July 21, 1936. L. L. LUSTIG 2,048,130

CENTRALIZED MOTOR CONTROL

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Fig. 1

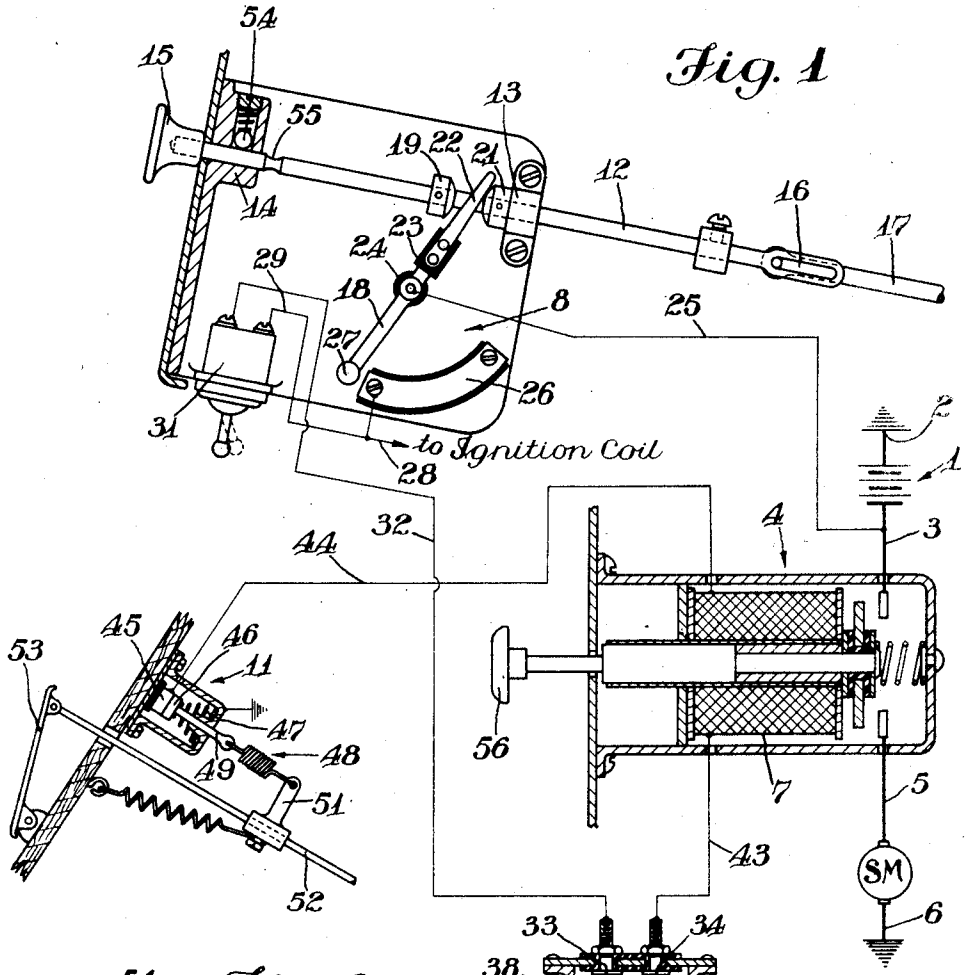
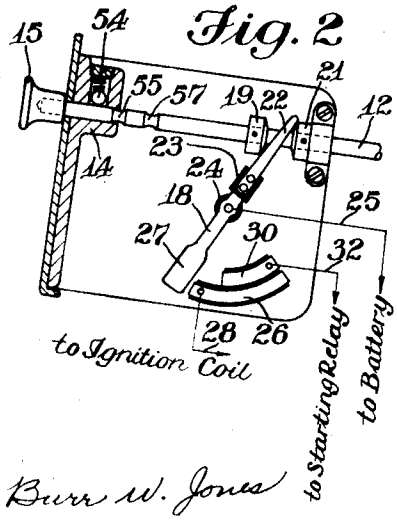



Fig. 2




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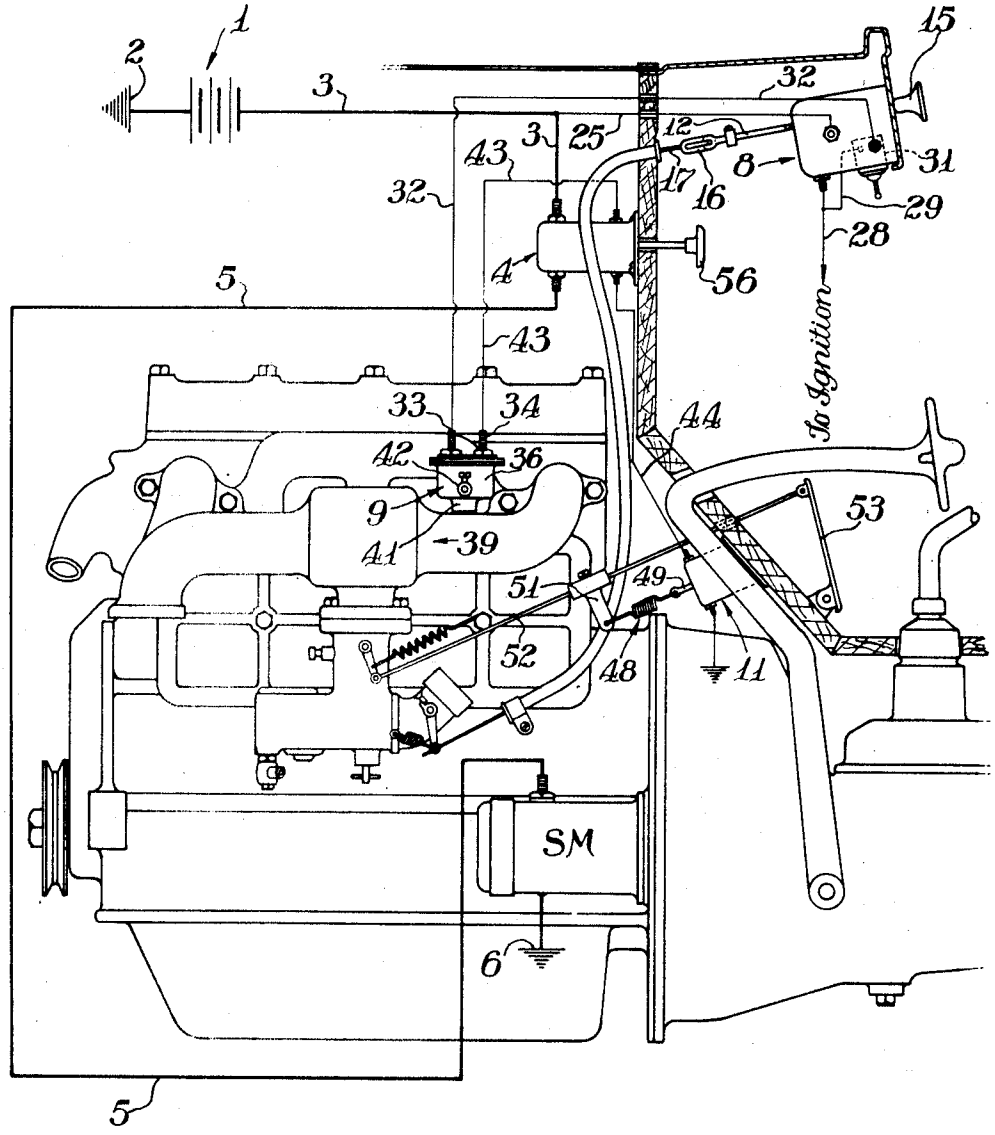
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Fig. 3




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## CENTRALIZED MOTOR CONTROL

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17 Claims. (Cl. 290—38)

This invention relates to a centralized motor control and more particularly to a device for operating the starting and ignition systems and the carburetor choke valve of an internal combustion engine from a common manual control member.

It is an object of the present invention to provide a novel unit control device which provides for controlling the starting and ignition functions from a manual control element of the engine such as the choke button.

It is another object of the invention to provide such a device which permits selective operation of the various devices controlled thereby, as desirable under various operating conditions of the engine.

A further object is to provide such a device which embodies automatic means for deenergizing the starting mechanism when the engine starts and for preventing reenergization thereof during self-operation of the engine.

Another object is to provide such a device which is convenient and reliable in operation while being simple and economical in construction.

Further objects and advantages will be apparent to those skilled in this art from the following description taken in connection with the accompanying drawings in which:

Fig. 1 shows in semi-diagrammatic form one preferred embodiment of the invention;

Fig. 2 is a detail of a second embodiment thereof and

Fig. 3 is a side elevation partly diagrammatic of the invention as applied to an internal combustion engine of conventional type.

Referring first to Fig. 1 of the drawings, an electrical starting system for an internal combustion engine, not shown, is illustrated comprising a battery 1, grounded at 2 and connected by a lead 3 to a magnetic starting switch indicated generally at 4. The switch 4 is connected by a lead 5 to a starting motor SM which is grounded at 6 to complete the starting circuit.

The starting switch 4 is arranged to be operated by a control circuit including a solenoid 7, energization of which by the battery 1 closes the starting switch. The control circuit also includes a manual switch indicated generally at 8, a switch means responsive to self-operation of the engine for opening the control circuit and deenergizing the cranking means, indicated generally by numeral 9, and a switch means 11 operated by the fuel controlling mechanism of the engine for preventing energization of the cranking means when the fuel admission means is open.

According to the present invention, the manual control switch 8 is a part of a unit for controlling the starting circuit, the ignition circuit and the mixture enriching means for the engine such as a carburetor choke. As here shown, this unit comprises a rod 12 slidably mounted in suitable bearings 13 and 14 and having an operating button 15 arranged conveniently to the operator. The rod 12 is provided with a lost motion connection 16 to a link 17 which is connected to operate the carburetor choke, not shown, when the button 15 has been drawn out sufficiently to take up the lost motion at 16.

A switch arm 18 is pivoted adjacent the rod 12 and is arranged to be operated thereby by suitable means such as collars 19 and 21 mounted on the rod 12 in position to engage the end of an arm 22 fixed to said switch arm and insulated therefrom as indicated at 23. Switch arm 18 is insulated from the body of the control unit as indicated at 24 and is connected by a lead 25 to the battery lead 3. A quadrant or arcuate contact 26 of suitable conducting material is arranged adjacent the lower end of switch arm 18, and said arm is there provided with a brush 27 of any suitable form arranged to engage and make electrical contact with said quadrant upon initial counter-clockwise rotation of said lever. Switch quadrant 26 is connected to the ignition circuit of the engine by means of a lead 28, and is connected through lead 29, snap switch 31, and lead 32 to the engine-operated switch means 9.

Switch means 9 comprises a pair of stationary insulated contacts 33 and 34 which are adapted to be bridged by a movable contact member 35. Bridge member 35 is slidably mounted in a cylindrical casing member 36 and is normally maintained in engagement with said contacts by means such as a spring 37. A piston member 38 having a substantially air-tight fit within the cylinder 36 is arranged to carry the bridge member 35 and to move the same away from the contacts 33, 34 responsive to a reduction in the pressure in cylinder 36. Cylinder 36 is connected with an element of the fuel intake system of the engine such as the intake manifold 39 by suitable means such as a conduit 41, whereby vacuum in said intake manifold operates to withdraw the piston 38 and thereby move bridging member 35 away from the contacts. An adjustable bleeder opening 42 is preferably provided in order to regulate the vacuum within the cylinder 36.

The lead 32 from the snap switch 31 is connected to one of said contacts such as 33, and

the other contact 34 is connected by a lead 43 to the starting switch solenoid 7. The opposite terminal of solenoid 7 is connected by a lead 44 to the accelerator-controlled switch 11 which, when closed, grounds the lead 44 and thereby completes the control circuit through the ground connection 2 to the battery 1.

Switch 11 comprises a fixed insulated contact 45 and a movable contact 46 which is yieldably held in engagement with contact 45 by suitable means such as a spring 47. Contact 46 is arranged to be withdrawn from contact 45 when the fuel controlling mechanism such as the throttle of the engine is opened, this result being accomplished as here illustrated by means of a yielding link 48 which is connected at one end to a stem 49 carrying the contact 46 and at its other end to a bracket member 51 mounted on the throttle rod 52 which is operated by an accelerator pedal 53.

In the operation of the device, and starting with the parts in the positions illustrated, when the operator pulls out the choke button 15, the switch lever 18 is immediately caused to engage the quadrant 26, thus causing the ignition circuit to be connected to the battery 1 through lead 28. Since the switches 31, 9, and 11, are all closed, the control circuit for the starting switch is also completed by closure of the manual switch 8, whereby the solenoid 7 is energized to close the starting switch and cause the engine to be cranked. Further motion of the button 15 after the lost motion at 16 is taken up operates the choke to enrich the fuel mixture for starting purposes in the usual manner.

During the cranking operation, a certain amount of vacuum is generated in the intake manifold 39, but since the rotation of the engine in cranking is comparatively slow and the throttle is partially open, this vacuum is not high. The strength of the spring 37 and the size of the bleeder opening 42 are so arranged that intake vacuum during cranking will not withdraw the bridging member 35 from its engagement with contacts 33 and 34. When the engine starts, however, the increase in intake vacuum withdraws the piston 38 and disconnects contacts 33, 34, thus breaking the control circuit and causing the starting switch 4 to open.

Piston 38 is held in its lower position by the intake vacuum during the normal operation of the engine, but in case of engine stall, the spring 37 causes reengagement of the bridging member 35 with contacts 33 and 34, thus causing the engine to be recranked unless the control button 15 has been returned to its idle position. The running position of control button 15 is preferably defined by some yielding means such as a detent 54 which is arranged to engage a groove 55 when the switch arm 18 engages contact 26.

When the engine is running slowly under load, a sudden complete opening of the engine throttle as by a full depression of the accelerator pedal 53 may cause sufficient drop in the intake vacuum to allow the switch 9 to close. The switch 11 is provided in order to prevent undesired actuation of the starting mechanism under such circumstances. This switch is arranged to be opened when the accelerator pedal 53 is depressed to any substantial degree, and thereafter the control circuit is maintained open even though the switch 9 may be temporarily closed by the drop in intake vacuum.

Should it be desired to crank the engine by hand, the snap switch 31 may be operated to open the control circuit, whereupon the ignition circuit may be closed in the usual manner by operation of the control button 15.

The starting switch 4 may be operated manually if so desired by means of a button 56 mounted on the stem of said switch.

In the embodiment of the invention illustrated in Fig. 1, the snap switch 31 constitutes means for optionally preventing the automatic energization of the starting system by the control button 15. Fig. 2 illustrates a second embodiment of the invention in which the selective controlling of the starter and ignition circuits is provided for without having recourse to an auxiliary manual switch.

As shown in Fig. 2, the elements of the choke controlling mechanism and of the switch arm 18 with its operating connections are the same as illustrated in Fig. 1 and are similarly numbered. The quadrant 26, however, is connected to the ignition circuit only, by means of the lead 28, and a shorter arcuate contact 30 is arranged concentric with the quadrant 26 in position to be engaged by the switch arm 18 subsequently to its engagement with the quadrant 26. Contact 30 is connected by the lead 32 directly to the engine control switch 9, whereby closure of the control circuit for solenoid 7 is effected when switch arm 18 engages contact 30.

In order to define the various positions of the choke rod 12, said rod is provided with grooves 55 and 57 arranged to cooperate with the detent 54, grooves 55 corresponding to the position of the choke rod and when the switch arm 18 engages the quadrant 26 only, and groove 57 defining the position of the choke rod 12 when the switch arm is in engagement with both contacts 26 and 30, but has not been moved sufficiently to operate the choke valve.

In the operation of this embodiment of the invention, pulling out the control button 15 till the detent 54 engages with the first groove 55 causes the switch arm 18 to engage quadrant 26, thus completing the ignition circuit only. In this position of the control button 15, the engine is in condition to be cranked by hand if so desired, and when so started will operate as usual but will not be automatically restarted in case of engine stall.

When the choke rod 12 is withdrawn further so as to cause the groove 57 to engage detent 54, switch arm 18 is caused to engage both arcuate contacts 26 and 30 whereby the control circuit for the starting relay is closed, causing the engine to be cranked, and providing for automatic restarting in case of engine stall. Further operation of the choke rod 12 causes the choke valve to be closed in the usual manner as described in connection with the first embodiment of the invention.

Although but certain 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 construction and arrangements of the parts without departing from the spirit of the invention as defined in the claims appended hereto.

What is claimed is:—

1. A centralized control system for internal combustion engines including a starting system, a fuel intake system, common manual means for causing the engine to be cranked and for enriching the fuel mixture, means for controlling the admission of fuel to the engine, and means

operated by said fuel controlling means for preventing energization of the cranking means.

2. In combination with an internal combustion engine having starting, ignition and fuel intake systems, manual means for enriching the fuel mixture, means operated thereby for selectively controlling the ignition and starting systems, means for controlling the admission of fuel to the engine, and means operated thereby for preventing actuation of the starting mechanism.

3. Controlling means for an internal combustion engine including a carburetor choke valve, a starting system and an ignition system, manual means for controlling said valve, means whereby initial operation of said manual means in a direction to close said valve causes energization of the ignition system, means whereby further operation thereof causes energization of the starting system, a connection whereby still further operation of said member controls the position of the choke valve, and means responsive to self-operation of the engine for deenergizing the starting system.

4. In combination with an internal combustion engine including a fuel intake system and a throttle valve for controlling the admission of fuel, a starting system for the engine, manual means for controlling said starting system, manual controlling means for said throttle, and means actuated by operation of said throttle control in a direction to open the throttle for preventing actuation of the starting mechanism.

5. In combination with an internal combustion engine including a fuel intake system and a throttle valve for controlling the admission of fuel, a starting system for the engine, manual means for controlling said starting system, means responsive to intake vacuum for preventing the actuation of the starting mechanism, manual control means for said throttle, and means actuated by operation of said throttle control in a direction to open the throttle for preventing actuation of the starting mechanism.

6. In combination with an internal combustion engine including a fuel intake system and a throttle valve for controlling the admission of fuel, an electrical starting system for the engine, a control circuit for said starting system, manual means for closing said control circuit, means responsive to intake vacuum for opening said control circuit, manual controlling means for said throttle, and means for opening said control circuit actuated by operation of the throttle control in a direction to open the throttle.

7. Controlling means for an internal combustion engine including a carburetor choke valve, a starting system and an ignition system, manual means for controlling said valve, means whereby initial operation of said manual means in a direction to close said valve causes energization of the ignition system, means whereby further operation thereof causes energization of the starting system and ignition system, means whereby still further operation of said member closes said choke valve, and means responsive to self-operation of the engine for deenergizing the starting system.

8. In combination with an internal combustion engine including a fuel intake system and a throttle valve for controlling the admission of fuel, a starting system for the engine including a magnetic starting switch, a control circuit for said starting switch, manual controlling means for said throttle valve, and means actuated by operation of said throttle control in a direction to open the throttle for breaking said control circuit.

9. In combination with an internal combustion engine including a fuel intake system and a throttle valve for controlling the admission of fuel, a starting system for the engine including a magnetic starting switch, a control circuit for said starting switch, means responsive to intake vacuum for breaking said control circuit, manual controlling means for said throttle valve, and means actuated by opening movement of the throttle control to prevent closure of the control circuit.

10. In an automatic controller for internal combustion engine starters, the combination with a throttle control mechanism, of a starting motor, a normally broken starting motor circuit, an electro-magnetic switch for closing the starting motor circuit and including a coil, an energizing circuit for said coil, and means actuated by the throttle control mechanism for disabling said energizing circuit upon opening of the throttle.

11. In an automatic controller for internal combustion engine starters, the combination with a throttle control mechanism, of a starting motor, a normally broken starting motor circuit, an electro-magnetic switch for closing the starting motor circuit and including a coil, an energizing circuit for said coil, and means for maintaining said energizing circuit open during slow engine speeds under heavily loaded conditions, said means being adapted to be actuated by said throttle control mechanism upon opening of the throttle.

12. In an automatic controller for internal combustion engine starters, the combination with a throttle control mechanism, of a starting motor, a normally broken starting motor circuit, an electro-magnetic switch for closing the starting motor circuit and including a coil, an energizing circuit for said coil, means actuated in accordance with engine conditions for making and breaking said energizing circuit, and additional means including a switch for breaking said energizing circuit during slow engine speeds under heavily loaded conditions, said last named switch being adapted to be opened by said throttle control mechanism upon opening of the throttle.

13. In an automatic controller for internal combustion engine starters, the combination with a throttle control mechanism, of a starting motor, a normally broken starting motor circuit, an electro-magnetic switch for closing the starting motor circuit and including a coil, an energizing circuit for said coil, means for breaking said energizing circuit when the engine starts rotating, and a switch for breaking said energizing circuit in the event said means close said energizing circuit while the engine is running, said last named switch being adapted to be opened by said throttle control mechanism upon opening of the throttle.

14. In an automatic controller for internal combustion engine starters, the combination with a throttle control mechanism, of a starting motor, a normally broken starting motor circuit, an electro-magnetic switch for closing the starting motor circuit and including a coil, an energizing circuit for said coil, means for maintaining said energizing circuit closed for engine throttle positions from the closed to substantially half open position and for breaking said energizing circuit for engine throttle positions from substantially the half open to the wide open position.

15. In an automatic controller for internal

combustion engine starters, the combination with a throttle control mechanism, of a starting motor, a normally broken starting motor circuit, an electro-magnetic switch for closing the starting motor circuit and including a coil, an energizing circuit for said coil, means actuated in accordance with engine conditions for making and breaking said energizing circuit, and additional energizing circuit interrupting means controlled by the engine throttle position adapted to be normally closed for starting conditions and open for open throttle positions greater than substantially the half open throttle.

16. In an automatic controller for internal combustion engine starters, the combination with a throttle control mechanism, of a starting motor, a normally broken starting motor circuit, an electro-magnetic switch for closing the starting motor circuit including a coil, an energizing circuit for said coil, means for breaking said energizing circuit when a substantial vacuum exists in the intake manifold of the engine, and additional means actuated by said throttle control mechanism for breaking said energizing circuit when the engine is running and insufficient vacuum exists in the engine manifold to actuate said first named means.

17. In an automatic controller for internal combustion engine starters, the combination with a throttle control mechanism, of a starting motor, a normally broken starting motor circuit, an electro-magnetic switch for closing the starting motor circuit including a coil, an energizing circuit for said coil, a normally closed relay actuated by vacuum in the intake manifold of the engine for opening said energizing circuit, and a switch actuated by said throttle control mechanism for opening said energizing circuit when the engine is running and insufficient vacuum exists in the intake manifold of the engine to actuate said relay.

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