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CONTROL MEANS FOR DIESEL ENGINES

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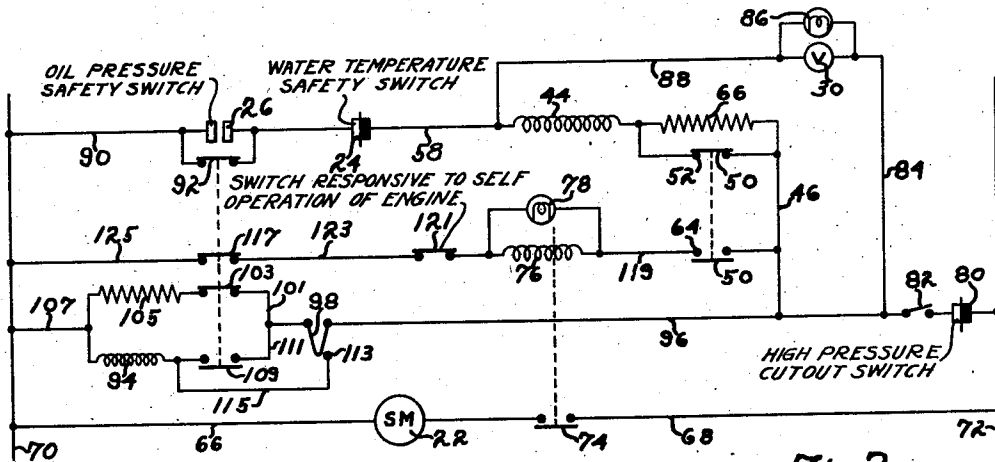


Fig. 2

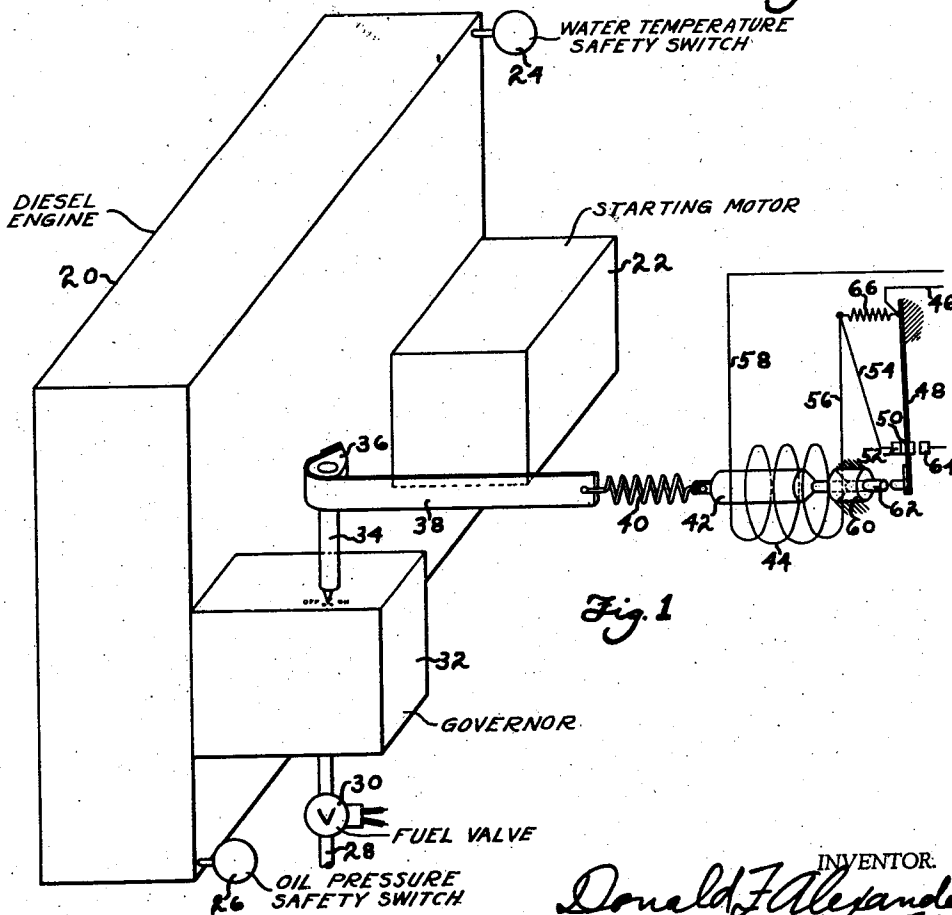


Fig. 1

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CONTROL MEANS FOR DIESEL ENGINES

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8 Claims. (Cl. 123—179)

This invention relates particularly to automatic controls for Diesel and other internal combustion engines used to operate refrigeration systems and kindred apparatus.

Since Diesel engines have no ignition system it is not possible to control them in the manner of ordinary gasoline engines.

It is an object of my invention to provide a system for automatic starting and controlling the operation of Diesel engines.

It is another object of my invention to provide electrical means for preventing operation of the engine upon failure of lubrication and yet permit starting.

It is another object of my invention to provide an electromagnetic control of the governor of a Diesel engine to control the starting and stopping of the engine from a position remote from the engine.

It is another object of my invention to provide a timing device for disabling the cranking means and for rendering operative the oil pressure safety control at the completion of the starting period of the engine.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of the present invention is clearly shown.

In the drawing:

Fig. 1 is a diagrammatic view of a Diesel engine provided with an automatic control system embodying my invention; and

Fig. 2 is a wiring diagram of the system shown in Fig. 1.

Referring now to the drawing and more particularly to Fig. 1, there is shown a Diesel engine 20 provided with an electric starting motor 22 for cranking the engine. This starting motor 22 may be connected to the Diesel engine 20 by some suitable drive such as an Eclipse-Bendix or a Dyer drive. The engine is provided with a water temperature safety switch 24 for stopping the engine in case the water temperature should become too high and it is also provided with an oil pressure safety switch 26 for stopping the engine if the lubricant pressure is not maintained. A fuel line 28 provided with an electromagnetic fuel valve 30 controls the supply of Diesel fuel oil to the governor 32 which in turn controls the amount of fuel injected into the cylinders.

The governor 32 is provided with a control rod 34 which renders the governor operative to supply fuel to the engine or inoperative in order to shut off the fuel supply for stopping the en-

gine. A pointer operated by the rod 34 cooperates with the legends "off" and "on" to indicate the inoperative and the operative positions of the control rod 34.

When the engine is to be started it is necessary for the rod 34 to be moved to the "on" position and when the engine is to be stopped it is necessary to move the rod 34 to the "off" position. The rod 34 is provided with a spring which normally holds it in the "off" position (not shown). To move the rod 34 to the "on" position when the engine is started, I provide a solenoid operating means acting upon the rod 34. For this purpose the rod 34 is provided with a drum 36 to which is clamped one end of a thin resilient metal strip 38 which is wrapped around the drum and has its free end connected to a spring 40 which in turn connects to the operating plunger 42. This operating plunger 42 operates within an electromagnet coil 44 which, when energized, attracts the operating plunger 42 to pull the spring 40 and the strip 38 to turn the rod 34 to the "on" position.

For this initial attraction the electromagnet 44 is supplied with current through the conductor 46, the spring contact strip 48, the movable contacts 50, the stationary contact 52, the conductor 54 and the conductor 56 to the coil 44 which in turn is connected to a conductor 58. The operating plunger 42 is provided with a pin 62 extending through a fixed pole piece 60, for moving the contact strip 48 so that the movable contact 50 is moved out of engagement with the contact 52 and into engagement with the contact 54 upon the completion of movement of the plunger. This causes the electromagnet coil 44 to be supplied with current through the conductor 46, the resistance 66, the conductor 56 to the coil 44 which in turn is connected to the conductor 58. The resistance 66 reduces the amount of current flowing through the coil 44 to an amount which is sufficient to hold the operating plunger 42 in the operating position without overheating the coil 44. Inasmuch as the operating plunger 42 must be attracted as long as the engine 20 is in operation it is obvious that it is desirable to keep the amount of current required as low as possible.

Referring now to Fig. 2, the starting motor 22 is shown connected by the conductors 66 and 68 to the supply conductors 70 and 72 from some suitable source of electric energy such as a suitably regulated battery circuit. The starting motor 22 is controlled by a switch 74 which is moved to closed position by an electromagnet 76. An

indicating light 78 is connected in parallel with the electromagnet 76 to indicate the energization of the starting motor 22. The starting system is controlled by the switches 80 and 82 which are connected in series with each other. When the engine is used to drive the refrigerating system the switch 80 is preferably a normally closed high pressure cutout switch which is responsive to condensing pressure. The switch 82 may be either manually, automatically or thermostatically controlled. Normally, the switch 82 controls the starting and stopping of the system while the switch 80 is used as a safety switch.

Connected to the switch 82 is a conductor 84 which connects to the electromagnetic fuel valve 30 which passes fuel only when energized and to an indicating light 86 connected in parallel with it to indicate whenever the fuel valve is in the open position. The fuel valve 30 is connected by a conductor 88 to the conductor 56 which in turn connects to the normally closed water thermostat switch 24 and to the oil pressure safety switch 26 connected by the conductor 90 to the supply conductor 70.

The switch 82 also controls the electromagnet coil 44 which moves the governor to operative position. The switch contacts 50 are normally in engagement with the contacts 52 upon the closing of the switch 82, but after the plunger 42 is attracted and moves to its final position, the switch contacts 50 move out of engagement with the contact 52 and into engagement with the contact 64, as previously explained in connection with Fig. 1, in order to allow current to flow through the conductors 96 and 46 as well as through the conductor 119 to the electromagnetic coil 76 for closing the starting motor switch 74. A switch 121 is also connected in series with the electromagnetic coil 76 and may be operated by the engine to deenergize the coil 76 when the engine approaches normal running speed. This switch 121 may be a centrifugal or speed responsive switch operated by the speed of the engine or it may be operated by lubricant pressure or some other means which indicates that the engine is in operation. The switch 117 is connected in series with the switch 121 through the conductor 123 and in turn connects through the conductor 125 to the supply conductor 70.

The bimetal timer 98, the electromagnet 94 controlled by the bimetal timer 98, the switches 92, 117, 103 and 109 operated by the electromagnet 94, together with the conductors 101, 111 and 115 and the contact 113 constitute a timing means which performs the timing functions required for controlling the operation of the engine and its starting system.

A switch 92 is connected in shunt with the contact of the switch 26 to complete the circuit through switch 24 during the starting period, before the lubricating oil pressure can be built up sufficiently to close the contacts 26. This switch 92, like the switches 117, 103 and 109, is operated by an electromagnet coil 94 which is under the control of the switches 80 and 82 and a bimetal timing device 98, connected to the conductor 96. This timing device 98, initially, is connected through a conductor 101 to the switch contacts 103 which in turn connect to a resistance 105 connected by the conductor 107 to the supply conductor 70. When the switch 82 is open, the contacts 92, 103 and 117 are in the closed position while in the open position are the contacts 109 which control the connection through the conductor 111 with the solenoid coil 94.

When current has passed through the bimetal timer 98 for a predetermined time it will move into engagement with the contact 113 which is connected by a conductor 115 with the electromagnet 94. This will energize the electromagnet 94 and cause it to close the switch 109, thereby maintaining a current flow through the electromagnet 94. Simultaneously the energization of the magnet 94 will open the switch 103, 92 and 117. This will render effective the lubricant pressure switch 26, since at the end of such a period the lubricating pressure should be sufficient to close the contacts 26 and provide ample lubrication. If the switch 121 has not been opened by the operation of the engine, the opening of switch 117 will deenergize the solenoid 76 which in turn will allow the opening of the switch 74 to deenergize the starting motor 22 to prevent damage to the starting motor windings and to prevent excess battery discharge from continued cranking.

In this diagram, all the switches are shown in the positions which they assume when the system is deenergized and the engine is idle. To start the system the switch 82 is closed thus energizing the fuel valve 30, to open the supply of fuel to the governor 32, and energizing the coil 44, to make the governor operative to admit fuel oil into the engine. As soon as the governor has been moved to operative position, the contact 50 makes engagement with the contact 64 to energize the solenoid 76 in order to close the starting motor switch 74 to cause the starting motor 22 to crank the engine. The cranking continues normally until the switch 121 opens to stop the cranking after the engine is started. However, in case the engine fails to start for any reason whatsoever, the timer 98 will engage contact 113 to energize the coil 94 which opens the switch 117 to deenergize the coil 76 thereby deenergizing the starting motor 22. In fact, the timer will operate even if the engine starts properly in order to open the switch 92 to render the oil pressure safety control 26 operative. When it is desired to stop the system, the switch 82 is opened thereby deenergizing the coil 44 to stop the flow of fuel to the engine. The coil 94 is also deenergized at the same time.

Thus, by this system, I have provided a simple dependable electrical control for automatically controlling the starting and operation of a Diesel or other internal combustion engine. I have also provided an electrical oil pressure control applicable to any type of engine.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A starting system for an internal combustion engine including a governing means provided with a control device having an operative position for controlling the normal operation of the engine and an inoperative position for stopping the operation of the engine, electrically operated means for moving the control device to operative position when energized and to inoperative position when deenergized, an oil pressure control for deenergizing said electrically operated means upon failure of oil pressure, and means for preventing the oil pressure control from cutting off the fuel supply during the starting period of the engine.
2. A starting system for an internal combustion engine including a governing means provided with a control device having an operative position for controlling the normal operation of the engine and an inoperative position for stopping the operation of the engine, electrically operated means for moving the control device to operative position when energized and to inoperative position when deenergized, an oil pressure control for deenergizing said electrically operated means upon failure of oil pressure, and means for preventing the oil pressure control from cutting off the fuel supply during the starting period of the engine.

tion engine including a governing means provided with a control device having an operative position for controlling the normal operation of the engine and an inoperative position for stopping the operation of the engine, electrically operated means for moving the control device to operative and inoperative positions, an oil pressure control for moving the control device to inoperative position, and means for preventing the oil pressure control from cutting off the fuel supply during the starting period of the engine.

3. A starting system for an internal combustion engine including a fuel controlling device having an operative and an inoperative position, an oil pressure control, means controlled by said oil pressure control for moving said device to inoperative position upon failure of oil pressure, means for cranking the engine, means for preventing the oil pressure control from interfering with starting of the engine, and a timing device for disabling the cranking means.

4. In combination, a compression ignition engine and a starting system for the engine including a governing means controlling the fuel supply for regulating the speed of the engine, said governing means having a control device provided with an operative position for regulating the normal operation of the engine and an inoperative position for cutting off the flow of fuel to the engine, electrically operated means connected to said control device for moving the control device to operative and inoperative positions, and means rendered effective by the operation of the electrically operated means when energized for reducing the electric current flow through the electrically operated means.

5. In combination, a compression ignition engine and a starting system for the engine including a governing means controlling the fuel supply for regulating the speed of the engine, said governing means having a control device provided with an operative position for regulating the normal operation of the engine and an inoperative position for cutting off the flow of fuel to the engine, electrically operated means connected to said control device for moving the control device to operative and inoperative positions, an oil pressure safety switch connected in series circuit relationship with said electrically operated means, a shunt for said safety switch, and a timing device for opening said shunt.

6. In combination, a compression ignition engine and a starting system for the engine including a governing means controlling the fuel supply for regulating the speed of the engine, said governing means having a control device provided with an operative position for regulating

the normal operation of the engine and an inoperative position for cutting off the flow of fuel to the engine, electrically operated means connected to said control device for moving the control device to operative and inoperative positions, a starting motor for cranking the engine, a second electrically operated means for energizing the starting motor, and means responsive to the operation of the control device to the operative position for energizing said second electrically operated means.

7. In combination, a compression ignition engine and a starting system for the engine including a governing means controlling the fuel supply for regulating the speed of the engine, said governing means having a control device provided with an operative position for regulating the normal operation of the engine and an inoperative position for cutting off the flow of fuel to the engine, electrically operated means connected to said control device for moving the control device to operative and inoperative positions, a starting motor for cranking the engine, a second electrically operated means for energizing the starting motor, means responsive to the operation of the control device to the operative position for energizing said second electrically operated means, and means responsive to the speed of the engine for deenergizing said second electrically operated means.

8. In combination, a compression ignition engine and a starting system for the engine including a governing means controlling the fuel supply for regulating the speed of the engine, said governing means having a control device provided with an operative position for regulating the normal operation of the engine and an inoperative position for cutting off the flow of fuel to the engine, electrically operated means connected to said control device for moving the control device to operative and inoperative positions, a starting motor for cranking the engine, a second electrically operated means for energizing the starting motor, means responsive to the operation of the control device to the operative position for energizing said second electrically operated means, means responsive to the speed of the engine for deenergizing said second electrically operated means, an oil pressure safety switch for deenergizing said first electrically operated means, a shunt for said safety switch, and a timing device having means for opening said shunt and for deenergizing said second electrically operated means at the end of a predetermined period of time.

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