July 19, 1960 H. O. SCHERENBERG ET AL 2,945,484

MIXTURE VARYING MEANS FOR INTERNAL COMBUSTION ENGINES

Filed June 11, 1956

Fig. 2

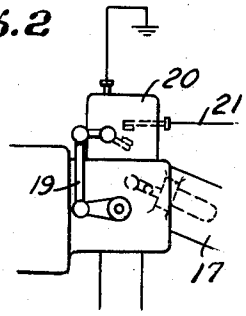


Fig. 3

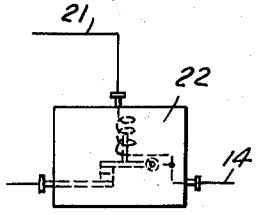
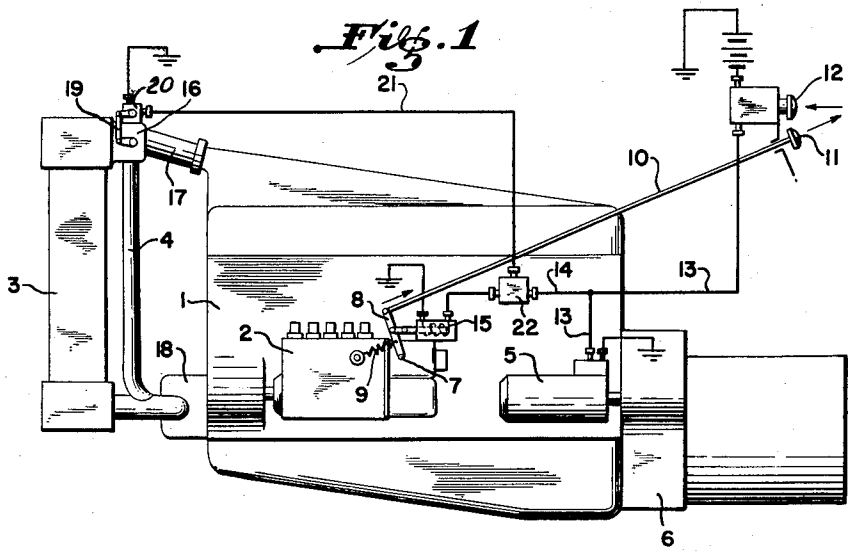


Fig. 1



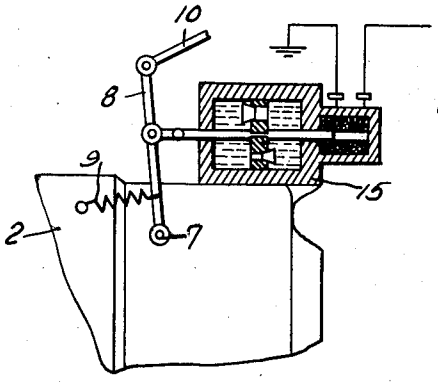


Fig. 4

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United States Patent Office 2,945,484 Patented July 19, 1960

2,945,484

MIXTURE VARYING MEANS FOR INTERNAL COMBUSTION ENGINES

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Filed June 11, 1956, Ser. No. 590,765

Claims priority, application Germany June 18, 1955

10 Claims. (Cl. 123—179)

This invention relates to mixture varying means for internal combustion engines and has for an object to provide, in the case of such engines having a starting motor, means operated as an incident to the operation of the starting motor for enriching the fuel mixture.

Another object is to provide, in the case of such engines having an electric starting motor, electro-magnetic means energized as an incident to the operation of the starting motor for enriching the fuel mixture.

Another object is to provide in connection with an internal combustion engine of the fuel injection type having a fuel injection pump with volume control and having a starting motor, means operating during the operation of the starting motor for operating the volume control means of said pump to deliver a larger quantity of fuel per work cycle.

Another object is to provide means for extending the period of mixture enrichment somewhat beyond the period of starter operation as by providing a time delay mechanism to delay the return to the normal mixture.

Another object is to provide such means together with mechanism controlled by engine temperature for disabling the mixture enriching means during the operation of the starter.

Another object is to provide manual means independent of the starter for enriching the mixture.

Another object is to provide such means in an internal combustion engine having a fluid circuit including a radiator or heat transfer means together with a thermostat for controlling the fluid flow in which the movement of the thermostat is utilized also to disable the connection of the starter motor with the mixture regulating mechanism.

These and other objects, features and advantages of the present invention will become more obvious from the following description of the mixture-varying means in accordance with the present invention when taken in connection with the accompanying drawing which shows, for purposes of illustration only, one preferred embodiment and wherein

Figure 1 is a side elevation of the engine showing the arrangement of the element for varying the mixture;

Figure 2 is a detailed view of the thermostatic control arrangement according to the present invention;

Figure 3 is a detailed view of the relay switch; and

Figure 4 is a cross-sectional view of a time delay device in accordance with the present invention.

Referring now more particularly to the drawing wherein the numeral 1 indicates the motor block of an internal combustion engine, for example of the fuel injection type having a fuel injection pump 2 of usual construction. There is also provided a radiator or heat exchanger 3 with which is shown associated a cooling water short circuiting conduit 4. Numeral 5 indicates a starter motor such as, but not necessarily, an electric motor which is connected or connectible by usual means to the usual ring gear of the engine fly wheel located within the housing

6. The fuel injection pump 2 is provided with a shaft 7 connected in the usual manner with the fuel volume control means within the pump. In the form shown, clockwise rotation of shaft 7 serves to increase the volume of fluid delivered per working cycle and therefore enriches the fuel mixture. Shaft 7 carries a lever 8 to which is attached spring 9 serving normally to hold lever 8 and shaft 7 in the position shown. Numeral 10 designates a connection from the lever 8 to the pull knob 11 for manually enriching the mixture at will.

Numeral 12 designates the knob of a starter switch which directly or through a relay closes an electric circuit to the starter motor 5. Said circuit includes the conductor 13. Energy is supplied by a battery of usual type. Said electric circuit is also connected through conductor 14 with an electro-magnetic device such as a solenoid in housing 15 having an armature linked to the lever 8. Therefore when the starting switch is closed, the starter motor 5 rotates to start the engine and the solenoid in housing 15 draws the lever 8 and connected shaft 7 clockwise to increase the fuel delivery volume or otherwise enrich the fuel mixture. When the starting switch is opened, the motor 5 is stopped, the solenoid de-energized and the lever 8 moves back to its normal leftward position under the action of the spring 9. If desired, this return movement may be delayed through a time delay mechanism such as a dashpot preferably of the hydraulic type located in the housing 15.

When the engine is at a high temperature from previous operation, it may be desirable to prevent the automatic enrichment of the fuel mixture. A thermostat located in the housing 16 and responsive to the temperature of the cooling water is arranged to allow the cooling water delivered through conduit 17 to be returned directly to the pump 18 through the by-pass conduit 4 when the water temperature is low. However, upon the occurrence of a higher cooling water temperature the thermostat closes the by-pass, forcing the cooling water through the radiator 3. This movement of the thermostat is taken advantage of for operating a switch in the housing 20 through the link 19 as shown in Figure 4. The switch 20 is connected electrically by means of a conductor 21 with a disconnect relay switch 22. Therefore when the thermostat through temperature rise is moved sufficiently to cause the cooling water to pass through the radiator 3, the disconnect switch 22 is actuated to break the electrical connection of the conduit 14 with the solenoid in the housing 15. Therefore at higher motor temperatures, the solenoid is not energized upon pressing of the knob 12 of the starting switch.

It will be noted that the construction shown and described will serve admirably to accomplish the objects stated above. It is to be understood, however, that the construction disclosed above is intended merely as illustrative of the invention and not as limiting as various modications therein may be made without departing from the invention as defined by a proper interpretation of the claims which follow.

We claim:

1. In an internal combustion engine particularly of the spark-ignition type employing fuel injection, a fuel charge forming means and means for varying the mixture of said fuel charge, a starter motor, control means for operating said starting motor and means controlled by said control means for enriching the fuel charge formed by said charge forming means only as long as said starting motor is operating together with time delay means for retaining said fuel charge forming means in enriched mixture condition momentarily after said starting motor has stopped.

2. In an internal combustion engine particularly of the

spark-ignition type employing fuel injection, a fuel charge forming means and means for varying the quantity of said fuel charge, a starter motor, control means for said starting motor, means controlled by said control means for enriching the fuel charge formed by said charge forming means, and manual means operatively connected with said quantity varying means for manually increasing the fuel charge to the engine to an amount essentially equivalent to that supplied by means of said fuel charge inriching means and independently therefrom only when said last-mentioned means is rendered ineffective.

3. In an internal combustion engine particularly of the spark-ignition type employing fuel injection, a fuel injection pump and means for varying the volume delivered by said pump, a starter motor, control means for said starting motor, means controlled by said control means for increasing the volume of fuel delivered by said pump, and manual means operatively connected with said volume varying means for manually increasing the fuel charge to the engine to an amount essentially equivalent to that supplied by means of said fuel charge enriching means and independently therefrom only when said last-mentioned means is rendered ineffective.

4. In an internal combustion engine, fuel charge forming means and means for varying the mixture of said fuel charge, a starter motor, control means for said starting motor and means controlled by said control means for enriching the fuel charge formed by said charge forming means, together with means responsive to the temperature of the engine for preventing operation of said fuel charge enriching means when the engine reaches a certain temperature.

5. In an internal combustion engine, fuel charge forming means and means for varying the mixture of said fuel charge, a starter motor, control means for said starting motor and means controlled by said control means for enriching the fuel charge formed by said charge forming means, together with cooling means for said engine including a radiator, means for circulating cooling fluid through said engine and radiator and a thermostat for controlling the flow of said fluid and means controlled by said thermostat for preventing the control means for said starter motor from enriching the fuel charge when the engine temperature has risen to a certain point.

6. In an internal combustion engine, particularly of the spark-ignition type employing fuel injection, a fuel charge forming means and means for varying the mixture of said fuel charge, a starter motor, control means for said starting motor, and means controlled by said control means for enriching the fuel charge formed by said charge-forming means, together with means responsive to the temperature of the engine for preventing operation of said fuel charge enriching means when the engine reaches a certain temperature.

7. In an internal combustion engine, particularly of the

spark-ignition type employing fuel injection, a fuel charge forming means and means for varying the mixture of said fuel charge, a starter motor, control means for said starting motor, and means controlled by said control means for enriching the fuel charge formed by said charge-forming means, together with means responsive to the temperature of the engine for preventing operation of said fuel charge enriching means when the engine reaches a certain temperature or during starting with the engine being at a high temperature.

8. An internal combustion engine, particularly of the spark-ignition type employing fuel injection, a fuel injection pump and means for varying the mixture of said fuel charge, a starter motor, control means for said starting motor and means controlled by said control means for enriching the fuel charge formed by said fuel pump, together with means responsive to the temperature of the engine for preventing operation of said fuel charge enriching means when the engine reaches a certain temperature.

9. In an internal combustion engine, particularly of the spark-ignition type employing fuel injection, a fuel charge forming means and means for varying the mixture of said fuel charge, a starter motor, control means for said starting motor and means controlled by said control means for enriching the fuel charge formed by said charge-forming means, together with means responsive to the temperature of the engine for preventing operation of said fuel charge enriching means when the engine reaches a certain temperature, and manual means for at will enriching the fuel charge.

10. An internal combustion engine, particularly of the spark-ignition type employing fuel injection, a fuel injection pump and means for varying the mixture of said fuel charge, a starter motor, control means for said starting motor and means controlled by said control means for enriching the fuel charge formed by said fuel pump, together with means responsive to the temperature of the engine for preventing operation of said fuel charge enriching means when the engine reaches a certain temperature, and manual means for at will increasing the volume of fuel delivered by said fuel pump.

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