

Jan. 8, 1952

A. E. WEST

2,581,737

SAFETY DEVICE FOR MOTORS

Filed Aug. 7, 1950

2 SHEETS—SHEET 1

Fig. 1

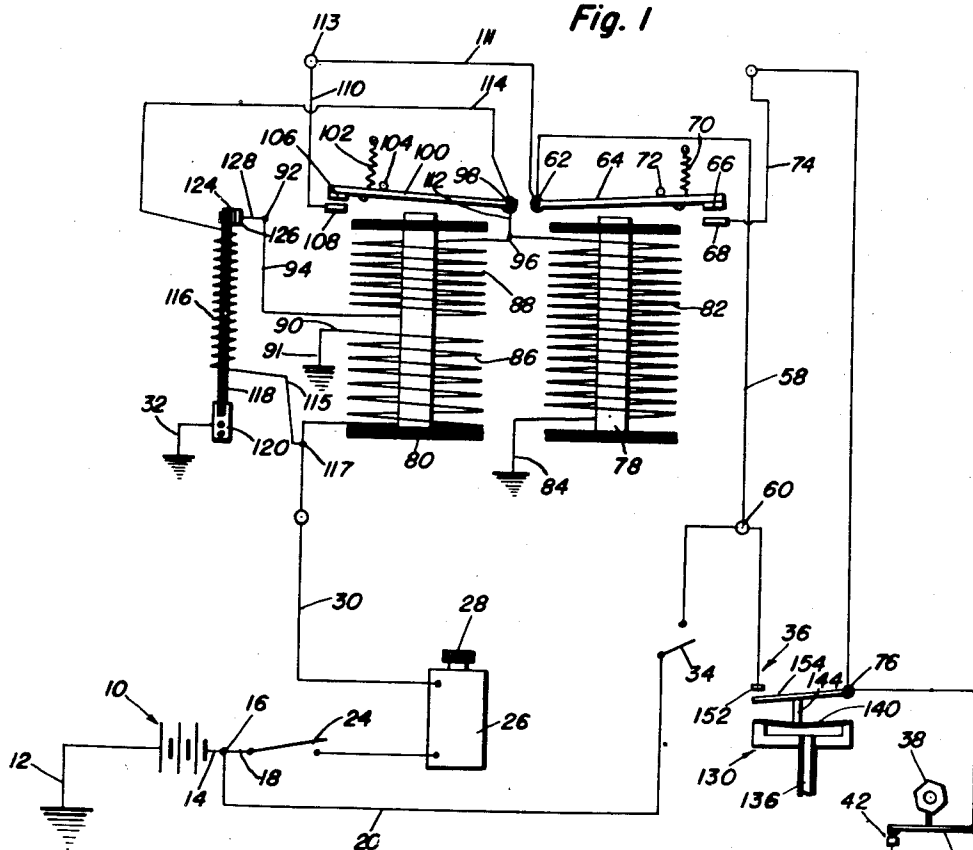


Fig. 2

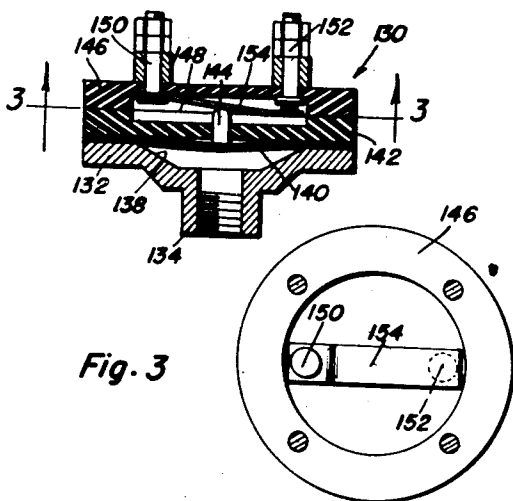
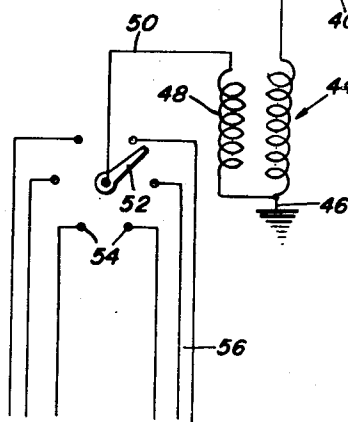


Fig. 3



Arthur E. West
INVENTOR.

BY *Charles A. Johnson*
and *Harvey B. Jackson*
Attorneys

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2 SHEETS—SHEET 2

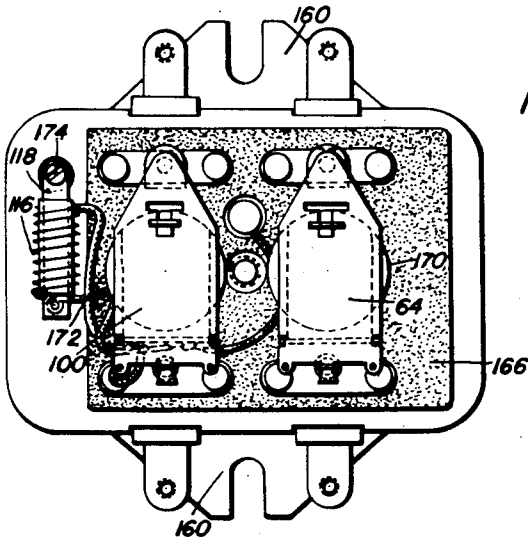


Fig. 4

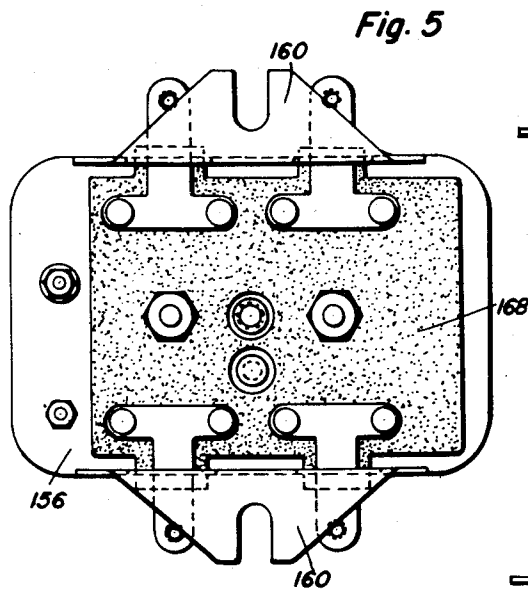


Fig. 5

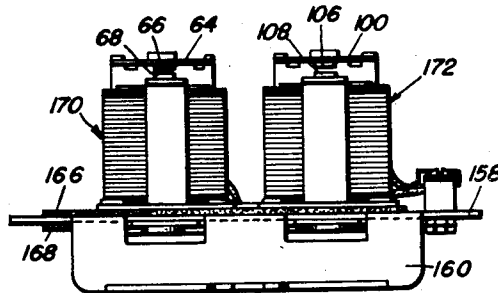


Fig. 7

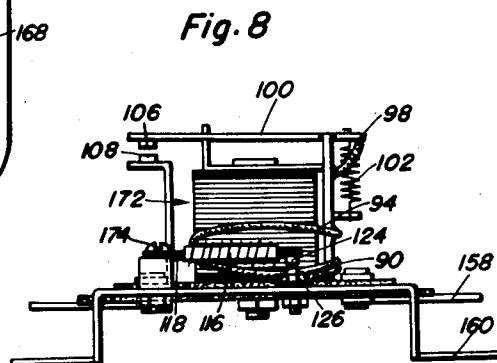


Fig. 8

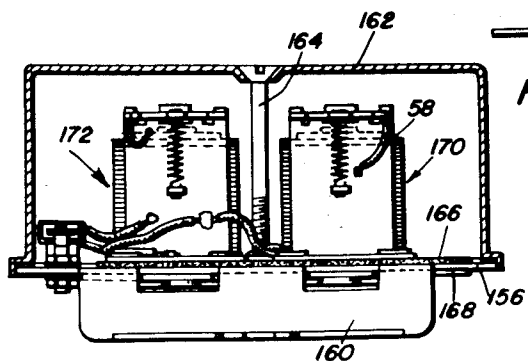


Fig. 6

Arthur E. West

INVENTOR.

BY *Almonce A. O'Brien*
and Harvey B. Jackson
Attorneys

UNITED STATES PATENT OFFICE

2,581,737

SAFETY DEVICE FOR MOTORS

Arthur E. West, Ladysmith, Wis., assignor of one-fourth to Jay H. West, one-fourth to William Walters, and one-fourth to Erwin B. True, all of Ladysmith, Wis.

Application August 7, 1950, Serial No. 178,017

3 Claims. (Cl. 290—38)

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This invention comprises novel and useful improvements in a safety device for motors, and more specifically pertains to a control device for electric circuits of an internal combustion engine of a motor vehicle for preventing damage to the engine by operation of the same when some vital element of the same, such as the lubricating system, is not operating; together with arrangements whereby the engine may be rendered temporarily operative during the starting operation of the same and to afford time whereby the starting of the engine may be enabled to render effective the aforesaid vital element.

The present invention relates to subject matter which is somewhat similar to but, in general, constitutes an improvement over that set forth in the prior application of George L. Hilbert, Arthur E. West and Jay H. West, Patent No. 2,136,504, issued November 15, 1938, for safety device for motors.

In said prior patent is disclosed a safety device for internal combustion motors which includes means for interrupting the ignition circuit of the motor if the oil pressure should cease or reach a dangerous condition by virtue of diminishing of the same. In general, the device disclosed in said patent operated to ground the ignition circuit when the motor was not running, but with the motor in operation utilized the oil pressure when the same attained a predetermined minimum value, to operate upon a diaphragm for closing contacts whereby the ignition system remained in operation. In order to prevent the device from interfering with the starting of the motor by virtue of the absence of an oil pressure at that time, an electromagnetic means was provided which was arranged to be energized by the closing of the starter switch and thereby rendering the grounding device inoperative to permit operation of the ignition system, and the build-up of the oil pressure during the starting operation was intended to maintain the safety device inactive and permit the continued operation of the ignition system.

However, in such a system, it was frequently necessary to continue the operation of the starting circuit for a sufficiently long period of time to permit the oil pressure to increase to a value sufficient to maintain the safety device inoperative, and this frequently necessitated the using of the starter circuit for a period of time much longer than that necessary to actually start the engine, thus producing an undue strain upon the starting system and the battery.

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It is therefore an object of the present invention to provide a mechanism which shall overcome the above-mentioned disadvantages and, in general, which will interrupt a vital function necessary to the engine operation as the ignition circuit, when some vital engine function, such as the oil pressure system, is not operating adequately; but at the same time to provide an automatic mechanism for overriding the safety device for a predetermined period of time to permit the engine to operate for an interval of time normally sufficient to bring the vital element of engine operation to a satisfactory working condition.

More specifically, the present invention contemplates the provision of a safety switch disposed in series in the ignition circuit of the engine, which safety switch normally maintains the ignition circuit open except when the switch is closed in response to proper operation of some engine vital element, as, for example, an adequate pressure in the engine lubricating system. Further, the invention, as disclosed, includes an electrical by-pass circuit for by-passing the safety switch to maintain the ignition circuit in operative condition, this by-passing circuit having a relay switch controlling the same, which relay switch is automatically closed while the starter circuit is being energized. Still further, the invention includes a solenoid for energizing the relay switch, the solenoid itself being operative to connect the relay switch directly to the storage battery and thus retain the relay switch in operative position, together with a time-controlled switch for rendering the solenoid inoperative after a predetermined time interval.

These, together with various ancillary features and objects of the invention which will later become apparent as the following description proceeds, are attained by the present invention, a preferred embodiment of which has been illustrated, by way of example only, in the accompanying drawings, wherein:

Figure 1 is a diagrammatic view illustrating the electrical circuits forming a part of the present invention;

Figure 2 is a vertical transverse sectional view through a pressure operated safety switch for the ignition circuit;

Figure 3 is a horizontal sectional view taken substantially upon the plane indicated by the section line 3—3 of Figure 2;

Figure 4 is a top plan view, with the cover removed, of a solenoid assembly forming a part of

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the automatic control mechanism of the by-pass circuit in accordance with this invention;

Figure 5 is a bottom plan view of the same;

Figure 6 is a vertical longitudinal sectional view through the arrangement of Figure 4;

Figure 7 is a side elevational view of the arrangement of Figure 4, the cover being removed; and

Figure 8 is an end elevational view taken from the left of Figure 4 and the right of Figure 7.

Referring now more specifically to the accompanying drawings, wherein like numerals designate similar parts throughout the various views, attention is directed first to Figure 1 for an understanding of the various electrical circuits forming a part of the invention and the manner in which they are interrelated to effect the operation of this invention.

Indicated at 10 is any suitable source of electric power, such as a storage battery, which is grounded as at 12, and which is provided with a conductor 14 for supplying current from the battery to any place of use. It will be understood that the battery 10 may be provided with a generator; or that any other desired source of power than the battery may be employed, as desired.

From the terminal 16 of the lead 14, current is supplied from the battery 10 to two separate conductors 18, 20.

The conductor 18, by means of a conventional form of starter switch 24, delivers current from the battery 10 or any other suitable source of supply to a conventional form of electric starter motor 26 which is provided with the usual starter gear 28 by means of which the internal combustion engine, not shown, is adapted to be cranked for starting. The current from the starter switch, after passing through the starter coils and conductors, is conducted by the electric conductor 30 eventually to a ground, such as that at 31, and these elements constitute the starter circuit for the internal combustion engine.

The conductor 20 constitutes part of an ignition circuit which includes the customary and conventional ignition switch 34, a safety ignition switch 36, an ignition breaker cam 38 operating a breaker shaft 40, and the customary breaker points 42 for supplying current to a spark coil, indicated generally at 44, the primary of which is grounded as at 46. The secondary of the spark coil, 48, is connected by a conductor 50 to the spark distributor switch contact 52 which rotatably engages the plurality of stationary distributor contacts 54, each of which is connected to one of the conventional spark plug leads 56 from which current is delivered to the spark plug of the engine, in a manner well understood in the art, but not illustrated.

It will thus be apparent that the above described ignition circuit is energized or rendered operative at all times by the closure of the conventional ignition switch 34, except when the safety switch 36 is actuated to open the circuit.

However, a by-pass circuit is provided for bypassing the safety switch 36 under certain conditions to be hereinafter set forth, so that when the conventional ignition switch 34 is closed, and the by-pass circuit is closed, the ignition circuit will be rendered operative, even though the safety switch 36 is open. This by-pass circuit includes a conductor 58 connected to the conductor 20 between the switches 34 and 36 as by a connection 60, the conductor 58 in turn being connected as at 62 to a switch arm 64 having a movable con-

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tact 66 operatively engageable with a stationary contact 68 but yieldingly urged to its open position, as by a spring 70, the arm 64 being held against a fixed stop or the like 72. However, when the arm 64 is actuated against the resistance of the spring 70 to close the contacts 66 and 68, current supplied by the conductor 58 is then delivered by a conductor 74 to a connection 76 which is in the ignition circuit on the other side of the safety switch 36 from the connection 60, whereby, when the contacts 66 and 68 are closed, the safety switch will be effectively by-passed by a parallel connection.

In order to effect the actuation of the by-pass circuit under certain conditions of engine operation, an automatic control mechanism is provided which is operatively connected with the engine starter circuit above described for initiation of its action, and is connected directly with the battery or source of electric current 10 in order to complete its action.

This automatic control mechanism includes a pair of electromagnets or solenoids having magnetic cores 78 and 80, the former, when magnetized, serving to attract the arm 64 to close the contacts 66 and 68 against the resistance of the spring 70, an electromagnetic coil 82 being provided encircling the core 78, and being grounded, as at 84.

The core 80 is provided with a pair of electromagnetic coils 86 and 88, the former being connected with the conductor 30 leading from the electric conductors and fields of the starter motor 26, and having an end portion 90 which is grounded, as at 91. The latter coil 88 is connected at one end, as at 96, to the ungrounded end of the above-mentioned coil 82, having its other end 94 connected, as at 92, to the lead 120, later to be described.

The numeral 98 designates both a pivot and an electrical connection for the end of a movable switch arm 100, the latter being urged as by a spring 102 against a stop 104, whereby the movable switch contact 106 will be normally retained away from the fixed contact 108, thereby breaking the circuit between these contacts. A conductor 110 leads from the contact 108 and is connected to a conductor 111, as at 113, which is further connected to the terminal 62 on the switch arm 64. Also connected to the terminal 98 is a conductor 114 whose other end is connected to an electric resistance heating element 116 which surrounds the bimetallic thermostatic switch blade 118. The other end 115 of the heating element 116 is connected to the lead 30, as at 117. The electric resistance heater 116 preferably surrounds the bimetallic element 118 throughout its entire length to better effect its operation. A fixed contact 126 cooperates with a movable contact 124 carried by the bimetallic element, and is connected to the above-mentioned connection 92 by a conductor 128.

As so far described, it will be seen that when the starter circuit is energized, current will flow through the starter motor and thence by way of conductor 30 to the terminal point 117 wherein there are two paths of conduction provided. One path of conduction is through the coil 86 to the ground 91 as by conductor 90, thereby providing current to energize the coil 86 and thereby close the contacts 106 and 108. The other path of conduction leading away from the terminal point 117 is by the lead 115 through the heating element 116 and then, as by lead 114, to the terminal or junction points 98 and 96 and through the coil

82 to the ground 84. Also from the junction point 86, current is permitted to flow through the coil 88 and then, as by lead 94, through the normally closed contacts 124 and 126, and thence through the bimetallic element 118 to the ground connection 32. From the foregoing, it will be noted that the core 78 will be energized, thereby closing the contact points 66 and 68, whereby the switch 36 will be bypassed and the ignition circuit will be rendered operative if the ignition switch 34 is closed. Obviously, both the starter switch 24 and the ignition switch 34 must be closed at the same time in order to render the whole device operative. When the starter switch is released, current by this path of conduction will cease to flow through the coil 82, whereby the contact points 66 and 68 would be opened by the spring 70 if it were not for a separate source of conduction provided by the lead 20, the closed ignition switch 34 and the conductor 58 to the terminal point 62. The various operations of these circuiting devices after the system has once been placed in operation will subsequently be explained.

It will be evident that the electric heating element 118 and the characteristics of the bimetallic thermostatic element 118 may be so selected as to cause the normally closed contacts 124 and 126 to be opened at a predetermined interval of time, thereby deenergizing the coil 88 and thence opening the ignition circuit in a manner subsequently to be explained.

Referring now again to the safety switch 36, it will be understood that the same is normally maintained in an open position, but is urged to closed position by an actuator which is dependent upon a predetermined condition of engine operation.

Referring now more particularly to Figures 2 and 3, it will be seen that this actuator, designated generally by the numeral 130, comprises a body 132 having an internally threaded connection 134 by means of which the same may be attached to any suitable source of pressure, as by a conduit 136, which source of pressure is vital to the engine operation.

The body 132 is provided with a recess or chamber 138 which is open at its upper end and communicates with the conduit 136 through the coupling 134. The chamber 138 is provided with a flexible top wall in the form of a diaphragm or the like 140, the latter being maintained in position by a dielectric body 142 having a central aperture for slidably receiving a plunger 144. A second body 146 is secured to the body 142, and the bodies 142 and 146 have complementary recesses defining a chamber 148 therebetween which constitutes a switch chamber and into which the plunger 144 extends. A pair of terminals or connectors 150 and 152 are mounted in the body 146 and extend into the chamber 148, the terminal 150 having a resilient switch blade 154 which is normally inherently biased or spring urged away from connection with the contact 152, but is moved against said contact by the plunger 144 upon upward movement of the diaphragm 140 in response to the attainment of a predetermined pressure in the chamber 138.

It will thus be apparent that when a predetermined pressure is present in the conduit 136, the safety switch 36 will be urged to closed position.

It is to be understood that any suitable fluid pressure medium may be supplied through the conduit 136, and by properly calibrating the

strength of the diaphragm 140 and tensioning of the switch member 154, it is evident that the safety switch 36 may be caused to open or close at any desired pressure, this pressure corresponding to that found to be essential for proper operation of that element of the engine which is being utilized as the control for the safety device. Thus, any suitable fluid pressure could be employed as the actuating medium, and while the pressure of the lubricating system has been disclosed in the above-mentioned patent as specifically referred to hereinbefore, it will be readily understood that other pressure, such as water pump pressure, intake manifold pressure, exhaust pressure, fuel pump or supercharger pressure, and the like, all within the scope and principles of this invention, could be employed.

Disclosed in Figures 4-8 is a conventional arrangement for housing and mounting the various elements of the automatic means for regulating the by-pass circuit. Although this construction does not, in itself, form any part of the present invention, the same has been illustrated to render a practical application of the invention more readily understood. Conveniently, all of these instrumentalities are housed in a single casing, being carried by a single base or supporting plate 156 having a mounting bracket 160 whereby the same may be mounted any convenient place upon a motor vehicle, a suitable covering body 162 being removably secured to the base 156 as by a fastening screw or the like 164. Mounted upon the base 156 is a suitable insulating plate 166 or a similar plate 168 is mounted below the base as shown in Figures 5 and 6.

A pair of electric solenoids are mounted upon the insulating pad 166 on the base 156 in any suitable manner as shown, these solenoids being indicated by the numerals 170 and 172, the former being the solenoid which houses the coil 82 and the core 78, while the latter solenoid contains the two previously described electric coils 86 and 88, together with the core 80. Mounted above these solenoids are the previously mentioned movable switch members 64 and 100, respectively, the construction of which has been previously described.

Mounted upon and grounded to the base 156, as by a fastening bolt 174, is the previously described bimetallic thermostatic element 118 having the electric resistance heating coil 116 and the above described connections and contacts.

Since the actual housing, mounting and construction of the solenoids and the switches controlled thereby are generally conventional, further explanation of the same is believed to be unnecessary, since the actual construction of these elements forms no part of the present invention, which resides primarily in the use made of these elements to obtain a novel result from the assembly.

The operation of the invention, in view of the foregoing explanation, will now be readily understood.

When the engine with which the device is associated is idle, that is, not running, there will be no fluid pressure in the conduit 136 and consequently the safety switch 36 will be open as shown in Figure 1. Therefore, regardless of whether the ignition switch 34 is open or closed, no current can flow through the ignition circuit, the device thereby preventing an unintentional drain upon the battery or source of electric current 10 by inadvertently closing the switch 34 when the motor is not running. Moreover, since no cur-

rent is flowing through the starter circuit because the starter switch 24 is open as shown in Figure 1, the various electric coils 82, 86 and 88 will be deenergized, so that the switch members 64 and 100 will be raised by their springs 70 and 102 against their stops 72 and 104 into their inoperative position, whereby the by-pass circuit will be deenergized; whereby the coil 82 will be disconnected from the source of current 10 through either the starter switch 24 or the conductor 111 and associated circuits; and whereby there will be no flow of current to the heating coil 116.

Assume, now, that the ignition switch 34 is closed and the starter switch 24 is then likewise closed. At this time the safety switch 36 is open, as aforesaid, so that current from the ignition switch 34 cannot complete its circuit through the ignition circuit to the spark coil and distributor. However, when the starter switch 24 is closed, current now flows through the starter motor and from thence through the conductor 30 to the coil 86 which is in series with the starter motor, and from the coil 86 through the conductor 90, to the ground 91. The current passing through the coil 86 thus magnetizes the core 80 and causes the same to draw the armature or switch blade 100 downwardly, thereby closing contacts 106 and 108. The closing of these contacts now establishes a circuit directly from the battery or source of current 10 by way of the conductor 20, the closed ignition switch 34, terminal 60, conductor 58, terminal 62 on the movable arm 64, conductors 110 and 111 to the closed contacts 106 and 108, and from thence through the movable arm 100 to the junction point 96 and thereby through the coil 82 to ground 84. This current flowing through the coil 82 magnetizes the core 78, thus drawing the member or movable armature 64 downwardly and closing the contacts 66 and 68, thereby establishing a by-pass circuit around the safety switch 36 whereby current, despite the absence of a suitable pressure in the conduit 136, may flow through the ignition circuit, permitting the engine to be started.

Moreover, the current flowing through the conductor 20, in the manner just described, will pass from the connection 96 through the coil 88, and by way of the conductor 94 to the connection 92, from whence the same will be grounded through the closed contacts 124 and 126, through the bimetallic element 118 to the ground 32. Finally, current flowing through the conductor 30 to the terminal point 117 and thence by way of conductor 115 through the heating element 116 passes to the junction point 96 and is grounded in the same manner as coil 88. It will thus be seen that the heating circuit of the bimetallic element 118, the solenoid 82 of the relay controlling the switch of the by-pass circuit, and the solenoid 86 controlling the normal or steady supply of current to both the heating circuit 116 and the relay solenoid 88, will all be energized. Assume, now, that the internal combustion engine has been started without any difficulty or delay, and the starter switch 24 is now released, or moved to its open position as shown in Figure 1. Since the starter circuit is rendered deenergized, no current will flow by way of the conductors 10, 30, or the motor 26 from the source of current 10. However, the contacts 106 and 108 are still maintained closed, because once the same have been closed, current is flowing by the conductor 20 through these contacts and through the coil 88 to ground, thus maintaining the core 80 ener-

gized and maintaining this solenoid in an actuated condition. It will be further noted that when the switch 24 is opened, there will be a shifting of current and voltage relationship throughout the entire circuit, but most notably in the conductor 114, the heating element 116, the conductor 115, and the coil 86 to ground 91. The result is that current is still maintained in the heating element and the solenoid by means of the conductor 20 through the closed contacts 106 and 108. Since the contacts 106 and 108 are maintained closed, current continues to flow through the coil 82, thus retaining the by-pass circuit in an operative condition.

This over-all condition of the circuit persists until such time as the heating element 116 has heated the bimetallic thermostat 118 to such an extent that the latter opens the contacts 124 and 126, thus deenergizing the coil 88, which in turn opens the contacts 106 and 108; whereby the opening of these contacts 106 and 108 in turn deenergizes the coil 82 and permits the spring 70 to open the contacts 66 and 68, thereby rendering the by-pass circuit inoperative.

If, previous to the predetermined time which the bimetallic element was set to kick out, sufficient pressure has built up in the conduit 136, this pressure will maintain the safety switch closed, thereby maintaining the ignition circuit in operative condition. If, however, sufficient pressure has not built up in the conduit 136, thus indicating an unsafe engine operating condition, the safety switch will open and the ignition circuit will be deenergized, thereby stopping the engine.

From the foregoing, the construction and operation of the invention, together with its many advantages, will be readily understood and further explanation is believed to be unnecessary. However, since numerous modifications and changes will readily occur to those skilled in the art after a consideration of the foregoing specification and accompanying drawings, it is not desired to limit the invention to the exact construction shown and described, but all suitable modifications and equivalents may be resorted to, falling within the scope of the appended claims.

Having thus disclosed and described the invention, what is claimed as new is as follows:

1. In combination, a source of electric energy, an ignition circuit for an internal combustion engine and connected with said source, a switch in said ignition circuit, means responsive to lubricant pressure of an internal combustion engine for operating said switch, a starter motor circuit for an internal combustion engine and connected with said source, a by-pass circuit connected with said ignition circuit and operable to by-pass said switch, a relay switch controlling said by-pass circuit, a solenoid for operating said relay switch, means responsive to energization of said starter circuit for actuating said solenoid.

2. In combination, a source of electric energy, an ignition circuit for an internal combustion engine and connected with said source, a switch in said ignition circuit, means responsive to lubricant pressure of an internal combustion engine for operating said switch, a starter motor circuit for an internal combustion engine and connected with said source, a by-pass circuit connected with said ignition circuit and operable to by-pass said switch, a relay switch controlling said by-pass circuit, a solenoid for operating said relay switch, means responsive to energization of said starter circuit for actuating said solenoid,

said last means being connected in series with said starter circuit.

3. In combination, a source of electric energy, an ignition circuit for an internal combustion engine and connected with said source, a switch in said ignition circuit, means responsive to lubricant pressure of an internal combustion engine for operating said switch, a starter motor circuit for an internal combustion engine and connected with said source, a by-pass circuit connected with said ignition circuit and operable to by-pass said switch, a relay switch controlling said by-pass circuit, a solenoid for operating said relay switch, means responsive to energization of said starter circuit for actuating said solenoid, additional means responsive to energization of said starter circuit for connecting said source to said solenoid for maintaining said relay switch in closed position for a predetermined time.

ARTHUR E. WEST. 20

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