Jan. 7, 1930. R. L. NAFZIGER 1,742,719

ENGINE CONTROL MEANS

Filed Aug. 16, 1928 2 Sheets-Sheet 1

Fig. 1.

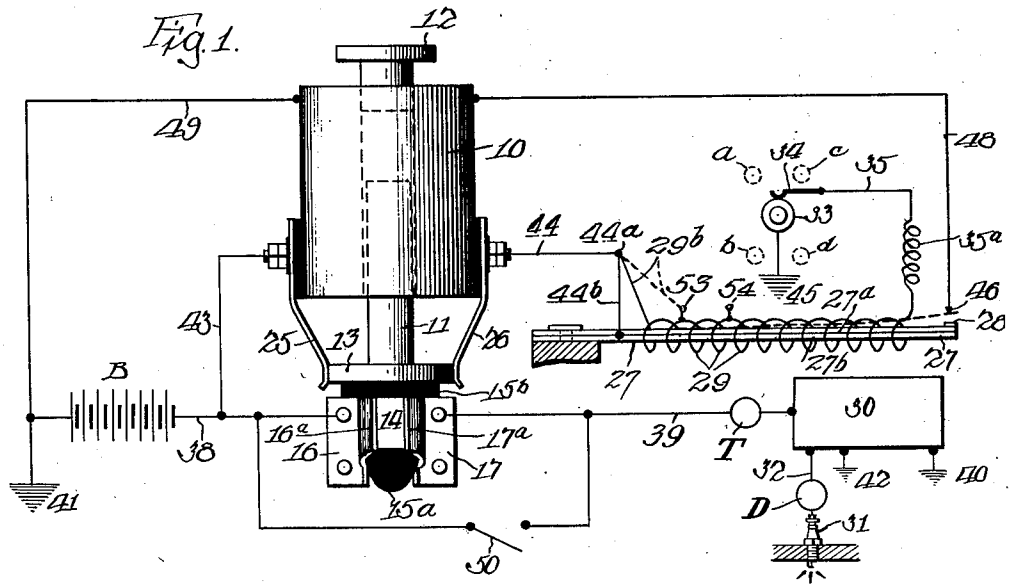


Fig. 2.

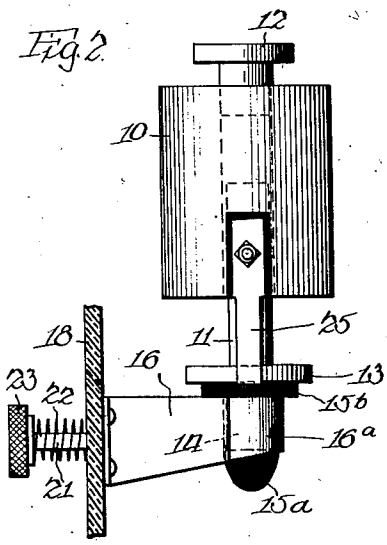


Fig. 3.

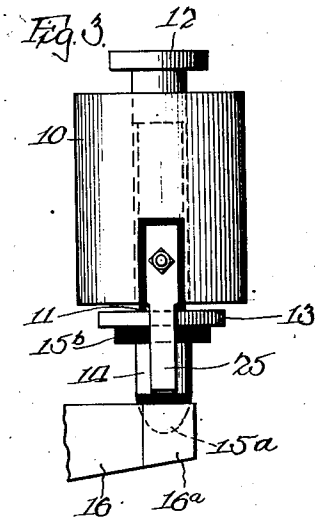


Fig. 4.

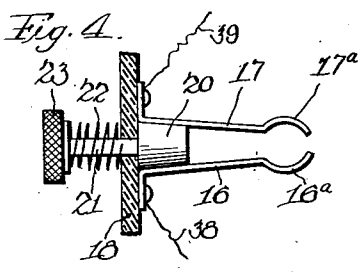
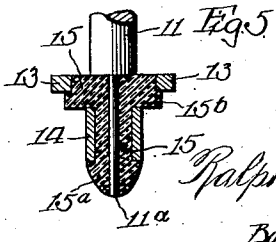


Fig. 5.



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Fig. 6.

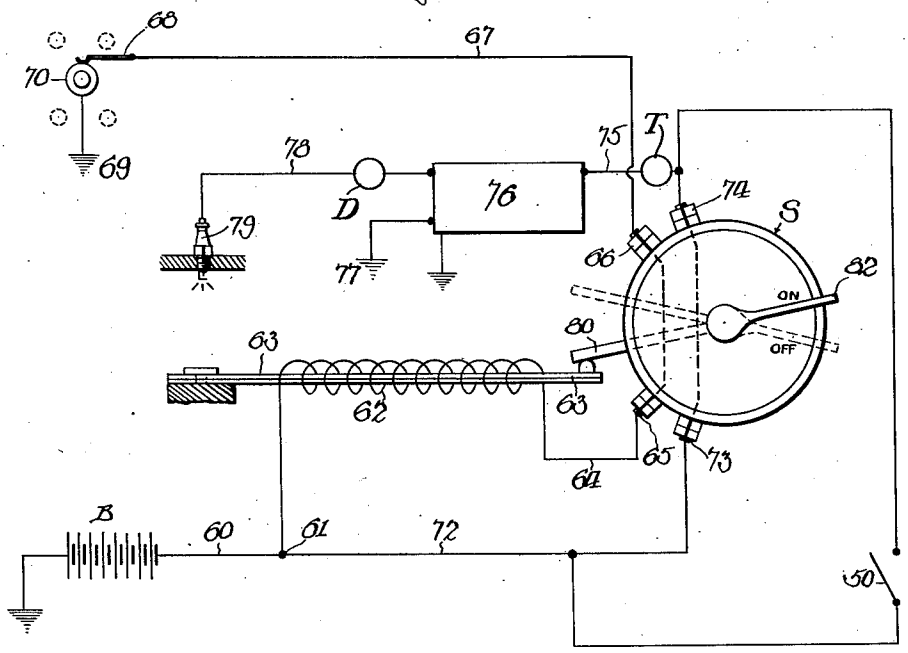
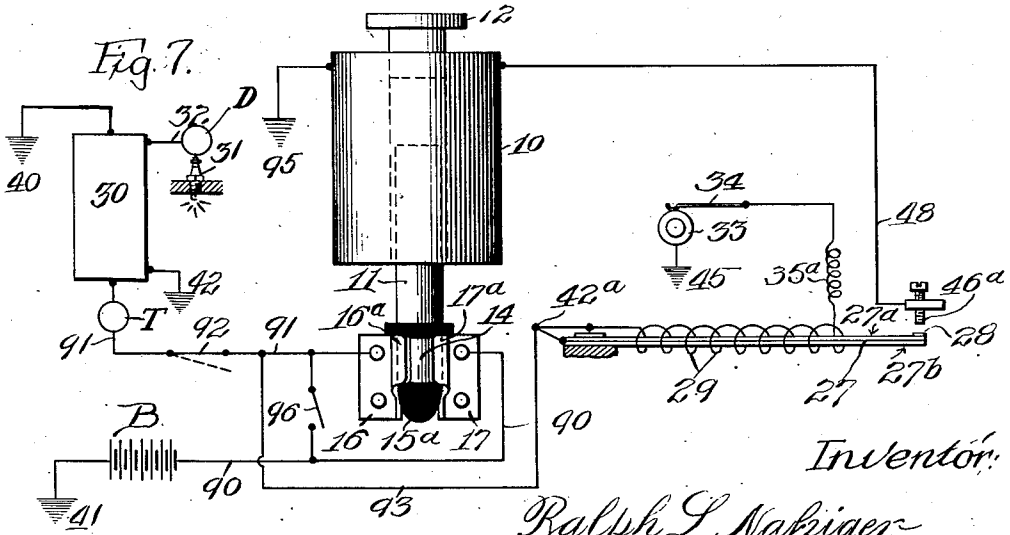


Fig. 7.



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Patented Jan. 7, 1930

1,742,719

UNITED STATES PATENT OFFICE

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ENGINE-CONTROL MEANS

Application filed August 16, 1928. Serial No. 300,043.

These improvements relate to means for controlling the operation of internal combustion engines, with special reference to their automatic control while idling.

It is the habit of drivers of automobile trucks, and sometimes of passenger cars, to leave the vehicle standing with the engine idling while they make deliveries or attend to other business, thus wasting fuel and filling the air with noise and noxious fumes from the exhaust.

The general or broad object of the invention is to overcome objections arising from the unnecessary idling of engines. This is accomplished through the provision of means which automatically cause the engine to stop within a short time after the gear-shift lever has been moved to neutral position.

An important and more specific object of the invention is to accomplish this result by means independent of the engine and without involving the operation of the engine for causing the engine to stop, thus effecting simplicity, avoiding mechanical difficulties and other objections, rendering the advantages more generally applicable, saving cost, etc. In the present embodiment this is accomplished through means for automatically discontinuing the spark at the spark plugs of the engine on moving the gear-shift lever into neutral position. The means are electrically controlled.

Another important object is to provide a system or device for the purpose which may be embodied as a small, compact unit which may be positioned behind the dash board of the vehicle or at some other convenient place. This makes for great convenience in application to cars already in service, and has various other advantages.

It is an object to provide a device for the purpose according to which a predetermined amount of time will elapse between the time when the gear-shift lever is moved to neutral position and the time when the engine stops, thus providing for the normal operation of the engine during short waits, as at street crossings, without moving another key.

An object is to provide a system or device according to which the automatic stop feature may be used at will, or, stated otherwise, to provide means whereby the engine may normally be kept in operation so long as may be desired, even when the gear-shift lever is in neutral position, having in mind that there are occasions when a longer idling of the engine than the predtermined one provided for is indicated.

Among the objects, also, are simplicity, fewness of parts, low cost of installation and operation, and dependability. Other objects and advantages will apepar hereinafter.

In the drawings, Figure 1 is a largely diagrammatic view of the several elements constituting an embodiment of the invention; Fig. 2 is a fragmentary view at right angles to the view of Fig. 1; Fig. 3 shows the parts as in Fig. 2 with the plunger raised; Fig. 4 is a fragmentary top view of parts shown in the other figures; Fig. 5 is a sectional detail of the parts at the end of the plunger; Fig. 6 shows a modified form; and Fig. 7, is a largely diagrammatic view following Fig. 1 in general and showing what I shall call herein the preferred form.

The system or device includes a magnet which is preferably in the form of a solenoid as 10 having a movable core or plunger 11 and the adjustable iron stop 12 limiting the inward movement of the plunger. The plunger 11 carries a metallic ring 13 and another metallic ring or band 14, these two rings being insulated from each other and mounted on the insulating piece 15 having the exposed and rounded nose or end 15^a. The plunger 11 has an axial extension 11^a passing through the insulation piece 15 and the part 15 may be moulded with the rings in place and also directly upon the stem 11^a. The ring 13 is of a larger diameter than the ring 14 and the latter is flush with the end part 15^a. The insulating shoulder at 15^b prevents short circuiting between parts 13 and 16—17.

A pair of contact members 16 and 17, of sheet spring metal, shown in top view in Fig. 4, are secured to a piece of insulation 18. These contact members incline toward each other in the direction of their end portions 16^a and 17^a respectively where they

are somewhat rounded as shown. As shown in Fig. 3 when the plunger 11 is retracted the insulating end 15^a rests upon these free ends 16^a and 17^a of the contact members. When the plunger 11 has descended, as in Figs. 1 and 2, the metallic cylinder 14 is between the ends 16^a and 17^a and the insulating flange 15^b rests on top of these contact members, limiting the further descent of the plunger. The downward movement of the plunger is gravity controlled.

Means for temporarily separating the contact members 16 and 17 are shown as a head 20 in the form of a truncated cone of insulating material carried at the end of a push rod 21 having a coiled expansion spring 22 thereon between the push button 23 and the insulating piece 18. When the push button 23 is moved inward the head 20 separates the contact members 16 and 17, allowing the head of the plunger to descend into the relative position shown by Fig. 2. On removing the finger the spring 22 forces the finger piece outward, retracting the head 20 and causing electrical contact to be made between the ends 16^a and 17^a and the cylindrical head 14.

Carried by the solenoid 10 is a pair of spring contact members 25 and 26 formed respectively to contact the ring 13 when the plunger is lowered, and to be out of such contact when the plunger is raised.

The element 27 (Fig. 1) is a strip or bar of bi-metal, meaning two pieces of metal face to face and extending from end to end of the bar. I have marked the upper one 27^a and the lower one 27^b. These two metals have different coefficients of expansion, and when the bar 27 is heated it bends. Bi-metal suitable for the purpose is a commercial article, and is well known in such devices as thermostats. It is a thermostatic element in this connection. The bi-metal member is firmly secured at one end to a rigid support and has a contact 28 at its free end.

Around the bi-metal piece 27, and insulated from it, is a coil of resistance wire 29 adapted to become heated when current passes through it. The wire of the coil 29 may be insulated wire or insulation may be put upon the bar 27 and the wire then wrapped, with the turns in spaced relation to each other upon the bar.

The induction coil or spark-current device 30 has its secondary connected to the spark plug 31 by a conductor 32. The conductor 39 leading to the primary of the coil in device 30 has an interrupter or timer T while the secondary output conductor 32 has the distributor D.

The gear shift is shown at 33, Fig. 1, and in its central or neutral position, its other operative positions being shown by the four dotted circles *a*, *b*, *c* and *d*. The contact spring 34 makes contact with the gear-shift lever when in this neutral position, but such contact is not made when it is in any of its other positions. The conductor 35 leads from the spring contact element 34 to the heating coil 29. Since the bar 27 carrying the heating coil changes its shape the conductor 35 is provided with flexibility near the heating coil, as by a few turns 35^a in the wire 35.

The battery B is in communication with the contact member 16 through the conductor 38, while the induction coil 30 is in connection with the contact member 17 through conductor 39. It is evident that when the plunger has descended, as in Fig. 1, a circuit is completed through the battery and the induction coil, the primary of which is grounded at 40, the battery being grounded at 41. The secondary of the induction coil is grounded at 42.

A conductor 43 leads from conductor 38 to the contact member 25 and a conductor 44 leads from contact member 26. For clearness of illustration the conductor 44 is shown as dividing at 44^a, one part 44^b being in an electrical connection with the bi-metal piece 27, the other part 29^b leading to the coil 29. The plunger-head ring 13 completes the connection between the battery and the two parts of the thermostatic device. Current may not flow through the conductor 43 however, until the gear shift-lever is moved into the neutral position, at which time current passes through the heating coil 38 and to ground at 45 at the gear-shift lever. The coil 29 heats up and communicates heat to the thermostatic strip 27, which bends, as we will assume, upward, as shown by a single dotted line in Fig. 1. After a predetermined interval, say ten seconds or whatever the time may be according to the construction or particular adjustment of the thermostat parts, the bar 27 bends sufficiently to make contact at 46. Thereupon the current which is divided at 44^a passes partly through the bar 27, contacts 28 and 46 and conductor 48 to the solenoid 10, passing therethrough and thence through the conductor 49 to ground.

As soon as current passes through the solenoid 10 the plunger 11 is drawn upward, or into the position shown by Fig. 3, and thereupon the respective circuits between the battery and the induction coil, between the battery and the solenoid, and between the battery and the gear-shift lever are broken. This results from the fact that the switch elements 13 and 14 have been drawn out of contact with their respective pairs of spring contact members.

When the circuit through the heating coil is thus broken the bar 27 cools and a gap again occurs between the contacts 28 and 46. When the operator desires to start the engine again he simply pushes the button 23, allowing the plunger to drop.

The switch 50 is bridged between the con-

ductors 38 and 39. This may be the usual ignition switch normally on the dash board of the car. If the push button 23 be not operated the engine may be run without the automatic stop feature. Should the automatic feature be in service at the time the switch 50 is closed and the gear shift lever is in neutral position the thermostatic device will still operate to retract the plunger, after such space of time as may be provided for by the winding on the thermostat bar 27. This results from the inclusion of the thermostat in a circuit which, when rendered operative, draws current as soon as the gear shift lever is brought to neutral position. It may be desirable to close the switch 50 in starting, both in order to have more of the battery available for that purpose and because of the time element involved. There may be times on the road also, in traffic jams for example, when it is desirable to close the switch 50. Ordinarily however, the switch 50 may be left open as long as the car is in use and in practice would preferably be omitted from the system.

At 53 and 54 I have shown taps into the heating coil at various places along its length. The connection 29^b may be made at any of these various places and the operator may thus vary the time during which the engine will idle before being stopped.

In Fig. 6 I have shown a somewhat simplified construction in which the magnet is eliminated. In this figure the current passes from battery through a conductor 60 and divides at 61, part thereof passing through the coil 62 around the thermostat element 63 and passes thence through conductor 64 to the contact post 65 of a double-pole switch S. When the switch is in the on or closed position, as shown, the current passes from post 65 to post 66 and thence through conductor 67 to the spring contact member 68 passing thence to ground at 69 through the gear-shift lever 70 when the latter is in its neutral position. This provides for heating the thermostat element 64 and causing it to bend upward.

Part of the current at 61 passes through the conductor 72 to the switch post 73, passing thence to the post 74 and thence through timer T and conductor 75 to the spark coil 76 and thence to ground at 77, assuming switch lever 82 to be in circuit-closing position. The current from the secondary of coil 76 passes through the distributor D and conductor 78 to the spark plug 79.

The switch S has a lever arm 80 closely overlying the free end of the thermostat bar 63. When the bar 63 bends upward this lever 80 is also moved upward, and in doing so breaks the circuit between posts 65 and 66 and also between posts 73 and 74. The internal mechanism of the switch is not shown as such switches are old in themselves. The type preferred in this instance is what is known as a snap switch, according to which on moving a part (as the lever 80) a predetermined distance a pivoted element is moved against spring pressure until its dead center is passed whereupon the spring pressure snaps the contact members out of contact, and then when a manually operable part (as the lever 80) is moved in the reverse direction, a similar action takes place snapping the contacts back so as to make the circuit.

Means for manually moving the lever 80 in the reverse direction are shown as the lever 82 shown as having an on and off position. This lever 82 may be appropriately on the dash board of the vehicle, as, indeed, may be the entire device, this construction of Fig. 6 admitting of installation as an exceedingly small and compact unit.

The auxiliary switch 60 is shown in Fig. 6 as being bridged between the source of current and the spark coil as in Fig. 1.

Referring to Fig. 7, which I shall call the preferred form, the parts which are in all respects like those in Figs. 1, 2 and 3 will be given the same reference characters, and specific description of them may be omitted. The solenoid switch of Fig. 7 omits the switch element 13 and its contacts but is otherwise the same as in Fig. 1.

Beginning at the battery in Fig. 7, the current passes through conductor 90 to contact member 17 passing thence through the contact-maker 14 to the contact member 16, and thence through conductor 91 through timer T to the ignition coil 30. The switch at 92 may be the ordinary dash-board lock-and-key controlled igintion switch normally on the car. It would be closed at the time of starting, and the push button 23 (not shown in Fig. 7) would be operated to complete the circuit at the solenoid switch.

When the gear-shift lever 33 is in its neutral position and switch 14—16—17 is closed, as shown, current passes through conductor 93 connected with conductor 91 and at 42^a the circuit divides as in Fig. 1, one part being the bi-metal strip 27, the other part being the heating coil 29. Current may not flow through the bi-metal element until it has bent or curved sufficiently to make contact at 28—46^a, at which time current passes through the conductor 48 to the solenoid 10. In Fig. 7 the coil of the solenoid is grounded at 95.

As soon as the solenoid 10 is energized the circuit is broken at 16^a and 17^a, breaking the circuit to the ignition coil and also through the heating coil and through the solenoid.

According to this arrangment I accomplish the same results as in Fig. 1 but with a single solenoid switch as distinguished from the double switch of Fig. 1. The manually-controlled switch 96 corresponds to the switch 50 of Fig. 1. The contact at 46^a may be adjusted

to vary the delay at which the engine will be stopped.

The thermostat shown is an electrically-operated device having a delayed action or one having a part which moves effectively with a delayed action. This delayed-action part controls a switch one object of which is to break the ignition circuit and another is to break the control-device circuit or circuits—the latter to save current and to provide other advantages. The switch so controlled is held in circuit—breaking position till the operator sets it to circuit-making position.

Tests with and without the present invention installed in delivery trucks engaged in the same work show a saving by the device of about two hours of engine idling per day or six hundred such hours per year. This saves a very considerable amount of fuel and lubricating oil and prevents unnecessary carbon deposits in the engine due partly to the faulty combustion of the low-speed idling operation. Of course the saving of engine wear and tear is also important. Where the same concern has a large number of trucks in operation, as in my practice, the saving of money value in a single month is quite notably great.

I contemplate as being included in the present invention all such changes, departures and modifications from what is thus specifically illustrated and described as fall within the scope of the appended claims.

I claim:

1. In an automobile having an internal combustion engine, the combination of a gear-shift lever having a neutral position, an ignition circuit and a source of current therein, switch means for making and breaking said circuit, an electrically-responsive device for operating said switch means, and means including a circuit controlled by moving the gear-shift lever into its neutral position for operating said electrically-responsive device to break the ignition-circuit.

2. The combination of claim 1 hereof in which means in the circuit controlled by the gear-shift lever operate with a delayed action to operate the electrically-responsive device after a predetermined interval of time.

3. The combination of claim 1 hereof in which means in the circuit controlled by the gear-shift lever operate with a delayed action to operate the electrically-responsive device, and there are means for varying the amount of delay in said action.

4. The combination of claim 1 hereof in which means in the circuit controlled by the gear-shift lever comprises a thermostat element and a circuit for heating said element.

5. The combination of claim 1 hereof in which said electrically-responsive device is a magnet.

6. The combination of claim 1 hereof in which said electricaly-responsive device is a solenoid having a plunger mounted to fall gravitationally, with contact means carried by the plunger.

7. The combination of claim 1 hereof in which there are manually-operable means for rendering said switch means operable to make the circuit in which said switch means are located.

8. The combination of claim 1 hereof in which said switch means control two circuits, one in which the electrically-responsive device is located and the other one being the ignition circuit.

9. The combination of claim 1 hereof in which the electrically-responsive device circuit and the ignition circuit are independent of each other.

10. The combination of claim 1 hereof in which the means in the circuit controlled by the gear-shift lever include a thermostat element of bi-metal constituting an electrical conductor and an electric heating coil around said bi-metal element.

11. In an engine control device of the character described, the combination of an electromagnet having a gravity-controlled part carrying a conductor, an open circuit containing said magnet, said gravity-controlled part falling when the magnet is de-energized and rising when the magnet is energized, a pair of contact members arranged to be bridged by said conductor on the descent of said part, a manually-controlled switch, a circuit containing said switch, and means in said last-mentioned switch circuit for closing the magnet circuit only after the circuit has been closed at said switch for a predetermined short period of time.

12. In an engine stopping device of the character described, the combination of a solenoid having a gravity-controlled plunger, contact-making means carried by the plunger, contact members arranged to be bridged by said contact-making means when the plunger descends, means for holding the contact-making means out of engagement with the contact members when the plunger is raised and the solenoid is deenergized, means under the control of the operator for releasing the plunger to descend gravitationally to make contact between the contact-making means and the contact members, a circuit for the solenoid controlled by said contact-making means, a manually-controlled switch and an automatically-operating delayed-contact switch in the said circuit, and means for connecting a spark-current device in a circuit also controlled by said contact-making means.

13. In an engine stopping device of the character described, the combination of a magnet, a two-circuit make-and-break switch device controlled by said magnet, a plurality of circuits controlled by said switch device, said magnet and a manually-controlled switch

and a delayed-action switch being in said circuits, the arrangement providing that when the circuit is closed at said manually-controlled switch said delayed-action switch is put into operation and closes the circuit in which the magnet is located, means for holding said make-and-break switch device in open position, and manually controlled means for restoring it to closed position.

14. In an engine stopping device of the character described, the combination of a magnet, a two-circuit make-and-break switch device controlled by said magnet, a manually controlled switch, two circuits controlled by said make-and-break switch device, a delayed-action switch being in one of said circuits and said magnet being in another thereof, said delayed-action switch including contacts in the magnet circuit and being adapted to make and break the magnet circuit, the arrangement providing that when the circuit is closed at said manually-controlled switch the delayed-action switch is put into operation and after a predetermined lapse of time closes the circuit to said magnet, the magnet thereupon operating to break both of the circuits at said make-and-break switch device.

15. In an automobile engine stopping device of the character described, the combination of a switch, a thermostat circuit controlled thereby, a thermostat device in said circuit, an ignition circuit, means under the control of the thermostat device for breaking the ignition circuit, and a gear shift lever for operating said switch for breaking the ignition circuit.

16. The combnation of claim 15 hereof in which said switch is in and is adapted to make and break both of said circuits.

17. In an automobile engine stopping device of the character described, the combination of a gear-shift lever having a neutral position, a circuit controlled by moving said lever into its neutral position, an electrical device in said circuit and having a part which moves effectively with a delayed action in response to current passing through said electrical device, an induction coil and a circuit including the primary thereof, a switch controlling both of said circuits, and means under the control of said delayed-action part for operating said switch.

18. In an automobile engine-stopping device, the combination of a gear-shift lever having a neutral position, a circuit controlled by moving said lever into its neutral position, an ignition circuit, a switch in said ignition circuit, and thermostat means controlled by moving the gear-shift lever to its neutral position for operating said switch.

19. In an automobile engine-stopping device, the combination of a transmission-control lever having a neutral position, electrical means operable to produce ignition sparks in the engine, and thermostat means including a circuit controlled by moving said lever to neutral position for stopping the operation of said spark producing means.

20. In an automobile engine-stopping device, the combination of a transmission-control lever having a neutral position, a battery, an ignition coil, a circuit including said battery and said coil, a switch controlling said circuit, and thermostat means under the control of said lever when in its neutral position for operating said switch to open the circuit controlled by it.

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