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IGNITION CONTROLLING DEVICE FOR INTERNAL-COMBUSTION ENGINES

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Fig. 1

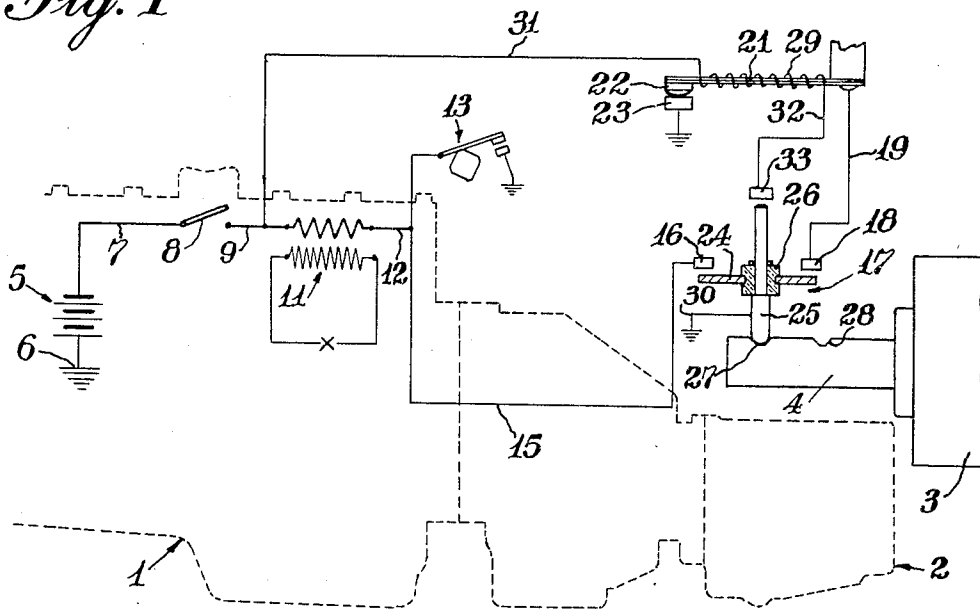
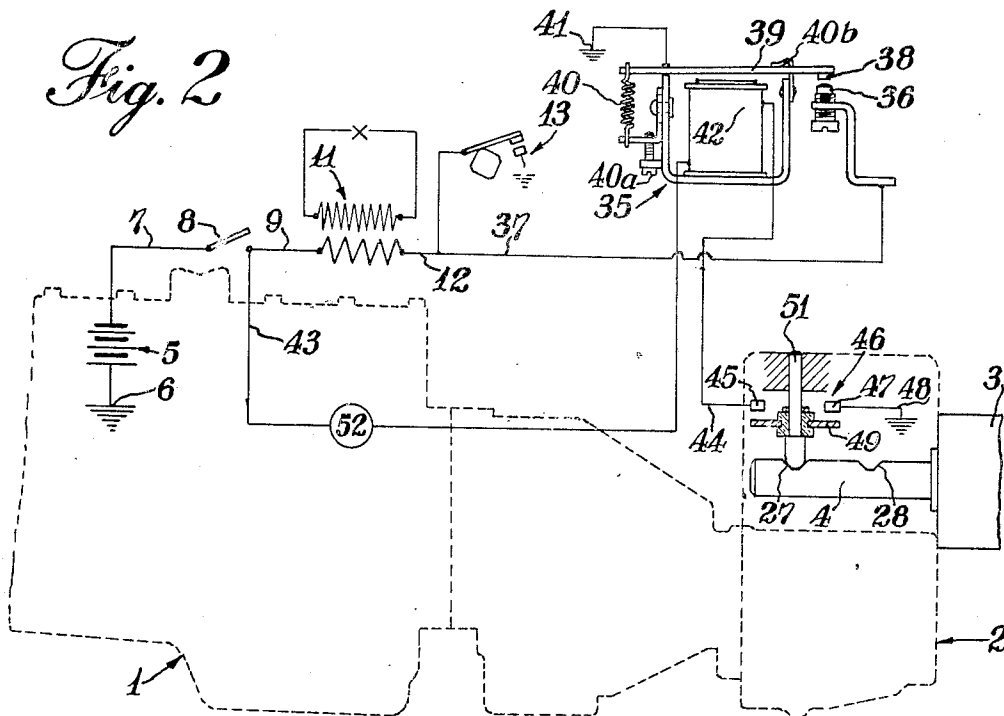


Fig. 2



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IGNITION CONTROLLING DEVICE FOR
INTERNAL-COMBUSTION ENGINESManuel H. Elkin, Elmira Heights, N. Y., assignor
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8 Claims. (Cl. 74-472)

The present invention relates to an ignition controlling device for internal combustion engines and more particularly a device for momentarily rendering the ignition of an internal combustion engine inoperative in order to facilitate the shifting of a variable speed transmission operated by the engine.

In certain types of variable speed transmission, it is difficult to change from one speed ratio to another while the transmission is under load. It is customary to obviate this difficulty in conventional automotive practice by interposing a clutch between the engine and transmission for disconnecting the transmission from the engine while the shift is being made. When such a clutch is not employed, the desired result may be accomplished by momentarily deenergizing the engine as by rendering the ignition inoperative by open-circuiting or grounding the same.

When the shifting of the transmission is done automatically, the control of the energization of the engine may be accomplished by some element of the shifting means, but it is desirable that the operative condition of the engine be restored after a brief time interval irrespective of the actuation of the shifting means in case the latter should for any reason fail to complete its cycle of operation.

It is an object of the present invention to provide a novel controlling device for internal combustion engines which is efficient and reliable in operation and simple and economical in construction.

It is another object to provide such a device such a device which is used in conjunction with an automatic variable speed transmission and is controlled primarily by the shifting means for the transmission.

It is a further object to provide such a device having thermally sensitive means for restoring the operative condition of the engine after a predetermined time irrespective of the functioning of the shifting means.

Further objects and advantages will be apparent from the following description taken in connection with the accompanying drawing in which:

Fig. 1 is a semi-diagrammatic illustration of a power plant incorporating a preferred embodiment of the invention; and

Fig. 2 is a similar view illustrating a second embodiment of the invention.

In Fig. 1 of the drawing there is indicated in

dotted lines an internal combustion engine 1 with a variable speed transmission 2 operated thereby, with shifting means 3 for the transmission including a slidable rail 4.

5 An ignition system for the engine is illustrated comprising a battery 5 grounded at 6 and connected by a lead 7 to an ignition switch 8. Switch 8 is connected by a lead 9 to an ignition coil 11 which is connected by lead 12 to a conventional form of breaker mechanism indicated generally by numeral 13.

According to the present invention, means for momentarily rendering the ignition system of the engine inoperative during shifting movement of the rail 4, is provided in the form of a grounding circuit comprising a lead 15 connected to the lead 12 between the ignition coil and breaker mechanism, and to a contact 16 of a switch 17. Contact 18 of switch 17 is connected by a lead 19 to a thermally sensitive element 21 anchored at one end and carrying at its free end a contact 22 which is normally in engagement with a fixed grounded contact 23.

Switch 17 is provided with a bridging contact 24 mounted on a slidable plunger 25 but insulated therefrom as indicated at 26. The lower end of plunger 25 normally rests in a notch 27 in the shift rail 4, but when moved out of said notch by longitudinal movement of the shift rail, the plunger 25 is adapted to raise the bridging contact 24 into engagement with fixed contacts 16 and 18 to connect the same. Rail 4 is provided with a second notch 28 adapted to come into registry with the end of plunger 25 when the shifting movement of the rail is completed, thereby permitting switch 17 to open and break the grounding circuit.

Means for heating the thermally sensitive element 21 upon closure of the rail-operated switch 17, is provided in the form of a heating coil 29 which is connected by a lead 31 to the ignition circuit lead 9, and at its other end by a lead 32 to a fixed contact 33 which is in position to be engaged by the upper end of plunger 25 when switch 17 is closed. Plunger 25 is grounded either by its contact with the rail 4 or in any other suitable manner as indicated at 30, so that when the switch 17 is closed and the plunger engages contact 33, the heating circuit is completed to the ground.

The thermally sensitive element 21 is arranged to maintain contact 22 in engagement with the ground contact 23 when said element is cold. When the element 21 is heated, however, it bends upward and after a predetermined time interval,

moves contact 22 out of engagement with contact 23.

In operation, closure of the ignition switch 8 completes the ignition circuit in the usual manner, but since switch 17 is normally open, no other circuits are completed. Upon the initiation of movement of the shift rail 4, however, switch 17 is cammed shut thereby, thus completing the grounding circuit through switch 17 and contacts 22, 23 whereby the ignition circuit of the engine is rendered inoperative. At the same time, the heating circuit for the heating coil 29 is completed through the plunger 25 of switch 17 to the ground and the thermally sensitive element 21 is heated. If shifting of the transmission proceeds normally, the shifting movement of the rail 4 is completed in a small fraction of a second, whereupon plunger 25 of switch 17 falls into notch 28 and switch 17 opens, and the operative condition of the engine is restored.

If, for any reason, the shift rail 4 should not complete its movement and the switch 17 is held closed, the heating of the thermally sensitive element 21 continues until contact 22 is moved away from contact 23. The grounding circuit for the ignition is thus broken and the engine restored to operation after a predetermined time interval dependent upon the characteristics of the thermally sensitive element 21 and heating coil 29. Contacts 22, 23 are thus maintained open until such time as the shifting operation of the transmission is completed, permitting the switch 17 to open, whereupon the parts return to their normal positions.

In the embodiment of the invention illustrated in Fig. 2, the engine, transmission, shift rail and ignition system are the same as illustrated in Fig. 1 and are similarly numbered. In this embodiment of the invention, however, a grounding circuit for the ignition circuit is provided which includes a sensitive relay 35. Relay 35 comprises an adjustable fixed contact 36 connected by a lead 37 to the ignition circuit lead 12, and a movable contact 38 mounted on a hinged armature 39 in position to engage contact 36 when the relay is closed. Armature 39 is grounded at 41 to complete the grounding circuit. A spring 40 having tension adjusting means 40a normally holds the armature up against a stop 40b. A coil 42 mounted adjacent the armature 39 is adapted when energized to attract the armature to close the relay.

A control circuit for the relay is provided comprising a lead 43 connected to the ignition circuit lead 9 and to one end of the relay coil 42. The opposite end of the relay coil is connected by a lead 44 to a contact 45 of a rail switch 46. Switch 46 includes a fixed contact 47 grounded at 48 and a bridging contact 49 mounted on a plunger 51. The lower end of plunger 51 normally rests in the notch 27 of shifting rail 4, in which position the bridging contact 49 is out of engagement with contacts 45, 47. Initial movement of the shift rail 4 cams the plunger 51 upward to close the switch 46 and maintain it closed until the shifting movement is completed, whereupon the plunger 51 drops into the second notch 28 of rail 4, permitting the switch 46 to open.

Relay 35 is constructed to be sensitive to variations in voltage applied to the actuating coil 42 thereof to cause the relay to close when the applied voltage exceeds a predetermined value, and to open when the voltage is reduced a predetermined amount below that value. This is accomplished by maintaining the space between the

armature and the coil comparatively large, so that the closing movement of the armature does not markedly affect the magnetic flux there-through, and by providing convenient means such as illustrated for adjusting contact 36 to regulate the air gap between the armature and the coil, and for adjusting the tension of the spring 40. A thermally sensitive element 52 is provided for causing the current in the control circuit to be reduced a predetermined time after closure of the circuit, to a value such as to cause release of the relay 35. This thermally sensitive element is in the form of a resistor having a positive temperature coefficient, which resistor may take the form of a ballast tube or may be an incandescent lamp of conventional type having suitable characteristics.

In the operation of this embodiment of the invention, closure of the ignition switch 8 energizes the ignition circuit in the usual manner, no other circuits being initially energized since relay 35 and rail switch 46 are both normally open. Upon initiation of the shifting movement of rail 4, switch 46 is closed, thus completing the control circuit through relay coil 42. Since the thermally sensitive element 52 is cold, it passes sufficient current to cause closure of relay 35 which completes the grounding circuit and thus deenergizes the internal combustion engine. When the shift is completed, plunger 51 of rail switch 46 drops into notch 28 of the rail 4, thus opening the control circuit and causing relay 35 to open, whereby the engine is restored to operation.

If the shift rail 4 should fail to complete its movement for any reason, the current passing through the control circuit heats up the thermally sensitive element 52, whereupon its resistance rises to a point where it causes relay 35 to open. The engine is thus restored to operative condition after a predetermined time delay dependent upon the length of time necessary to heat the filament of the thermally sensitive element 52.

When the variable speed transmission has been properly adjusted so that the rail 4 completes its shifting movement, rail switch 46 opens, thus breaking the control circuit and restoring the elements to normal condition.

Although but two embodiments of the invention have been shown and described in detail, it will be understood that other embodiments are possible and various changes may be made in the design and arrangement of the parts without departing from the spirit of the invention as defined in the claims appended hereto.

What is claimed is:

1. In combination with an internal combustion engine and a variable speed transmission operated thereby, automatic controlling means for the transmission including a movable shift member, an ignition circuit for the engine including a battery, an ignition coil and a breaker mechanism, electrical circuit means controlled by initial movement of the movable member to ground the terminal of the coil which is connected to the breaker mechanism, said means including a heat-sensitive element, a heater for said element, a circuit separate from the ignition grounding circuit closed by the movable member for heating said element from the battery, and means operable by heating said element for breaking said ground connection.

2. In combination with a shift member for a variable speed transmission for internal combustion

tion engines, an engine ignition system including an ignition switch, a grounding circuit for said ignition system including a normally open switch and a normally closed thermostatic switch, means responsive to initial movement of the shift member for closing said normally open switch, a heater for the thermostatic switch, and a circuit separate from the grounding circuit for energizing the heater, said heater circuit including the ignition switch and the normally open switch.

3. In combination with a shift member for a variable speed transmission for internal combustion engines, an engine ignition system including a battery, an ignition switch, an ignition coil and a breaker mechanism; a grounding circuit for the ignition system including a normally open switch, one terminal of which is connected to the breaker side of the coil, and the other terminal of which is connected to the ground; a pair of normally closed contacts in said ground connection, thermostatic means for opening said contacts, a heating unit for the thermostatic means having one terminal connected to the ignition circuit between the ignition switch and the coil, and the other terminal grounded through the normally open switch, and means responsive to operation of the shift member for closing the normally open switch.

4. In a power plant in combination with a gear shift member, means for deenergizing the power plant responsive to actuation of the shift member including a balanced relay, and a control circuit for the relay including a resistor having a positive temperature coefficient such that when cold it passes sufficient current to operate the relay, but when heated by the current passing therethrough, it causes the relay to return to its normal position.

5. In a power plant in combination with a gear shift member, an engine ignition system, means for rendering the ignition system inoperative in-

cluding a magnetic switch, a control circuit for said switch including a normally open switch and a resistor having a low resistance when cold and a high resistance when hot, and means responsive to movement of the shift member for closing the normally open switch, said magnetic switch being constructed and arranged to be closed by current traversing the resistor when cold, and to open when the resistor is heated by the current passing therethrough.

6. In a power plant in combination with a gear shift member, an ignition system, means for grounding the ignition system including a magnetic switch, a control circuit for said switch including a normally open switch and a ballast tube having a low resistance when cold and a high resistance when hot, and means responsive to initial movement of the shift member for closing the normally open switch, said magnetic switch being constructed and arranged to be closed by current traversing the ballast tube when cold, and to open when the ballast tube is heated by the current passing therethrough.

7. Controlling means for an internal combustion engine including a relay and means operative upon closure of the relay to deenergize the engine, and a control circuit for the relay including a resistance element having a resistance when cold so low as not to interfere with the closure of the relay, but when heated by the current traversing the control circuit, having a resistance sufficient to cause the relay to open.

8. Controlling means for an internal combustion engine including a relay and means operative upon closure of the relay to deenergize the engine, and a control circuit for the relay including an incandescent lamp adapted when cold to pass sufficient current to cause closure of the relay, but when heated to incandescence, reducing the current flow sufficiently to cause the relay to open.

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