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2,166,498

SWITCHING MEANS

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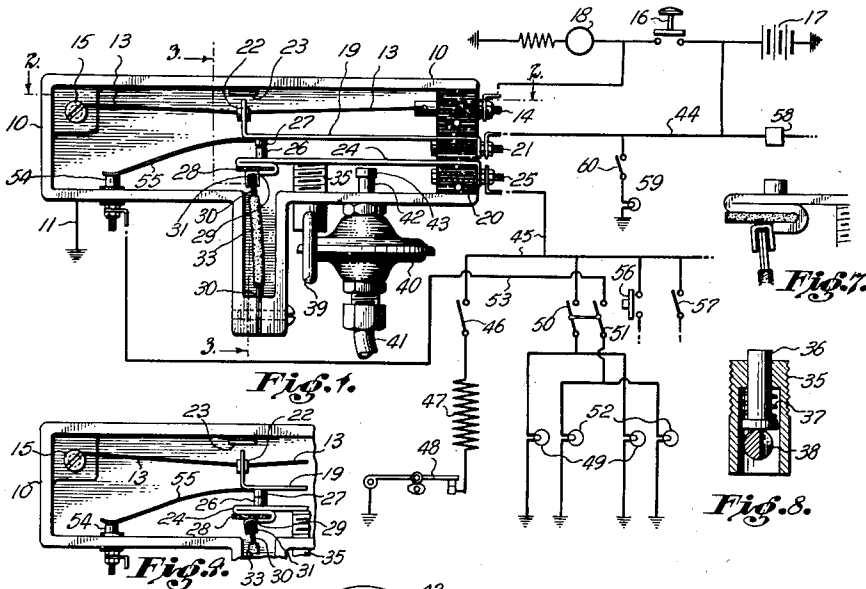


Fig. 1.

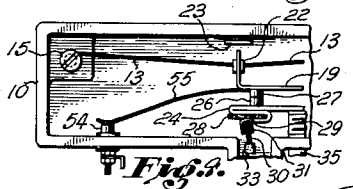


Fig. 2.

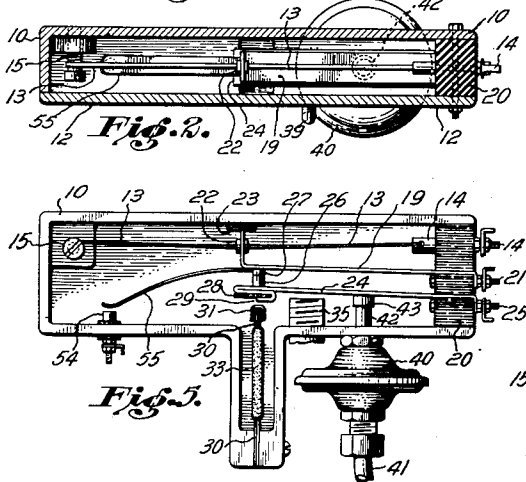


Fig. 3.

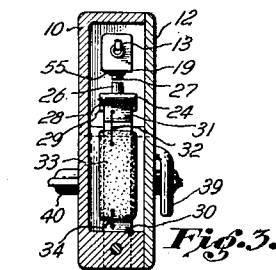


Fig. 4.

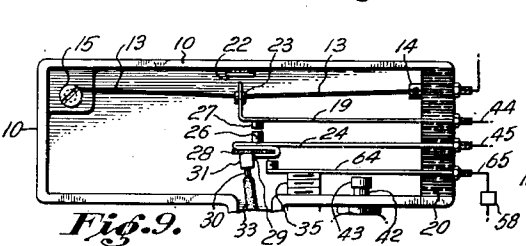


Fig. 5.

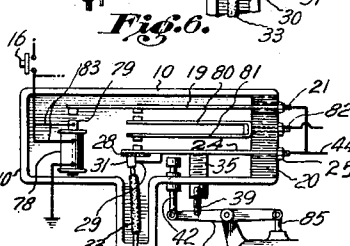


Fig. 6.

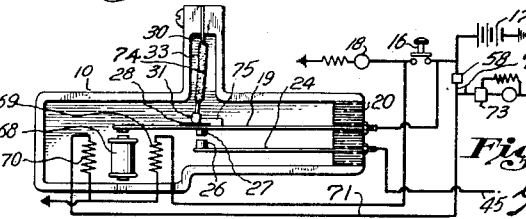


Fig. 7.

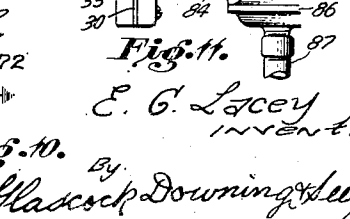


Fig. 8.



Fig. 9.

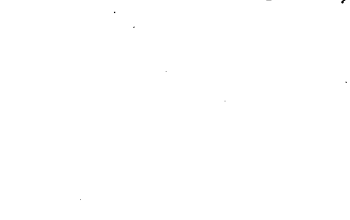


Fig. 10.

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UNITED STATES PATENT OFFICE

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SWITCHING MEANS

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18 Claims. (Cl. 290—38)

This invention relates to improvements in and connected with electric circuits of internal combustion engines and/or of associated apparatus and refers especially, but is not limited, to the electric circuits of motor vehicles.

It occasionally happens, that, through inadvertence, the ignition switch of a motor vehicle is left closed for lengthy periods when the engine is not running and as a result the storage battery is sometimes discharged through the primary winding of the aforesaid ignition coil, so that it is subsequently unable to supply sufficient current to actuate the starting motor of the vehicle. The battery may also "run down" if any of the lighting circuits are inadvertently left closed.

Now, the chief object of the present invention is to provide improvements in protective switching means of a motor vehicle adapted to prevent the battery circuit from being inadvertently left closed when the vehicle is not in use.

One broad feature of the invention resides in providing the battery circuit auxiliary switch means arranged to temporarily close the said circuit when the engine is being started, characterised in that the said switch means is so constructed as to be closed by direct or indirect manual operation and to maintain the battery circuit closed for a predetermined minimum period.

Automatic switch means are also provided to maintain the battery circuit closed when the engine starts and to open the said circuit when said engine stops or when further operation thereof is undesirable, said automatic switch means being preferably controlled by means responsive to the pressure of the lubricating oil, though it may be actuated by any other means responsive to the operation of the engine.

The aforesaid auxiliary switch means and the automatic switch means may be arranged in parallel between the battery and the ignition and/or other devices to be energised thereby, or alternatively a single switch may be provided, said switch being operable independently by said auxiliary switch means and by said automatic means.

By employing switch means which maintain the battery circuit closed for a predetermined minimum period, a sufficient time lag is provided to enable the automatic switch means to become effective before the auxiliary switch means are rendered ineffective.

Another feature of the invention resides in the provision of bimetallic strip means arranged to effect a positive opening movement of the aforesaid automatic switch means.

The said auxiliary switching means preferably embodies a resistance wire through which current is caused to pass when the engine is about to be started whereby said wire will expand owing to the increase in temperature, such expansion being utilised to effect the closing of the aforesaid switch. When the resistance wire is de-energised, the rate at which it cools and contracts determines the period of the time lag which will occur in the opening movement of the switching means. Preferably the resistance wire is arranged in parallel with the starting motor so as to be energised when the usual starting switch is actuated.

In the drawing:

Figure 1 is a view in elevation of a switching device in accordance with the invention and is shown as connected to the relevant electrical circuits of a motor vehicle.

Figure 2 is a view in sectional plan taken on the line 2—2 of Figure 1.

Figure 3 is a view in vertical section taken on the line 3—3 of Figure 1.

Figures 4, 5 and 6 are views similar to Figure 1 and show different stages in the operation of the switching device.

Figure 7 is a detail view of portion of the switching device shown in Figure 1 and is drawn to a larger scale.

Figure 8 is a view in vertical section of change-over means incorporated in the switching device and is drawn to a larger scale, and

Figures 9, 10 and 11 are views similar to Figure 1 and illustrate modified forms of the switching device.

In the drawing the invention is shown as adapted to the "one wire" system or wiring in which one terminal of the battery is "earthed" to the chassis of the vehicle but it will be understood that the invention is equally applicable to the "two wire" system.

Referring now to Figures 1, 2 and 3 of the drawing the reference numeral 10 designates an elongated metal casing which is mounted in any convenient position on a motor vehicle and connected to "earth" as diagrammatically indicated at 11. This casing is open at one side which is fitted with a detachable cover plate 12.

A flexible ribbon 13 of "nichrome" or the like hereinafter referred to as the "thermal wire" is arranged substantially longitudinally within the casing and adjacent the top thereof, this wire being supported at one end on a member forming part of a terminal 14 which projects from the adjacent end of the casing.

The opposite end of the thermal wire 13 is

wrapped around a screw 15 which is disposed laterally within the casing and which permits of a tension being imparted to the said wire. The screw 15 also serves to connect the adjacent end of the thermal wire to earth.

The terminal 14 is connected by a conductor to the usual starting switch 16 located between the battery 17 and the starting motor 18 with the result that the thermal wire is energised and de-energised in unison therewith.

A resilient contact arm 19 is arranged horizontally below the thermal wire and has its fixed end received in a slot provided in a block 20 of the insulating material suitably secured to the casing. An external terminal 21 is electrically connected to this fixed end of the contact arm 19.

The free end of the arm 19 is bent upwardly and carries a bush 22 of insulating material through which the central position of the thermal wire extends. The arm 19 has a downward bias and consequently a downward pressure is exerted thereby on the thermal wire.

An insulated stop member 23 is fitted to the top of the casing somewhat above the top of the upwardly bent free end of the contact arm 19.

The second resilient contact arm 24 is arranged substantially horizontally within the casing below the arm 19 and its fixed end is similarly mounted in the block 20 and is connected to an external terminal 25.

A contact member 26 fitted to the top of this contact arm 24 adjacent to the free end thereof is disposed just out of engagement with a similar contact member 27 fitted to the underside of the upper contact arm 19.

The lower arm 24 is doubled back upon itself for a short distance and is then bent forwardly over the adjacent end of a strip 28 of insulating material.

It will be noted that the free end of the metal strip forms a shoulder 29 and the depth of this shoulder slightly exceeds the width of the gap between the contact members 26 and 27.

A bimetallic strip 30 is located substantially vertically within a central downward extension of the casing 10 and the lower end of this bimetallic strip is clamped thereto while the upper end is free to move laterally.

When the bimetallic strip is not heated it tends to assume a vertical position, but when the device is in the condition shown in Figure 1 this is prevented by a conductor cap 31 on the upper end of the bimetallic strip abutting against the aforesaid shoulder 29 on the lower surface of the free end of the contact arm 24. (See also Figure 7.)

The conductor cap 31 is insulated from the bimetallic strip but is connected by a conductor 32 (shown diagrammatically in Figure 3) to the adjacent end of a resistance winding 33 which surrounds the central portion of the bimetallic strip, the opposite end of this winding being earthed, by a conductor 34, to the adjacent portion of said bimetallic strip.

The contact arm 24 also has a downward bias whereby it normally rests on the upper end of a stop member 35 secured to the casing. This stop member is formed with an axial bore which accommodates a plunger 36 of insulating material.

(See Figure 8.) A compression spring 37 serves to maintain the lower end of the plunger in contact with a cam 38 which is rotatable by means of an integral arm 39. By displacing the arm 39 from the position shown in Figure 1, the plunger may be raised as indicated in Figure 8 whereby

the contact arm 24 is moved upwardly to cause the contact 26 to engage contact 27.

A diaphragm chamber 40 is secured to a lower portion of the casing and is provided in the well-known manner with a resilient diaphragm having a downward bias. The lower compartment of the diaphragm is connected by a pipe 41 to the pressure lubricating system of the engine of the vehicle, while a vertical plunger 42 arranged with its lower end in contact with the top of the diaphragm, has its upper end projecting into the casing and fitted with a cap 43 of insulating material.

The terminal 21 for the contact arm 19 is connected to the battery of a conductor 44 while a conductor 45 connected to the terminal 25 serves for the supply of current to the ignition and other suitable electrical equipment of the vehicle.

The usual ignition switch is diagrammatically indicated at 46 in series with the primary winding 47 of the ignition coil and the mechanical interrupting device 48.

The headlamps 49 are arranged to be placed in circuit with the conductor 45 by means of the usual switch 50 and in the arrangement shown in Figure 1 this switch is mechanically coupled to a switch 51 arranged in circuit with parking lamps 52. The upper contact of the switch 51 is connected by a conductor 53 to an insulated contact 54 arranged within the casing and normally engaged by a resilient contact strip 55 secured to the free end of the contact arm 19.

The switch 56 in circuit with the conductor 45 may be arranged to control an electric horn (not shown) whilst the switch 57 may be arranged in circuit with a wireless receiving set (not shown). It is to be understood however that any desired electrical equipment may be connected in circuit with the conductor 45 through a suitable switch.

The electric generator (not shown) is connected in the usual way to the battery through the usual automatic cut-out switch diagrammatically indicated at 58.

In some cases it may be desired to energise the parking lamps and/or certain other electrical equipment direct from the battery in the usual way and the reference numeral 59 designates by way of example one such lamp which is controlled by a switch 60.

Now when the engine of the vehicle is not operating the device is in the condition shown in Figure 1, the conductor 45 being disconnected from the battery 17 at the contacts 26-27. Consequently no current passes through the ignition coil 47 if the switch 46 has been inadvertently left closed and likewise the closure of switches 50, 56 and 57 would be without effect upon the devices in circuit therewith. It is to be noted, however, that if the switch 51 is mechanically coupled to the switch 50 as shown, the closure of switch 51 simultaneously with the switch 50 causes the parking lamps 52 to be energised through a circuit extending from the battery by way of conductor 44, terminal 21, spring contact arm 19, contact strip 55, insulated contact 54, conductor 53, switch 51 and parking lamps 52 to earth.

The engine of the vehicle may be started up in the usual way by closing the ignition switch 46 and depressing the starter switch 16. The actuation of the latter switch simultaneously energizes the starting motor 18 and the thermal wire 13 which are connected in parallel. As the thermal wire is formed of "nichrome" or the like

it is heated by the passage of current to such an extent that the resultant expansion thereof enables the contact arm 19 to move downwardly until the contact 27 thereon engages the contact 26 thereby closing the ignition circuit and also the circuit of the headlamps 49, if it be assumed that switch 50 was previously closed. (See Figure 4.)

The engine therefore starts up in the usual way and the lubricating oil is circulated by the usual pump so that the pressure thereof is increased. When the oil pressure reaches a safe working value the resistance of the resilient diaphragm within the diaphragm chamber 40 is overcome and the diaphragm is displaced upwardly thereby raising the plunger 42 so that the cap 43 on the upper end thereof engages the underside of the contact arm 24. The contact arm 24 is thus forced upwardly together with the contact arm 19 until further movement is prevented by the upwardly turned free end of the contact arm 19 moving into engagement with the insulated stop member 23. (See Figure 5.) Consequently the contacts 26 and 27 which are initially closed as a result of the expansion of the thermal wire are maintained closed by the pressure of the lubricating oil when the engine is running. It will be evident that in lieu of arranging the diaphragm plunger to directly actuate the contact arm 24, said plunger may be utilised to close a switch in the circuit of an electromagnet arranged to attract the said contact arm.

It is to be noted also that the upward displacement of the contact arm 24 enables the bimetallic strip 30 to assume the vertical position and that the contact spring 55 is disengaged from the insulated contact 54 thereby breaking the circuit of the parking lamps 52. At this time, however, the head lamp circuit is closed by means of contacts 26—27 and the switch 50.

Now it is important to note that if for any reason the oil pressure does not immediately build up to a safe value when the engine is started, the contacts 26—27 do not reopen as soon as the starter switch 16 is released because a time delay takes place while the thermal wire is cooling and contracting. This time delay in the tendency of the contacts 26—27 to reopen constitutes an important feature of the invention because it ensures that the contacts will remain closed for a sufficient time after the engine has started to enable the oil pressure to rise to the requisite value. The duration of the time delay may be varied by varying the resistance of the thermal wire or by controlling the rate of dissipation of heat therefrom.

Assume now that the oil pressure falls below the safe operating value either as a result of the ignition switch 46 being opened to stop the engine or the engine being stalled or of a defect occurring in the lubricating system. The reduction in the oil pressure enables the resilient diaphragm in the diaphragm chamber 40 to return to its lower position thus causing the contact arms 24 and 19 to move downwards in unison until the under surface of the free end of the strip forming the arm 24 engages the electrically conducting cap 31 on the top of the bimetallic strip 30. (See Figure 6.) It will be noted that this downward movement of the arm 24 is insufficient to enable the contact 26 to be disengaged from the contact 27 and thus the ignition and headlamp circuits remain closed as shown in the figure.

The resistance winding of the bimetallic strip however is now energised through a circuit extending from the battery through contact arm 19, contacts 27—26, contact arm 24, conductor cap 31 on the bimetallic strip, conductor 32 and winding 33 to earth. The increase in temperature of the bimetallic strip consequent upon the energisation of the winding 33 causes the upper end thereof to move towards the left of Figure 1 so that after the lapse of a predetermined time, the conductor cap 31 passes over the shoulder 29 thus enabling the contact arm 24 to further descend through a distance equivalent to the depth of the said shoulder, at the same time causing the contact 26 to be separated from the contact 27. The winding 33 of the bimetallic strip and the circuits supplied with current through the conductor 45 are thus de-energised so that the device is restored to the condition shown in Figure 1 of the drawing.

One advantage of the bimetallic strip 30 is that it provides a time lag which serves to maintain the conductor 45 energised for a predetermined period if the engine should stall, while a further advantage is that it minimises arcing at the contacts 26—27 by ensuring a rapid opening movement thereof.

In some cases it may be advantageous for the switches 50 and 51 for the headlamps and parking lamps respectively to be actuated independently of each other while as previously stated and as shown at 59 in Figure 1 the parking lamps may be connected to the battery independently of the protective switching apparatus arranged within the casing 10.

By turning the arm 39 and raising the insulated plunger 36 in the stop member 35 as shown in Figure 8 the contact 26 on the lower contact arm 24 may be constantly held in engagement with the contact 27 on the contact arm 19 so that the electrical equipment in circuit with the conductor 45 may be energized in the orthodox manner, i. e. irrespective of whether the engine is running. A signal device may be arranged for operation by the arm 39 so as to be energised when the plunger 36 is raised thereby warning the driver that the protective switch is not in operation.

Figure 9 shows a modification in which a third spring contact arm 64 is located within the casing 10 below the arm 24, the free end of the arm 64 being normally disposed out of contact with the arm 24. The arm 64 normally rests upon the top of the earthed stop member 35 and the plunger 42 of the diaphragm chamber 40 is arranged to engage the said arm 64.

A terminal 65 connected to the outer end of the arm 64 is connected to the automatic cut out switch 58 of the usual electric generator which is not shown. Thus in this modification the cut out switch instead of being connected direct to the battery in the usual way as shown in Figure 1 is connected to the contact arm 64. The upper contact arm 19 is connected to the battery 17, as in Figure 1 and likewise the contact arm 24 is connected to the conductor 45 leading to the ignition and other switches shown in Figure 1.

It will be evident that this apparatus operates substantially in the same manner as the construction previously described except that the automatic cut out switch of the generator is not connected in circuit with the battery until the oil pressure rises to a value sufficient to displace

the diaphragm contained in the diaphragm chamber 40.

In the event of the oil pressure failing, the descent of the plunger 42 enables the contact arm 64 to descend out of contact with the arm 24, but damage to the generator is prevented by said arm 64 moving into engagement with the earthed stop member 35. Subsequently after a lapse of time the duration of which is determined by the bimetallic strip 30 the arm 24 is permitted to move downwards so that contacts 26—27 are separated. Furthermore, by disconnecting the generator from the conductor 45 before the battery is disconnected therefrom, the possibility of the devices in circuit with said conductor being damaged by an excessive circuit from the generator, is obviated.

In the further modification shown in Figure 10 the contact arm 19 is electrically connected to the battery 17 as in Figure 1 while the contact arm 24 is provided with a conductor 45 which leads to the ignition and other switches shown in Figure 1.

An electromagnet 68 arranged vertically within the casing 10 coacts with an armature on the free end of the contact arm 19 and this magnet 68 is provided with two windings shown diagrammatically at 69 and 70. The winding 69 is arranged in parallel with the starting motor 18 and is therefore energised when the starter switch 16 is closed while the winding 70 is connected by a conductor 71 to a conductor 72 which connects the generator 73 to the automatic cut out switch 58.

A bimetallic strip 74 arranged above the contact arm has its upper end secured to the casing 10 whilst a cap on its lower end normally engages a shoulder formed by one end of a contact member 75 secured to the said contact arm the arrangement being generally similar to that of the bimetallic strip 30 in Figure 1.

When the starting switch 16 is depressed the winding 69 of the electromagnet 68 is energised to attract the armature on the contact arm 19 which thereby descends so that the contacts 26 and 27 are closed as in the previous constructions.

The downward movement of the arm 19 allows the bimetallic strip 74 to assume its vertical position with the result that contacts 26 and 27 cannot be separated until a predetermined time delay takes place.

When the engine starts the winding 70 of the electromagnet 68 is energised by current from the generator 73 and it is to be noted that this energisation is effected before the usual automatic cut out switch 58 is closed. Consequently the arm 19 which was pulled downwards as a result of the energisation of the winding 69 is held down during the normal operation of the engine, as a result of the energisation of the winding 70.

If the engine should be stalled or the ignition circuit opened the winding 70 is de-energised and the contact arm 19 is released whereby it undergoes a small upward movement which is arrested by the contact member 75 thereon moving into engagement with the conductor cap on the lower end of the bimetallic strip 74. This upward movement is insufficient to permit contacts 26 and 27 to separate.

The winding of the bimetallic strip is therefore energised in the manner previously described so that after the lapse of a predetermined period the lower end of the bimetallic strip moves lat-

erally over the end of the contact member 75 and allows a further upward movement of the arm 19 to take place so that the contacts 26 and 27 are separated.

Yet another modification is shown in Figure 11 in which the upper contact arm 19 is extended and is provided at its free end with an armature which is arranged to coact with an electromagnet 78 the core 79 of which is formed of one of several known alloys the magnetic permeability of which decreases rapidly when the alloys are raised to particular temperatures. The winding of the magnet is connected in parallel with the starting motor whereby it is energised to attract its armature when the starter switch is closed. The armature and the core of the magnet constitute self holding contacts for which purpose a conductor 83 passes from the core to the adjacent end of the winding, portion of which is formed of resistance wire.

The downward displacement of the arm 19 consequent upon the energisation of the magnet 78 causes a contact on the underside thereof to engage a contact on the upper surface of a resilient arm 80 which is formed integrally with a similar arm 81 arranged horizontally therebelow, these arms being connected to a terminal 82.

The arm 81 is provided on its underside with a contact which normally is disposed clear of a contact on the upper face of the contact arm 24. The bimetallic strip 30 operates in the manner described with reference to Figure 1 of the drawing.

A vertical plunger 42 is arranged below the contact arm 24 and its lower end is pivoted to a lever 84 the opposite end of which is connected to a rod 85 having its lower end secured to a flexible diaphragm accommodated within a diaphragm chamber 86. A pipe 87 connected to the lower end of the diaphragm chamber is led to the induction manifold of the engine, in which a partial vacuum is maintained when the engine is running.

The terminals 21 and 25 are both connected to the conductor 44 which as shown in Figure 1 leads to the ignition and other switches of the vehicle while the terminal 82 is connected to the battery.

When the starting switch 16 is closed the winding of the electromagnet 78 is energised whereby the contact arm 19 is moved downwardly into engagement with the contact arm 80. Current then flows from the battery through arm 80, arm 19 and armature thereon to the core 79 of the magnet, conductor 83 and the winding of the magnet to earth. The magnet 78 therefore remains energised when the starting switch is opened. However the resistance wire included in the winding of the magnet causes the temperature of the core 79 to increase and when the critical temperature is reached the magnetic flux falls sharply and the armature is released, thereby breaking the self holding circuit and separating the contacts on the contact arms 19 and 80.

When, however, the engine starts, consequent upon the operation of the starting switch, the partial vacuum created in the induction manifold causes the diaphragm within the chamber 86 to be displaced downwards so that the plunger 42 is moved upwards to impart movement to the contact arm 24 and cause the contact on its upper face to engage the contact on the arm 81. The engagement of these contacts is effected before the corresponding contacts on

the arms 19 and 80 are separated so that the opening of the latter does not ordinarily effect the equipment in circuit with conductor 45.

When the engine stops the plunger 42 descends to permit the contact arm 24 to move downwards into engagement with the cap on the bimetallic strip 30 and after a predetermined lapse of time the said cap moves laterally through a sufficient distance to permit the arm 24 to undergo a further downward movement whereby the parts are restored to the positions shown in Figure 11.

It is convenient to utilise the usual starting switch as previously described to effect the temporary closure of the switching means included in the casing 10, as by so doing no additional step is introduced into the operations which are necessarily involved in starting the engine. It will be evident however that if desired a separate push button or other suitable type of switch may be provided for this purpose. Thus for example the switch 16 shown in Figure 11 may be regarded as being an independent push button switch arranged in any position which is conveniently accessible to the driver.

I claim:

1. In an electric circuit of a motor vehicle, a source of electric energy, a device in circuit with said source of energy, auxiliary switching means operable to temporarily close a break in said circuit, manually operable means for effecting the actuation of said auxiliary switching means, time delay means operable to cause said break to remain closed for a minimum period consequent upon the actuation of said manually operable means and automatic switching means responsive to the running of the engine to maintain said break closed during normal operation thereof.

2. In an electric circuit associated with an engine, an electric battery, a device in circuit with said battery, means normally interrupting said circuit when the engine is not running, manually operable means for effecting the closure of said interrupting means, time delay means operable to retain said interrupting means closed for a minimum period consequent upon actuation of said manually operable means and means responsive to the running of the engine for maintaining said interrupting means closed during normal operation of the engine.

3. Apparatus comprising an internal combustion engine, electric ignition means for said engine, an electric battery arranged in circuit with the ignition means, switching means in said circuit, said switching means being normally open when the engine is not running, manually operable means for closing said switching means, time delay means operative to maintain said switching means closed for at least a minimum period following the operation of said manually operable means, means responsive to the running of the engine for maintaining said switching means closed during normal operation thereof and an ignition switch in series with said switching means.

4. An apparatus according to claim 3, an electric lamp in circuit with the said switching means and in parallel with said ignition means, a bimetallic strip, means operable upon the closure of said switching means to permit displacement of said bimetallic strip to maintain said switching means closed, a resistance winding for said bimetallic strip, and means operable consequent upon said means, responsive to the running of the engine,

becoming inoperative, to close the circuit of said resistance winding, characterized in that the consequent increase in temperature of the bimetallic strip causes same to be displaced to permit re-opening of the said switching means.

5. Apparatus comprising an internal combustion engine having a pressure lubrication system, electric ignition means for said engine, an electric battery arranged in circuit with the ignition means, a pair of switches arranged in parallel in said circuit, both of said switches being normally open when the engine is not running, manually operable means for effecting the closure of one of said switches, time delay means operative to cause said last mentioned switch to reopen after a limited period, means responsive to the pressure of the lubricating oil to close the other said switch and an ignition switch in series with said pair of switches.

6. Apparatus comprising an internal combustion engine having a pressure lubrication system, an electric battery, electric ignition means in circuit with the battery, said circuit being normally interrupted between two points therein when the engine is not running, a starting motor and a starting switch in another circuit of said battery, means operable upon actuation of the starting switch to close the ignition circuit between said points therein, means responsive to the pressure of the lubricating oil to maintain the ignition circuit closed between said two points during normal operation of the engine, time delay means operable to interrupt the circuit between said two points therein unless said means responsive to the pressure responsive means has been actuated within a limited period following the operation of the starting switch and an ignition switch in circuit with the ignition means.

7. Apparatus comprising an internal combustion engine, an electric battery, electric ignition means in circuit with the battery, said circuit being normally interrupted between two points therein when the engine is not running, an expansible resistance element in another circuit of said battery, a manually controlled switch in the last mentioned circuit, means operable consequent upon the energization and expansion of said resistance element to close the ignition circuit between said two points therein, said last mentioned means tending to interrupt the circuit consequent upon the de-energization and contraction of the resistance element, means responsive to normal operation of the engine to maintain the ignition circuit closed between said two points therein and an ignition switch in the said ignition circuit.

8. Apparatus comprising an internal combustion engine having a pressure lubrication system, an electric battery, electric ignition means in circuit with the battery said circuit being normally interrupted between two points therein when the engine is not running, a resistance element in another circuit of the battery, a manually controlled switch in circuit with the resistance element, means operable consequent upon energization and expansion of the resistance element to temporarily close the ignition circuit between said two points therein, means responsive to the pressure of the lubricating oil, to maintain said ignition circuit closed between said points therein when said oil pressure exceeds a predetermined value and an ignition switch in said ignition circuit.

9. Apparatus comprising an internal combustion engine having a pressure lubricating system, an electric battery, ignition means, an electric lamp, said ignition means and said electric lamp

being arranged in parallel circuits of said battery, a circuit element common to said parallel circuits, said common circuit element being normally interrupted between two points therein when the engine is not running, a starting motor, a starting switch in circuit with said starting motor and said battery, means operable consequent upon actuation of the starting switch to close said common circuit element between said points therein means responsive to the pressure of the lubricating oil for maintaining the circuit closed between said points during normal operation of the engine, and time delay means operable consequent upon release of the starting switch to reopen the circuit between said two points if said means responsive to the oil pressure has not been actuated within a predetermined time.

10. Apparatus according to claim 9 including time delay means operable consequent upon said means, responsive to operation of the engine, becoming inoperative to delay reopening of the circuit between said two points therein.

11. Apparatus comprising an internal combustion engine, an electric battery, a device in circuit with said battery, said circuit being normally interrupted between two points therein when the engine is not running, manually controlled means operable to effect the closure of the circuit between said points therein, means operable responsive to the operation of the engine to maintain the circuit closed between said points during normal operation of the engine, and time delay means operable to interrupt the circuit between said points therein unless said means responsive to operation of the engine has been operated within a limited period following the operation of said manually controlled means.

12. In a motor vehicle, an internal combustion engine having a pressure lubrication system, electric ignition means for said engine, an electric battery arranged in circuit with the ignition means, an electric lamp in a parallel circuit of said battery, switching means in circuit with said ignition means and said electric lamp, said switching means being normally open when the engine is not running, manually operable means for effecting the closure of said switching means, time delay means operative to maintain said switching means closed for a minimum period following the operation of said manually operable means, means responsive to the pressure of the lubricating oil for maintaining said switching means closed during normal operation of the engine, an ignition switch arranged in the said circuit in series with said switching means and time delay means operative to maintain said switching means closed for a limited period after said means, responsive to the running of the engine, becomes inoperative.

13. In a motor vehicle, an internal combustion engine having a pressure lubrication system, electric ignition means for said engine, an electric battery arranged in circuit with the ignition means, a switch in said circuit, manually controlled means operable to close said switch, means responsive to the pressure of lubricating oil for maintaining said switch closed during the normal operation of the engine, means operative within a limited time after said manually controlled means has been operated to reopen said switch unless said means responsive to the oil pressure has been actuated, and an ignition switch in series with the first mentioned switch.

14. In a motor vehicle, an internal combustion

engine having a pressure lubrication system, electric ignition means for said engine, an electric battery in circuit with the ignition means, a movable switch member in said circuit, a coacting switch member in said circuit, said movable switch member being biased for movement towards the coacting switch member, an expansible electric resistance element, means connecting the movable switch member to the resistance element whereby said movable switch member is normally held out of contact with the coacting switch member, manually operable means for causing said electric resistance element to be energized from said battery whereby said resistance element will expand and permit the movable switch member to engage the coacting switch member, and means responsive to the pressure of the lubricating oil to maintain said switch members in engagement during normal operation of the engine.

15. In a motor vehicle according to claim 14 a resilient bimetallic strip having one end fixed whereby its opposite end is displaceable from an inoperative to an operative position, means operable, consequent upon actuation of said means responsive to the pressure of the lubricating oil, to permit movement of the bimetallic strip to its operative position, said bimetallic strip when disposed in its operative position preventing separation of the switch members, a resistance winding for the bimetallic strip and means operative consequent upon said pressure responsive means, becoming inoperative, to energize said winding whereby the bimetallic strip is heated and is displaced into its original inoperative position.

16. In a motor vehicle, an internal combustion engine having a pressure lubrication system, electric ignition means for said engine, an electric battery in circuit with the ignition means, a resilient switch arm in said circuit, a second resilient switch arm in said circuit and disposed adjacent to the first mentioned switch arm, said first mentioned switch arm being biased for movement towards the second switch arm, an expansible electric resistance element, means supporting the ends of the resistance element, means connecting the first mentioned switch arm to an intermediate portion of the resistance element, whereby said first mentioned switch arm is normally held out of contact with the second switch arm, manually operable means for causing said electric resistance element to be energized from said battery whereby said resistance element will expand and permit the first mentioned switch arm to move into engagement with the second switch arm, and means responsive to the pressure of the lubricating oil for imparting movement to the second switch arm in the direction of the first mentioned switch arm.

17. In a motor vehicle, an internal combustion engine having a pressure lubrication system, electric ignition means for said engine, an electric battery in circuit with the ignition means, a resilient switch arm in said circuit, a second resilient switch arm in said circuit and disposed adjacent to the first mentioned switch arm, said first mentioned switch arm being biased for movement towards the second switch arm, an expansible electric resistance element, means supporting the ends of the resistance element, means connecting the first mentioned switch arm to an intermediate portion of the resistance element, whereby said first mentioned switch arm is normally held out of contact with the said second switch arm, manually operable means for causing said electric resistance element to be energized from

5 said battery whereby said resistance element will
expand and permit the first mentioned switch arm
to move into engagement with the second switch
arm, means responsive to the pressure of the
lubricating oil for imparting a closing movement
10 to the second switch arm in the direction of the
first mentioned switch arm, a bimetallic strip
fixed at one end and having its opposite end ar-
ranged to coact with the second mentioned switch
arm, means maintaining the free end of the bi-
metallic strip in an inoperative position until a
closing movement is imparted to the second men-
tioned switch arm, said bimetallic strip, when in
its operative position, serving to prevent disen-
15 gagement of the said switch arms, a resistance
winding for the bimetallic strip, and means oper-
able when said means responsive to oil pressure,
becomes inoperative, to energize said winding
whereby the bimetallic strip is displaced to permit
20 disengagement of the said switch arms.

18. In a motor vehicle, an internal combustion
engine having a pressure lubrication system, elec-
tric ignition means for said engine, an electric
battery in circuit with the ignition means, a resil-
ient switch arm in said circuit, a contact in said
5 circuit, said contact being disposed adjacent to
but normally out of engagement with the switch
arm, an electro-magnet energizable to move said
switch arm into engagement with said contact,
manually operable means for effecting energiza-
10 tion of said electromagnet, time delay means op-
erable to maintain engagement between said
switch arm and said contact for a predetermined
period, and means responsive to the pressure of
the lubricating oil for maintaining said switch
15 arm in engagement with the contact during nor-
mal operation of the engine.

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