pedal $o'$, sufficient to release the engine clutch and to engage the contact $o$, the magnet $j$ will be energized. As a result of the traction of the magnet, the steel armature will receive such movement as to engage the bridge contact $n$ with the spaced contacts $m$—$m'$ and close the circuit to the motor $a$, which condition will be maintained until the circuit to the magnet $j$ is interrupted by the action of the secondary controller, or the release of the clutch pedal and its resultant movement away from the contact $o$.

When the engine is running under its own power, the current from the generator $b$ will energize the magnet $q$, the traction of which will move the movable contact $r'$ out of engagement with the fixed contact $r$ against the tension of the spring $r^2$ and interrupt the circuit to the magnet $j$ irrespective of the position of the clutch pedal. It will be noted, however, that if the generator should not be functioning for any reason, the circuit to the magnet $j$ may be interrupted by means of the clutch pedal, it being necessary under this condition, and while the engine is running, to exercise care in depressing the clutch member so as not to engage it with the contact $o$.

To permit the setting of the contact $o$ with regard to the movable pedal $o'$ so as to ensure a complete release of the clutch before the circuit to the magnet $j$ is closed with a resultant closing of the circuit to the motor $a$, said contact $o$ is made adjustable as shown, it being desirable to so set this contact that the pedal $o'$ will engage it only after the clutch pedal is completely released, it being preferable to provide for a little excess motion of the clutch pedal in order to engage it with said contact after the clutch is released.

The projecting stem $n'$ and its head $n^2$ is provided merely for emergency use in the event of some disarrangement of the electrical connections to the primary and the secondary controllers.

If all parts of the starter are in good working condition, so long as the engine is running the secondary controller will at all times prevent the closing of the circuit through the contact $r$—$r'$ so that the clutch pedal may be actuated freely without energizing the magnet $j$, the bridge contact $n$ being held out of engagement by the spring $p^2$ with the contacts $m$—$m'$ so long as the magnet $j$ is not energized.

The cutout $i$ has its usual function in recharging the battery $c$ or supplying current from the generator to the ignition system, which also has its usual function.

While the circuit to the primary controller mechanism is shown as being grounded through the contact $o$ and clutch pedal $o'$, it is apparent that the make and break mechanism consisting of these parts, may be arranged in any part of the circuit to the magnet $j$, the arrangement shown being merely a matter of convenience.

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 may be placed in circuit with said battery, a normally open make and break mechanism in said circuit, and adapted to be actuated by the clutch pedal controlling the transmission of power from the engine, whereby the circuit to said magnet can be closed only when said clutch is released, and a normally closed make and break mechanism also 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, and 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 permit the energizing of said primary controller only when the clutch is released, 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 and prevent the closing of the circuit to said starting motor by the actuation of the clutch pedal to release the clutch.

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 may be placed in circuit with said battery, an electroconductive clutch pedal, a fixed contact positioned in the path of movement of said pedal and adapted to be engaged thereby with the movement of said pedal to release the engine clutch, said contact and said pedal being arranged in the circuit to said starting motor, whereby the circuit to said magnet can be closed only when said clutch is released, and a normally closed make and break mechanism also in said circuit, a secondary circuit controller consisting of an electro magnet operative upon said last named make and break mechanism, and electrical connections whereby said magnet is placed in circuit with said generator, and 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 permit the energizing of said primary controller only when the clutch is released, 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 and prevent the closing of the circuit to said starting motor by the actuation of the clutch pedal to release the clutch.

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 may be placed in circuit with said battery, an electroconductive clutch pedal, a fixed contact positioned in the path of movement of said pedal and adapted to be engaged thereby with the movement of said pedal to release the engine clutch, said contact and said pedal being arranged in the circuit to said starting motor, whereby the circuit to said magnet can be closed only when said clutch is released, and a normally closed make and break mechanism also in said circuit, means whereby said contact may be adjusted toward and from said pedal, whereby the closing of the circuit to said motor may be timed in relation to the release of the clutch by said pedal, a secondary circuit controller consisting of an electro magnet operative upon said last named make and break mechanism, and electrical connections whereby said magnet is placed in circuit with said generator, and 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 permit the energizing of said primary controller only when the clutch is released, 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 and prevent the closing of the circuit to said starting motor by the actuation of the clutch pedal to release the clutch.

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, 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 may be placed in circuit with said battery, a normally open make and break mechanism in said circuit, and adapted to be actuated by the clutch pedal controlling the transmission of power from the engine, whereby the circuit to said magnet can be closed only when said clutch is released, and a normally closed make and break mechanism also 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 con-

troller, whereby the closing of said manually operative switch will permit the energizing of said primary controller only when the clutch is released, 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 and prevent the closing of the circuit to said starting motor by the actuation of the clutch pedal to release the clutch, and manually operative means whereby the make and break mechanism and the primary controller may be actuated independently of the magnet forming a part of said controller.

In witness whereof I have hereunto affixed my signature this 23rd day of May, 1922.

JOHN HASSELBRING, JR.