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AUTOMATIC STARTING MEANS FOR INTERNAL COMBUSTION ENGINES

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Fig. 1

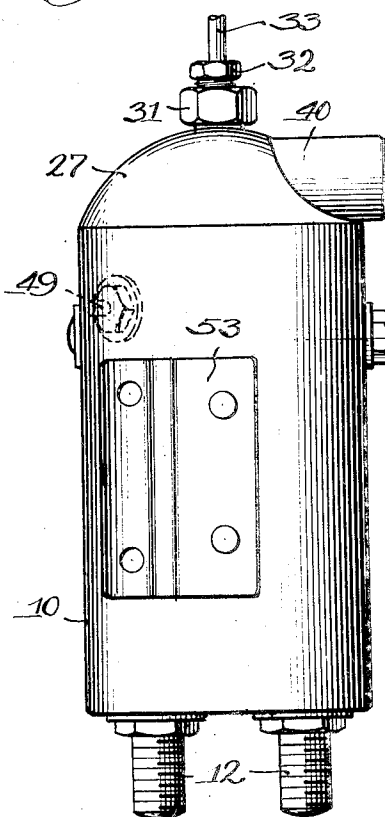


Fig. 2

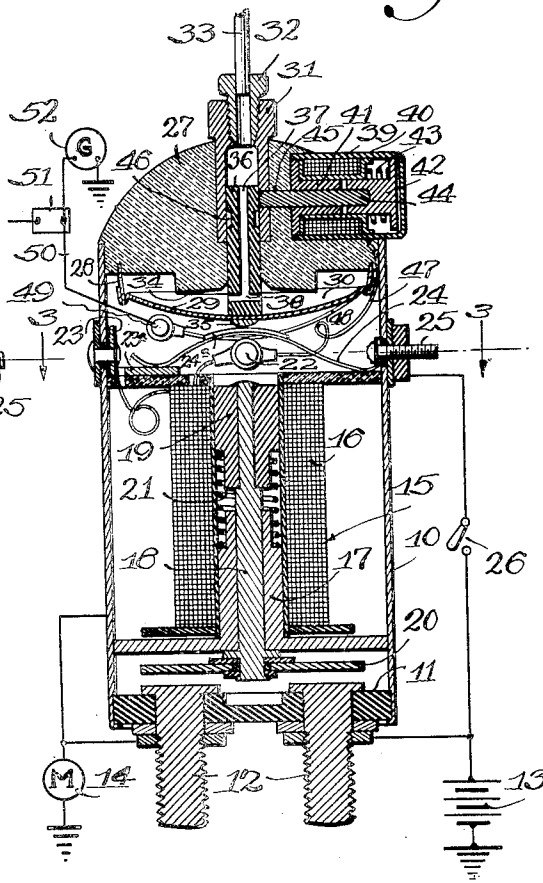
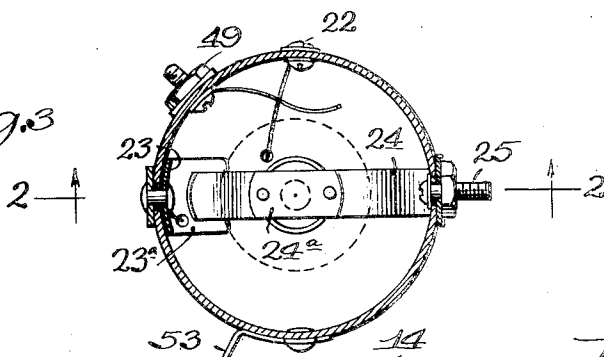


Fig. 3



Witness:

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AUTOMATIC STARTING MEANS FOR INTERNAL COMBUSTION ENGINES

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This invention relates to improvements in automatic starting means for internal combustion engines.

One object of the invention is to provide a device for installation on a motor vehicle for effecting the closing of the starting motor circuit automatically when the engine stops while the ignition switch is open, said device comprising a controlling switch which is held open by sub-atmospheric pressure or suction of the engine while the same is operating but which automatically closes when the engine stops, and an electric-locking mechanism which holds the control switch open as long as the generator of the engine is in operation to prevent the closing of the starting motor circuit, even though the engine is so operating as to produce a very low vacuum on the fuel intake.

Another object of the invention is to provide a device of compact construction which can be attached readily to a motor vehicle and which, as compared with other devices of similar nature of which applicant is aware, requires but relatively few conductors in establishing its circuits, whereby the installation of the apparatus is considerably simplified.

Other objects relate to various features of construction and arrangement of parts which will be apparent from a consideration of the following specification and accompanying drawing, wherein

Fig. 1 is a lower plan view of a device embodying the present improvements.

Fig. 2 is a longitudinal sectional view taken on line 2—2 of Fig. 3.

Fig. 3 is a transverse sectional view taken on line 3—3 of Fig. 2.

In the drawing, 10 is a casing or housing which carries the operating parts of the device and has a base 11 preferably of insulating material which supports terminals 12, one of which is adapted to be connected to the battery 13 of the vehicle, and the other to the starting motor 14. When the terminals 12 are bridged, the circuit from the battery to the starting motor will be closed and the engine of the vehicle, not shown, will be started.

Also carried in the housing 10 is an electromagnet or solenoid 15 having a winding 16 and stationary core 17 of magnetic material which is centrally apertured. Extending through the aperture is a stem 18 of non-magnetic material which is secured at its upper end to the plunger 19 of magnetic material, which is caused to reciprocate when the coil 16 is energized. The stem 18 carries a bridging member 20 at its lower end whereby when the plunger 19 moves downwardly from the position shown in Fig. 2, the battery-starting motor circuit will be closed. A spring 21 is disposed between the upper end of the stationary core 17 and the lower end of the plunger 19, and serves to move the latter to the position shown in Fig. 2 upon the deenergization of the solenoid. One end of the winding 16 may be grounded on the post 22 which is electrically connected to the casing 10, while the other end of the winding is connected to a terminal 23 of angular shape, which is insulated from the casing 10.

A resilient conducting member 24 is secured at one end by post 25 and is also insulated from the casing 10. Conductor 24 is bowed upwardly as shown and its free end rests upon flange 23a of the member 23, when forced to such position by means hereinafter described. The post 25 may be electrically connected to the ignition circuit of the engine whereby when the ignition switch 26 is closed current will tend to flow to the post 25 through the resilient conductor 24, member 23, to the coil 16 for causing the bridging member 20 to be moved into contact with the terminals 12 for closing the battery-motor circuit.

A member 27, preferably of insulating moldable material such as bakelite, is secured in the upper end of the housing 10. Embedded in the lower end of the member 27 is a metallic ring 28 to which is secured as by welding or soldering, a flexible metallic diaphragm 29. The diaphragm and adjacent end of the member 27 form a sub-atmospheric pressure chamber 30. The closing member 27 has a central passage therethrough carrying a nipple 31 and a tightening member 32 whereby the tube 33 may establish com-

munication between the chamber 30 and the intake manifold of the engine. It will thus be seen that while the engine is running on its own power, the exhaustion of air from chamber 30 will cause the diaphragm 29 to collapse or move toward the seat 34, whereupon conducting member 24 is released and moves out of contact with the terminal 23^a, thus opening the circuit of the solenoid 15 and permitting the spring 21 to lift the plunger 19 and with it the stem 18 and the bridging member 20, and thus open the starting motor circuit.

Secured to the diaphragm 29, as by a screw 35, is a stem 36 which is slidable within the passage of the closing member 27. The stem 36 may be provided with a longitudinal recess 37 which communicates with the transverse recess 38 which permits the exhaustion of air from the chamber 30 during the operation of the engine under its own power. Mounted in the member 27 is a casing 39 carrying a solenoid comprising windings 40, stationary core 41 and spring resisted plunger 42, the spring being indicated at 43. The plunger 42 operates a locking pin 44 which is slidable in the lateral passage 45 which connects with the central passage of the member 27. When the solenoid is energized the plunger 42 moves the pin 45 inwardly or to the left, as viewed in Fig. 2, whereby its inner end is caused to seat in a groove 46 formed in the stem 36. This locking action of course cannot take place until the diaphragm has been deflected inwardly by suction through the tube 33, but when so interlocked, the diaphragm 29 cannot return to its distended position during the energization of the windings 40. The forward end of the pin 45 is beveled, as shown, whereby the stem 36 can be immediately released upon deenergization of the solenoid 40 by the force exerted by the diaphragm 29 in returning to distended position. In fact the spring 43 may be eliminated if desired. One end of the winding 40 may be grounded to the post 22 by means of the wire 47 while the other end of the winding is connected by means of wire 48 with the terminal post 49. From the post 49 a wire 50 extends to the generator side of the cut out 51, preferably.

It will thus be seen that while the generator 52 is being turned over by the engine, current will be carried through wire 50 and other parts of the circuit just described, to the solenoid 39, and the diaphragm 29 which will have previously been moved to upper position, will be held in such position as long as the generator is operated even though the vacuum produced by the engine may be at its lowest degree, and the suction through the tube 33 would be insufficient to hold the diaphragm against returning to its distended position. It has been found that in the manufacture of diaphragms for like apparatus uni-

formity can be obtained with respect to the vacuum required to collapse them whereby the battery-starting motor circuit will not be interrupted prior to the operation of the engine under its own power. However, a diaphragm having sufficient stiffness to resist the collapsing action of the suction established by the turning over of the engine, as during cranking prior to running under its own power, will frequently snap back into distended position when the accelerator of the engine is opened suddenly, or the vacuum is otherwise caused to drop close to the zero point, thereby cutting in the starting motor during the operation of the engine. By providing the locking device above described the diaphragm is held against return movement even though the suction created by the engine may drop, as the locking device is held in operative position by very slight current from the generator and will not release the diaphragm until the generator has stopped, which of course takes place upon stopping of the engine.

The casing 10 may be provided with a bracket 53 whereby it can be mounted conveniently and grounded to the starting motor 14. In use should the engine stop no current will be generated by the generator 52 and the winding 40 would be deenergized whereupon the spring 43 will move the plunger 42 and locking pin 45 to the right as viewed in Fig. 2. Suction of the engine having also ceased, the diaphragm 29 will be free to return immediately to the distended position shown in Fig. 2, which movement of the diaphragm forces the spring conductor 24 into contact with the terminal 23^a, whereupon current flows from the ignition circuit through the solenoid 15 and thus causes the bridging member 20 to close the circuit to the starting motor 14. This of course cannot take place if the ignition switch 26 is opened. Immediately upon the starting of the engine under its own power atmospheric pressure within chamber 30 will be reduced, thus causing the diaphragm 29 to collapse and move the stem 36 upwardly. At the same time the current from the generator will energize the winding 40 and effect the movement of the locking pin 45 into engagement with the groove 46 and will thus hold the diaphragm against movement to distended position during the operation of the engine, as above described. The spring conductor 24 may be provided with an insulating strip 24^a to prevent short circuiting the solenoid 15 through contact with the screw 35.

Although I have shown and described my improvements for the purpose of illustration, I do not wish to be restricted specifically to the disclosure except as so limited by the appended claims.

What I claim is:

1. Circuit establishing means comprising

- a housing, a pair of spaced terminals supported thereby, a bridging member for closing a circuit through said terminals, a solenoid in said housing having a longitudinal apertured stationary core, a spring resisted solenoid plunger adjacent one end of said core, a member operated by said plunger and extending through said aperture into engagement with said bridging member for moving the same into and out of contacting relation with said terminals, and means for closing the circuit of the solenoid windings, said means comprising a sub-atmospheric pressure responsive device within said housing.
2. Circuit establishing means comprising a pair of spaced terminals, a bridging member for said terminals, a solenoid having a spring resisted plunger for actuating said bridging member, a closing member for closing the circuit of the solenoid windings, said member being arranged to move normally to circuit opening position, a sub-atmospheric pressure device for controlling the movements of said flexible member, said device comprising a chamber forming means including a flexible diaphragm adapted when in extended position to hold said closing member in position for closing the circuit through said windings and when in retracted position due to reduced atmospheric pressure in said chamber permitting said closing member to open said solenoid circuit whereby said spring resisted plunger moves said bridging member out of contact with said terminals.
3. A device of the class described comprising an apertured supporting member, a flexible diaphragm supported by said member and spaced from one end thereof and defining a chamber therebetween, a suction conduit communicating with said chamber through said aperture for effecting the reduction of atmospheric pressure in said chamber to cause the inward deflection of said diaphragm, circuit opening and closing means controlled by the movements of said diaphragm, a member attached to said diaphragm and slidable within said aperture, and means adapted to engage said slidable member for holding said diaphragm in inner position.
4. A device of the class described comprising a centrally apertured supporting member, a flexible diaphragm supported by said member and spaced from one end thereof and defining a chamber therebetween, a suction conduit communicating with said chamber through said aperture for effecting the reduction of atmospheric pressure in said chamber to cause the inward deflection of said diaphragm, circuit opening and closing means controlled by the movements of said diaphragm, a member attached to said diaphragm and slidable within said aperture, and means adapted to engage said slidable member for holding said diaphragm in inner position, said last named means comprising a reciprocable pin and a spring resisted solenoid plunger for operating the same into and from engaging relation with said slidable member.
5. A device for controlling the opening and closing of an electric circuit comprising a supporting member having a ring in one end thereof, a flexible diaphragm secured to said ring and defining a chamber between said diaphragm and supporting member, said supporting member having a passage therein communicating with said chamber and with means for reducing the atmospheric pressure therein, said supporting member having a lateral passage extending from said first passage, a slidable member in said first passage secured to said diaphragm and movable therewith, a reciprocable pin in said lateral passage, and an electrically operated member for operating said pin into engagement with said slidable member for holding said diaphragm in inwardly deflected position during the energization of said electrically operated member.
- In testimony whereof, I have subscribed my name.
- HERBERT A. DAVIS.