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AUTOMATIC SELF STARTER FOR INTERNAL COMBUSTION ENGINES

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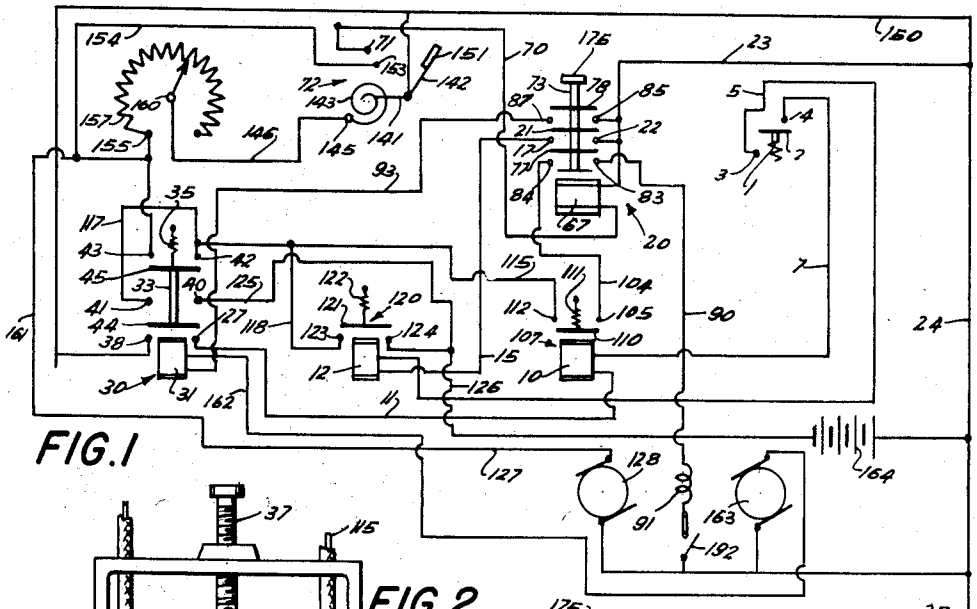


FIG. 1

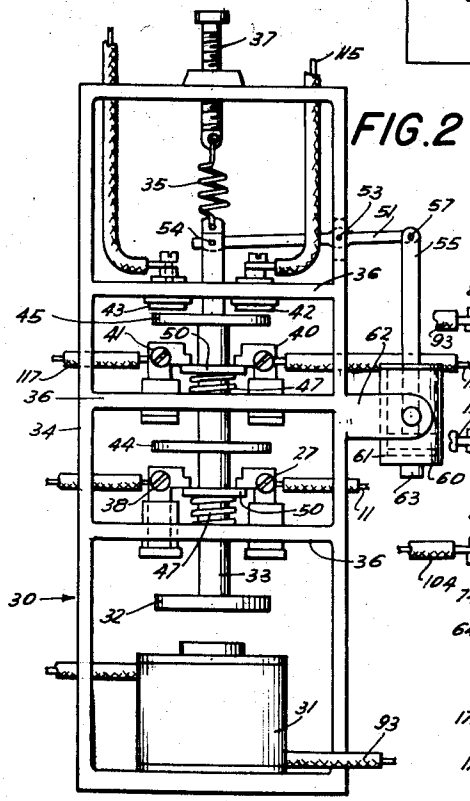


FIG. 2

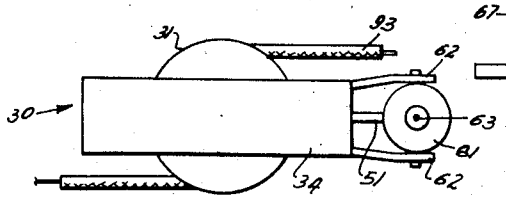


FIG. 3

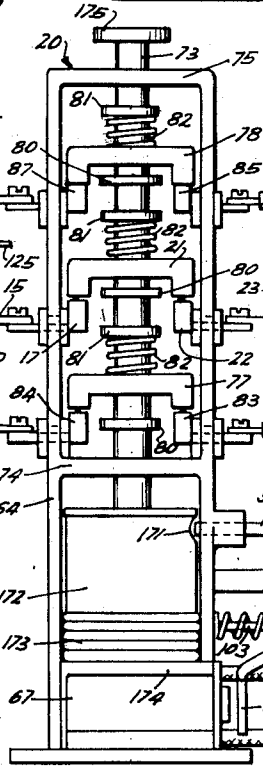


FIG. 4

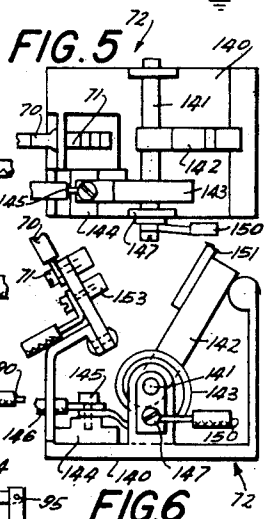


FIG. 5

FIG. 6

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AUTOMATIC SELF STARTER FOR INTERNAL COMBUSTION ENGINES

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1 Claim. (Cl. 290—2)

My present invention relates to a starting device for an internal combustion engine, and more particularly to such apparatus arranged for use on automotive vehicles and the like.

In the operation of an automotive vehicle employing an internal combustion engine as the source of energy, difficulty has been experienced in storing the vehicle in an unheated garage, due to the thickening of the cold lubrication oil in the crankcase and other parts of the engine, which makes the starting of an engine in cold weather difficult and tends to deplete the battery that forms the source of current for the electric starter motor.

Therefore, one object of the present invention is the provision of a device of the character described which will keep the engine and particularly the motor block warm by automatically starting the engine from time to time through a thermostatically controlled mechanism whenever the temperature has been lowered below a predetermined value, and which also automatically will cause the engine to stop after a predetermined temperature in the engine block has been attained. Since the water circulation through the radiator of an automotive vehicle is controlled by a thermostatically actuated valve, my new and improved device can be used for keeping warm only the engine and the motor block, but not necessarily of all the water in the entire cooling system and in the radiator.

Another object of the present invention is the provision of a device of the character described which is comparatively simple in construction, consisting of only a few inexpensive parts that can be manufactured and assembled economically by mass production processes, and which also is light in weight and small in size.

A further object of the present invention is the provision of a device of the character described which is simple to operate as well as reliable in use, and which is well adapted for being installed into existing motor vehicles as well as into newly manufactured motor vehicles.

With the foregoing and other objects in view which will appear as the description proceeds, the invention consists of certain novel details of construction and combinations of parts hereinafter more fully described and pointed out in the claim, it being understood that changes may be made in the construction and arrangements of parts without departing from the spirit of the invention as claimed.

In the accompanying drawing a preferred form of the invention has been shown.

In said drawing:

Figure 1 is wiring diagram of a preferred embodiment of my invention;

Fig. 2 is a detailed side view of a magnetically actuated switch;

Fig. 3 is a bottom plan view of the switch of Fig. 2;

Fig. 4 is a detailed side view of a manually and automatically operated switch;

Fig. 5 is a detailed top plan view of an automatic shut-off device; and,

Fig. 6 is a side view of the device of Fig. 5.

Similar reference characters refer to similar parts throughout the several views.

In the drawing the numeral **1** denotes a thermostat which—when a predetermined low temperature has been reached—presses a conductive plate **2** against a contact **3**, to which is connected a wire **5**. The wire **5** is connected to one terminal of an electro magnet **12**, whose other terminal is connected by a wire **15** to a terminal **17** of a triple switch or circuit breaker **20** (Figs. 1 and 4). If the circuit breaker or switch **20** is in a closed position, a contact plate **21** connects the terminal **17** to a terminal **22**, which through wires **23** and **24** is grounded at **25** to a conductive part of the body or chassis of the vehicle.

The wire **7** connects the terminal **4** to one terminal of an electro magnet **10**, whose other terminal is connected by a wire **11** to a terminal contact **27** of a magnetically actuated multiple switch or relay **30**, which has a magnet **31** adapted to attract a plate **32** that is secured to a rod **33**. The rod **33** is slidably guided in a frame work **34** and is suspended from a spring **35**, which is adjustably mounted on the framework **34** by means of an adjustment screw **37**. Three pairs of contact terminals **27**, **38**, as well as **40**, **41** and **42**, **43** are mounted on traverse portions **36** of the framework **34** and are insulated therefrom. Two conductive plates **44** and **45** are mounted on the rod **33** and are insulated therefrom. Shock absorbing springs **47** preferably are interposed between the traverse portions **36** of the framework **34** and insulating washers **50** secured to the rod **33**. I prefer to provide the switch **30** with any suitable damper means, which in the present instance consist of a lever **51** pivoted at **53** to the framework **34** and at **54** to the rod **33**, and of a plunger rod **55** pivoted at **57** to the lever **51**, a piston **60** secured to the rod **55**, and a cylinder **61** in which the piston **60** is slidable and which is mounted on a pair of lugs **62** extending laterally from the framework **34**. A valve element **63** on the cylinder **61** allows only a small quantity of air to escape from the cylinder **61** while the piston **60** slides therein, thus causing a delaying and cushioning effect upon the downward movements of the parts **33**, **44** and **45**.

The previously mentioned triple switch **20**, which can be manually operated or automatically operated, is similarly constructed as the switch **30**. It has a framework **64** in the lower portion of which is located a small electro magnet **67**, one terminal of which is connected by means of the wires **23** and **24** to the ground **25**, while its other terminal is connected by means of a wire **70** to a terminal **71** of an automatic shut-off device **72**. A rod **73** extends shiftably through cross portions **74** and **75** of the framework **64** as well as through contact plates **21**, **77** and **78**. Ring members **80** and **81** are secured to the rod **73**, and springs **82** are interposed between the members **81** and the contact plates **21**, **77** and **78**. When the switch **20** is in a closed position, the plate **77** electrically connects to each other pairs of contact terminals **83** and **84**, the plate **78** connects a terminal **85** to a terminal **87**, and the plate **21** connects the terminal **17** to the terminal **22**. The terminal **85**, as well as the terminal **22**, is connected to the wires **23** and **24** and to the ground **25**; and the terminal **83** is connected by means of a wire **90** to a coil **91** of the ignition system of the vehicle, which is controlled by an ignition-key operated switch **92**. The terminal **87** is connected by means of a wire **93** to a terminal of the electro magnet **31** of the switch **30**. The switch **20** is provided

with a plunger 94, which is pivoted at 95 to a lever 97. The lever 97 is pivoted at 100 to a bracket portion 101, which extends laterally from the framework 64, and is kept in position by means of a pressure spring 102. Through the spring 102 extends a bar 103, which also is extended from the framework 64 and which is of such a length as to allow a swinging of the lever 97 without directly touching the same. The terminal 84 is connected by a wire 104 to a terminal 105 of a switch or relay 107, which is actuated by the magnet 10, and which is similarly constructed as the switch 30. The switch or relay 107, which is only a two-terminal switch, has a contact plate 110 suspended from a spring 111, and its second terminal 112 is connected by wires 115 and 117 to the terminals 42 and 41 of the switch 30. A switch or relay 120, which is of the same construction as the switch 107, is actuated by the electro magnet 12 and has a contact plate 121, suspended by a spring 122, and two terminals 123 and 124. The terminal 123 is connected by a wire 118 to the wire 115. The terminal 40 of the switch 30 is connected by a wire 125 to the other terminal 124, which is also connected by a wire 126 to a terminal of a battery 164 of the vehicle.

The automatic shut-off device 72 consists of an insulated frame member 140 (Figs. 5 and 6), a shaft 141 rotatably mounted on the member 140, an insulating arm 142 mounted on the shaft 141, and a conductive coil 143, one end of which is secured to the shaft 141, whereas its other end is mounted on an insulating member 144 and electrically connected by means of a screw 145 or the like to a wire 146. That end of the coil 143 which is secured to the conductive shaft 141, is electrically connected through the shaft 141 and through a conductive bearing member 147, as well as a wire 150, to the wire 24 and the ground 25. A contact plate 151 is secured to the outer end portion of the insulating arm 142, and next to the terminal 71 there is mounted on the insulating member 140 another terminal 153, which is connected by a wire 154 to a terminal 155 of an adjustable resistor 157. The other terminal 160 of the resistor 157 is connected by the wire 146 to the coil 143. The wire 154 also is connected by a wire 161 and the wire 127 to the starter 128. The second terminal of the electro magnet 31 is connected by a wire 162 to the generator 163 of the vehicle. The contact plate 151 is adapted for electrically connecting the contacts 71 and 153 to each other when the arm 142 is moved in a counter-clockwise direction, so that the plate 151 meets the contacts 71 and 153. The coil 143, when heated by an electric current passing therethrough, will uncoil and thus turn the shaft 141 and move the arm 142.

When the thermostat 1 has caused an electric connection of the contact 3 to the plate 2, the electro magnet 12 is energized, which causes a closing of the switch 120, so that the contact terminal 123 is connected to the terminal 124 by the plate 121. While the spring 111 forces the contact plate 110 of the switch 107 against the terminals 105 and 107, the wire 104 is electrically connected to the wire 115, which is connected directly to the terminal 42, and to the terminal 41 through the wire 117 of the switch 30. While the spring 35 of the switch 30 forces the plate 45 against the terminals 42 and 43, the wire 115 is also connected through the wires 161 and 127 to the starter 128, while the wire 104 connects the terminal 105 of the switch 107 to the terminal 84 of the switch 20. As long as the switch 20 is closed, the plate 77 connects the terminal 84 to the terminal 83, the wire 90 and the ignition coil 91. Thus the starter 128 as well as the ignition coil 91 is energized, causing the motor of the vehicle to start and thus causing the generator 163 to produce electricity, which in turn will energize the magnet 31 of the switch 30. This causes a pulling of the plate 31 and the rod 33 toward the magnet 31, thereby interrupting the electrical circuit of the starter 128 by moving the plate 45 away from the terminals 42 and 43, and at the same time electrically connecting to each other the terminals 40 and 41 by the plate 45 and the terminals 21 and 38 by the plate 44. The connection of the terminal 40 to the terminal 41 by the plate 45 constitutes a by-pass for the terminal of the coil 91. As soon as the motor of the vehicle has warmed up, the thermostat 1 will disconnect the terminal 3 from the plate 2, which will interrupt the passing of the electric current through the electro magnet 12, so that the spring 122 will pull the plate 121 away from the terminals 123 and 124 of the switch 120. Without the terminals 40 and 41 being connected to each other by the plate 45, now the electric connection to the coil 91 is interrupted.

When the temperature has risen to such an extent that the plate 2 of the thermostat touches the contact 4, which is connected by the wire 7 to a terminal of the electro magnet 10 of the switch 107, magnet 10 moves the plate 110 away from the terminals 105 and 112, so as to stop the motor of the vehicle. The stopping of the motor and the generator 163 will de-energize the electro magnet 31 and cause the spring 35 of the switch 30 to pull the parts 44 and 45 away from the terminals 27 and 38 as well as 40 and 41 respectively.

During the starting period a circuit in shunt to the starter 128 passes from the wire 161, to the adjustable resistor 157 and the wire 146 to the coil 143 of the shut-off device 72 and by wires 150 and 24 to the battery and to ground 25. The amount of electric current (amperes) passing from the resistors 157 to the coil 143 can be controlled by adjusting the resistor 157. The coil 143 will heat up as the current passes through it and, while thus being heated up, will uncoil, thereby moving the arm 142 from the position shown in the drawing to a position in which the contact plate 151 touches the terminals 71 and 153. The speed of the uncoiling of the coil 143 and of the aforesaid movement of the parts 142 and 151 will be controlled by the amount of electricity passing from the resistor 157 to the coil 143, as per the adjustment of the resistor 157. In the event that the motor of the vehicle does not start due to a defect or the like, the energizing of the starter 128 during a controllable period of time, will have caused a heating and uncoiling of the coil 143 to such a degree that the plate 151 touches the terminals 71 and 153. Thereupon, the electro magnet 67 of the switch 20 will become energized, attracting a plate 170 (Fig. 4) and causing a tilting of the lever 97, so that the plunger 94 will leave an excavation 171 of a block 172 upon which rests one end of the rod 73. Thus a spring 173, interposed between the block 172 and a base traverse portion 174 of the frame member 64 will cause the rod 73 to move into a position in which the contact plates 21, 77 and 78 no longer connect to each other the terminal pairs 17, 22, 83, 84, and 85—87 respectively. This makes the device inoperative. When the motor of the vehicle has been brought into a condition in which it can be started, the operator presses upon a knob 175 on the rod 73, to move the same and the plates 21, 77 and 78 back to the operative position shown in Fig. 4. In this operative position the rod 73 will be held by the parts 94, 97, 102, 103 and 172 as long as the motor of the vehicle remains in a startable working condition.

Since certain changes may be made in the above article and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claim is intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which as a matter of language might be said to fall therebetween.

Having thus fully described my said invention, what I claim as new and desire to secure by Letters Patent is:

In a vehicle having an internal combustion engine, a

starter electric motor, an ignition coil, as well as a generator, the combination of a thermostatic switch constructed and arranged to close a first electric circuit at a predetermined low temperature and to open said first circuit and to close a second circuit at a predetermined high temperature, with a first relay constructed and arranged to close a third electric circuit at the closing of said first electric circuit, a second relay constructed and arranged to open a fourth electric circuit at the closing of said second electric circuit, a multiple relay actuated by the electric current produced by the generator of the vehicle, being constructed and arranged to control said third and fourth electric circuits, an adjustable resistor having two terminals, the first one of which is electrically connected to the starter motor of the vehicle, a conductive coil so constructed and arranged that it will partially uncoil itself when an electric current passes through it and having two terminals, one of which is grounded while the other is electrically connected to the second one of said terminals of said adjustable resistor, a shut-off switch mechanically

connected to said coil so as to be moved by the uncoiling and the re-coiling thereof, an electro magnet controlled by said switch, a multiple circuit breaker connected to control said first relay and said multiple relay as well as the ignition coil of the vehicle, resilient means tending to move said multiple circuit breaker into an open position in which the electrical circuits controlled by it are interrupted, and locking means normally holding said circuit breaker in a closed position being constructed and arranged to be actuated by said magnet so as to allow said resilient means to open said circuit breaker.

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