

Aug. 14, 1923.

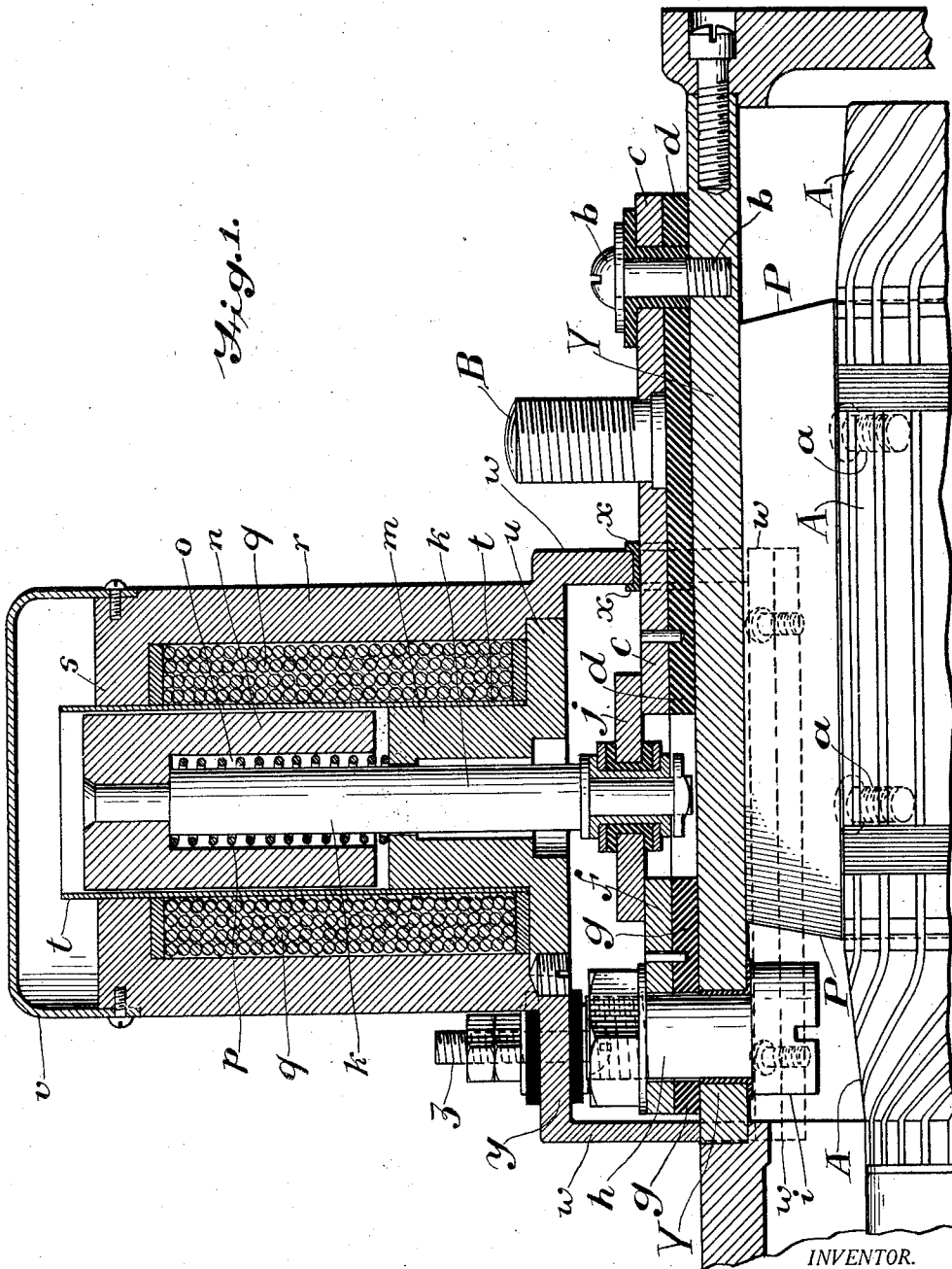
A. A. KENT

1,464,714

ENGINE STARTING APPARATUS

Filed May 22, 1920

2 Sheets-Sheet 1



*Fig. 1.*

INVENTOR.

Arthur Atwater Kent

BY

Charles L. Chet

his ATTORNEY.

Aug. 14, 1923.

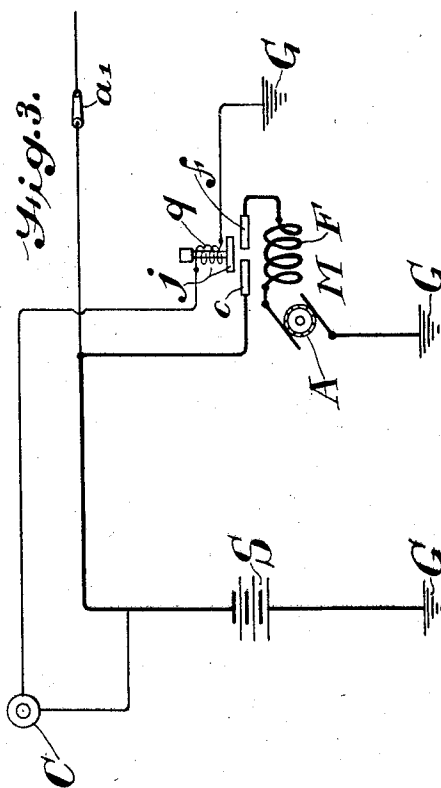
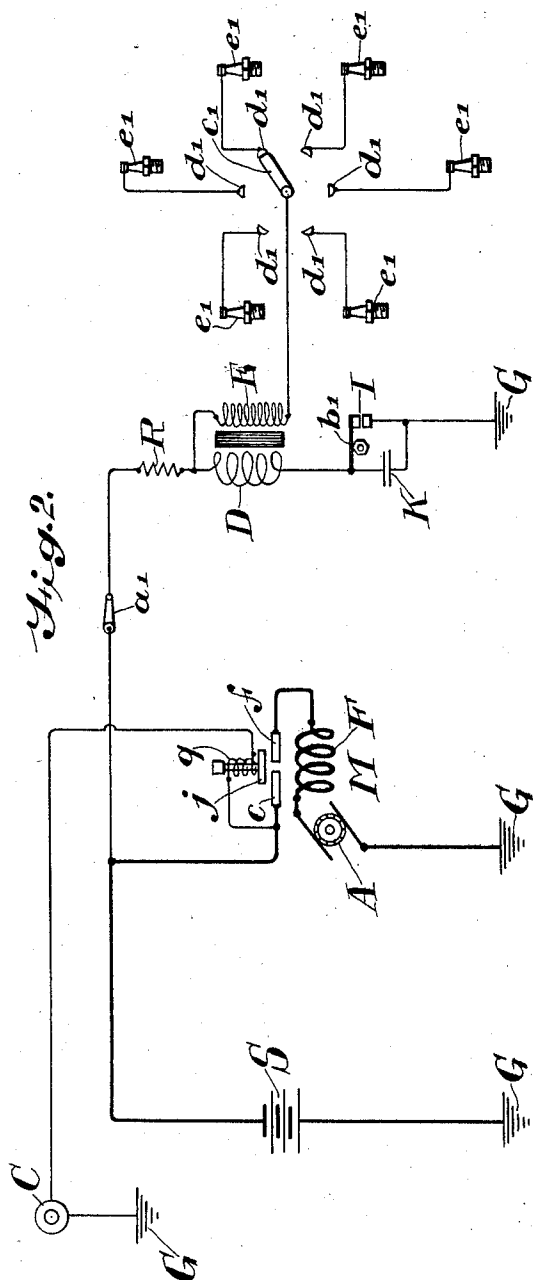
1,464,714

A. A. KENT

ENGINE STARTING APPARATUS

Filed May 22, 1920

2 Sheets-Sheet 2



INVENTOR.

Arthur Atwater Kent

BY

Cornelius L. Elbert

his ATTORNEY.

Patented Aug. 14, 1923.

1,464,714

# UNITED STATES PATENT OFFICE.

ARTHUR ATWATER KENT, OF ARDMORE, PENNSYLVANIA.

## ENGINE-STARTING APPARATUS.

Application filed May 22, 1920. Serial No. 383,497.

*To all whom it may concern:*

Be it known that I, ARTHUR ATWATER KENT, a citizen of the United States, residing in Ardmore, county of Montgomery, and State of Pennsylvania, have invented certain new and useful Improvements in Engine-Starting Apparatus, of which the following is a specification.

My invention relates to apparatus for electrically starting internal combustion engines.

It is the object of my invention to provide for the electric motor employed for cranking or starting an internal combustion engine electro-magnetically controlled or operated switching mechanism directly upon the frame, field yoke or other stationary part of the electric motor.

It is a further object of my invention to provide switching mechanism of the character referred to whose electro-magnetic winding shall be energized from the same battery or source of current which energizes the motor, the circuit of the winding being controlled by push button or other switch preferably located adjacent the operator of a vehicle driven by the internal combustion engine.

To these ends I have provided structure of the character hereinafter described and claimed.

For an illustration of some of the various forms my invention may take, reference is to be had to the accompanying drawings, in which:

Fig. 1 is a sectional view, parts in elevation, through a part of the electric motor and the electro-magnetic switching mechanism.

Fig. 2 is a diagrammatic view of a circuit arrangement suitable for employment of my structure.

Fig. 3 is a diagrammatic view of a modified circuit arrangement.

Referring to Fig. 1, A represents in elevation part of the rotor or armature of an electric motor adapted to crank or operate an internal combustion engine, such, for example, as employed upon a motor vehicle, for starting or bringing the engine to condition to operate under its own power. The armature A rotates with respect to suitable number of field poles one of which is indicated at P suitably secured, as by screws  $a, a$ , to the field yoke Y, which may be a cylindrical member of steel or iron.

Secured upon the exterior of the frame member or yoke Y by a screw  $b$  is the strip or plate of copper or other suitable conducting material  $c$ , between which and the member Y intervenes the member  $d$  of insulating material, the screw  $b$  being suitably insulated from the member  $c$ . Suitably secured to or in electrical contact with the plate  $c$  is the binding post B, with which is adapted to connect any suitable conductor to connect the plate  $c$  with the motor energizing battery. One end of the plate  $c$  serves as the terminal of the motor controlling switch, the second switch terminal  $f$ , of copper or other suitable material, being suitably spaced from the plate  $c$  and secured to the member Y, but insulated therefrom by the member  $g$ . Connecting with the second switch terminal  $f$  is the conducting stud  $h$  extending through, but insulated from the shell or yoke Y into communication with the member or terminal  $i$ , with which may connect one terminal of the motor winding, for example, one terminal of the series field winding thereof.

Adapted to bridge and electrically connect the switch terminals  $c$  and  $f$  is the movable metallic bridging member  $j$ , carried by but insulated from the vertically movable member  $k$ , preferably of magnetizable material, extending freely through the magnetizable stationary core member  $m$  and attached to the movable core member  $n$ . The movable core  $n$  has a bore  $o$ , through which the aforesaid member  $k$  extends, the annular space being occupied by a helical spring  $p$  tending to raise the member  $n$  and the attached switch member  $j$ . Surrounding the core members  $m$  and  $n$  is the coil or magnetizing winding  $q$ , in turn surrounded by the jacket or housing  $r$  of magnetizable material, and having the inwardly extending upper flange  $s$  having an aperture through which extends the sleeves or spool  $t$ , within which extend the aforesaid core members  $m$  and  $n$ . The stationary core member  $m$  has an outwardly extending flange  $u$  making a joint of low magnetic reluctance with the jacket or housing  $r$ . Carried by the housing  $r$  is the removable closure cap  $v$ .

Secured to or integral with the jacket or housing  $r$  are the flanges or saddle members  $w$  having recesses or depressions conforming to the yoke or frame Y and, in the case of the right hand flange  $w$ , having a notch for straddling the members  $c$  and  $d$ ,

a member  $\alpha$  of insulating material preventing contact between the flange and the contact plate  $c$ . Carried by the extension  $\gamma$  of the housing or jacket member  $r$  is the binding post  $z$ , suitably insulated and connecting with one terminal of the winding  $q$ , the other terminal of which, as in Fig. 2, may connect with one of the stationary switch terminals, or, as in Fig. 3, may be grounded, as by connecting with the core member  $m$ , housing  $r$  or other suitable grounded element.

Referring to Fig. 2,  $S$  is the source of current, as a storage battery, one terminal of which is connected to the frame or ground  $G$ , or other suitable return conductor. Its other terminal connects to one of the stationary switch terminals, as  $e$ . The other switch terminal, as  $f$ , connects with one terminal of the electric motor  $M$ , as for example, with one terminal of its series field winding  $F$ , whose other terminal connects with the armature  $A$  whose other terminal connects to ground or return conductor  $G$ . One terminal of the winding  $q$  is connected to one terminal of the battery  $S$ , while its other terminal connects with one terminal of the push button or switch  $C$ , whose other terminal connects to the ground or return conductor  $G$ . From one terminal of the battery  $S$  connection is made through switch  $\alpha^1$  with one terminal of the primary circuit of the ignition apparatus comprising, for example, the resistance  $R$  and the primary  $D$  of an induction coil, the timer or interrupter  $I$ , shunted as usual by condenser  $K$ , and actuated by the engine driven cam  $b^1$ . The high tension secondary circuit winding  $E$  has its one terminal grounded, as by connecting with the primary circuit, and its other terminal connecting with the rotatable distributor element  $c^1$  driven in unison with the cam  $b^1$  and co-acting successively with the stationary distributor contacts  $d^1$ , each of which connects with a spark plug  $e^1$ .

The operation is as follows:

With the internal combustion engine at rest, it may be started, without directly—as manually or by foot—actuating the motor current controlling switch, by pressing the push button  $C$ , whereupon current will flow from the battery  $S$  through the winding  $q$  and the push button  $C$ , energizing the electro-magnet or solenoid, causing the core member  $n$ , Fig. 1, to be attracted downwardly in opposition to spring  $p$ , causing the movable contact  $j$  to engage and bridge the contacts  $e$  and  $f$ , whereupon current will flow from the battery  $S$  through contacts  $e$ ,  $j$  and  $f$  in succession, through the series field  $F$  of the electric motor, and thence through the armature  $A$ , energizing the motor, which then cranks or actuates the internal combustion engine which will,

with the switch  $\alpha^1$  closed, then start under its own power. Immediately upon release of the push button  $C$  the winding  $q$  will be deenergized and the spring  $p$  will raise the contact  $j$ , thereby breaking the motor energizing circuit.

As shown in Fig. 3, the circuit arrangement may be modified by connecting one terminal of the push button  $C$  to the same terminal of the battery  $S$  which connects with the motor control switch. In this case, the other terminal of the winding  $q$  connects to the ground or return conductor  $G$ . The operation, however, is the same as that described in connection with Fig. 2.

By means of the structure hereinbefore described, it is possible by simple push button or manually operated switch to energize an electro-magnetic switch controlling the engine starting motor.

It is further of advantage to mount the electro-magnetic control switch directly upon the starting motor unit, as upon its frame, field yoke or other suitable stationary member, the connections then between the starting switch and motor being short and direct, with the further advantage that the combined motor and electro-magnetic control switch therefor may be constructed and marketed as a unit; and with the further advantage that when so constructed and marketed only a relatively small conductor suitable for conveying the current for energizing the winding  $q$  need be run to the control switch or push button, as  $C$ , in lieu of running a conductor of large current carrying capacity to a switch suitably located within the reach of the foot or hand of the automobile driver.

What I claim is:

1. The combination with an engine starting motor, of a fixed switch contact secured directly upon and insulated from a stationary portion of said motor, a co-acting movable contact, an electro-magnet whose movable member carries said movable contact, and a magnet housing secured to said stationary portion and enclosing the magnet winding and said movable contact.
2. The combination with an engine starting motor, of a fixed switch contact secured to and insulated from the frame of said motor, a co-acting movable contact, an electro-magnet whose movable member carries said movable contact, and a magnet housing carried upon said frame and enclosing the magnet winding and said movable contact, said fixed contact extending to the exterior of said housing and insulated therefrom.
3. The combination with an engine starting motor, of a fixed switch contact secured to and insulated from the field yoke of said motor, a co-acting movable contact, an electro-magnet whose movable member carries said movable contact, and a magnet housing

secured to said field yoke and enclosing the magnet winding and said movable contact, said fixed contact extending to the exterior of said housing and insulated therefrom and secured to said field yoke outside of said housing.

4. The combination with an engine starting motor, of fixed contacts secured upon a stationary portion of said motor, electro-magnetic means comprising a winding and a movable member, a movable contact movable by said movable member to engage and bridge said fixed contacts, a connection from one of said fixed contacts through said stationary portion to a terminal of said motor, and a housing enclosing said winding and said fixed and movable contacts, said housing secured to said stationary portion.

5. The combination with an engine starting motor having a field winding, of a fixed contact secured to a stationary portion of said motor, a connection from said fixed contact through said stationary portion to a terminal of the field winding of said motor, a second fixed contact secured to said stationary portion, a movable contact adapted to engage and bridge said fixed contacts, electro-magnetic means comprising a winding and a movable member, said movable contact carried by said movable member, a housing secured to said stationary portion enclosing said winding and said switch contacts, one of said fixed contacts extending to the exterior of said housing, and a binding post thereon exterior to said housing.

6. The combination with an engine starting motor having a cylindrical field yoke, of a starting switch comprising fixed contacts directly secured upon and insulated from said field yoke, a co-operating movable contact, a housing secured to said field yoke enclosing said movable contact and one of said fixed contacts, the other of said fixed contacts extending to the exterior of said housing, connecting means on said portion of said contact exterior to said housing, a connection from said one of said fixed contacts through said field yoke to the inner side thereof, and electro-magnetic means in said housing for actuating said movable contact.

7. The combination with an engine starting motor comprising an armature and field poles and a frame member surrounding them, of a starting switch comprising a fixed contact insulated from said frame member, a conducting member connecting with said contact and extending through said frame member and insulated therefrom and securing said contact upon said frame member, a co-operating movable contact, electro-magnetic means carried by said frame member for actuating said contact, and a connection from said conducting member to one terminal of said motor.

8. The combination with an engine start-

ing motor comprising field poles, an armature and a frame member enclosing them, of a starting switch comprising a fixed contact secured directly upon and insulated from said frame member, a housing secured upon said frame member and comprising a plurality of chambers, a magnet winding in one of said chambers, a co-acting movable magnetizable member, and a movable contact actuated by said magnetizable member and disposed with said fixed contact in another of said chambers.

9. The combination with an engine starting motor comprising field poles, an armature and a frame member enclosing them, of a starting switch comprising a fixed contact secured directly upon and insulated from said frame member, a housing secured upon said frame member and comprising a plurality of chambers, a magnet winding in one of said chambers, a co-acting movable magnetizable member, a movable contact actuated by said magnetizable member and disposed with said fixed contact in another of said chambers, said fixed contact extending to the exterior of said housing, and a circuit connection on said contact exterior to said housing.

10. The combination with an engine starting motor comprising field poles, an armature and an enclosing frame member therefor, of a starting switch comprising fixed contacts secured directly upon and insulated from said frame member, a conducting member extending from the interior to the exterior of said frame member through the same and insulated therefrom, said conducting member connected to one of said fixed contacts, one terminal of said motor connected to the inner end of said conducting member, a movable contact co-acting with said fixed contacts, a housing secured directly to said frame member and enclosing said one of said fixed contacts, said movable contact and a portion of another of said fixed contacts, and electro-magnetic means within said housing for actuating said movable contact.

11. The combination with an engine starting motor comprising field poles, an armature and an enclosing frame member having a body portion and an end closure, of starting switch mechanism comprising an electro-magnet, a housing therefor, said housing having flanges secured to said body portion of the frame member independently of said end closure and forming a chamber, fixed contacts within said chamber and at least one of which is insulated from said frame member, and a co-operating movable contact actuated by said electro-magnet.

12. The combination with an engine starting motor comprising field poles, an armature and a cylindrical field yoke, of starting switch mechanism comprising an electro-

magnet, a housing therefor having flange extensions reaching and secured to said field yoke and forming therewith a chamber, a movable contact in said chamber actuated by said electro-magnet, a co-acting fixed contact secured to and insulated from said field yoke, one of said flange extensions having an aperture through which said fixed contact extends to the exterior, and circuit connecting means on said fixed contact exterior to said housing.

13. The combination with an engine starting motor comprising field poles, an armature and a cylindrical field yoke, of starting switch mechanism comprising a housing secured to said field yoke and forming a chamber, co-acting movable and fixed contacts within said chamber, a movable core structure carrying the movable contact and movable in a direction radial to said field yoke, and a winding within said housing surrounding said core structure.

14. The combination with an engine starting motor comprising field poles, an armature and a cylindrical field yoke, of starting switch mechanism comprising a housing secured to said field yoke and forming a chamber, co-acting movable and fixed contacts within said chamber, a movable core structure carrying the movable contact and

movable in a direction radial to said field yoke, and a member within said housing through which said core structure moves dividing said winding from said chamber.

15. The combination with an electric motor provided with an enclosing frame having body and end portions, of an electro-magnet, a housing secured to the body portion of said frame independently of said end portions and forming a chamber, a fixed contact within chamber, and a coacting movable contact therein actuated by said electro-magnet.

16. The combination with an electric motor having a casing provided with body and end portions, of switch mechanism for the motor comprising an electro-magnet, a housing therefor detachably secured to the body portion of said casing independently of said end portions and forming a chamber, a stationary contact within said chamber secured to the motor casing and extending to the exterior of said chamber, and a movable contact also located within the chamber and actuated by the said electro-magnet.

In testimony whereof I have hereunto affixed my signature this 20th day of May, 1920.

ARTHUR ATWATER KENT.