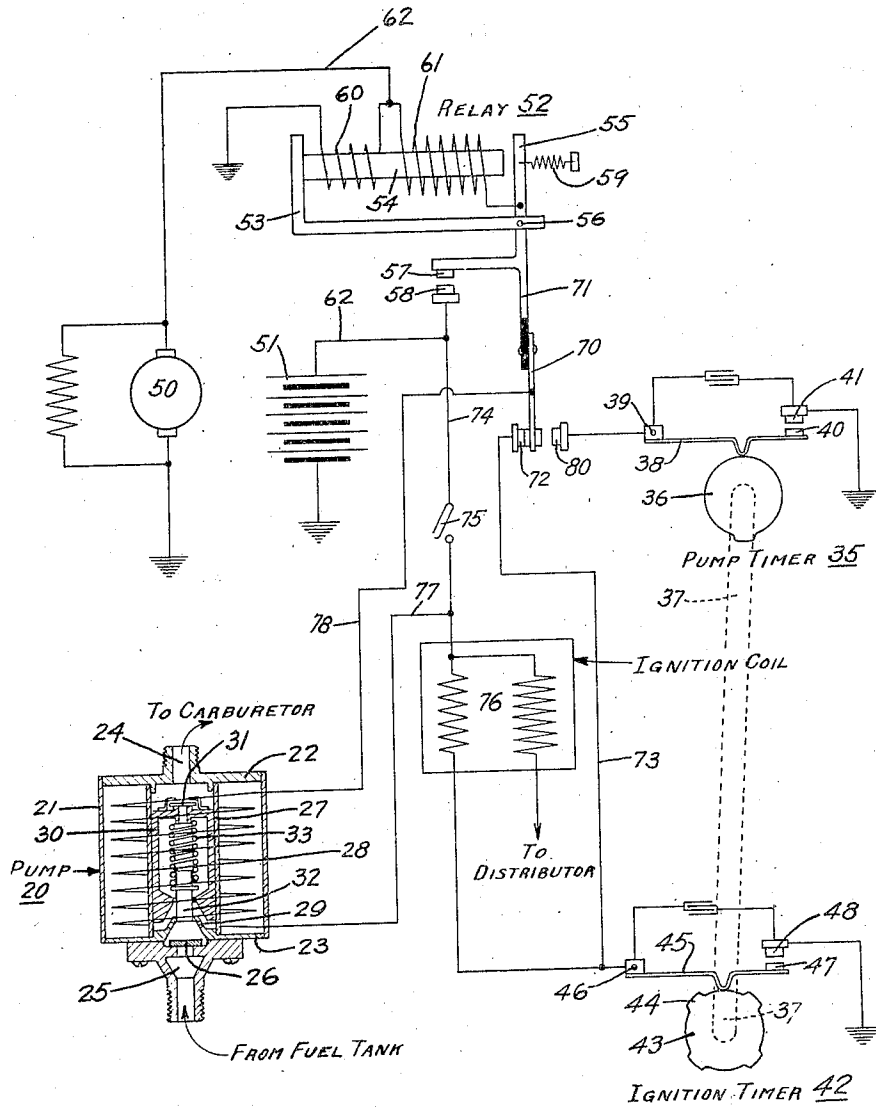


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J. H. HUNT
FUEL SUPPLY SYSTEM
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UNITED STATES PATENT OFFICE.

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FUEL-SUPPLY SYSTEM.

Application filed December 3, 1923. Serial No. 678,127.

To all whom it may concern:

Be it known that I, JOHN H. HUNT, a citizen of the United States of America, residing at Dayton, county of Montgomery, and State of Ohio, have invented certain new and useful Improvements in Fuel-Supply Systems, of which the following is a full, clear, and exact description.

This invention relates to controlling devices for pumps and more specifically to devices for controlling the operation of pumps for supplying fuel to internal combustion engines.

It is among the objects of the present invention to control the operation of the fuel supply device for internal combustion engines so that said devices will be operated to provide a sufficient amount of fuel at both high and low engine speeds.

This object is accomplished in the present invention by controlling the operation of the fuel pump by means of the circuit controlling relay which assumes one position when the engine is operating at slow speeds and another position when the engine is operating at high speeds. Means are associated with this circuit controlling relay for changing the ratio of the frequency of pump operation to engine speeds, so that at slow engine speeds the ratio between the pump and engine operations will be increased and the ratio between the pump and engine operations will be decreased when the engine is running at a predetermined higher speed.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing the single figure of which shows a preferred embodiment of one form of the present invention.

Referring to the drawing which diagrammatically illustrates the various elements of the device and their respective electrical connections, the numeral 20 designates the electric fuel pump comprising a casing 21 and end covers 22 and 23. The upper end cover 22 has a channel 24 which is in communication with the inside of the pump and the carburetor not shown. The lower end cover 23 has a projection mounted or formed integral therewith, said projection being provided with an internal passage 25 which is also in communication with the interior of the pump and with the main fuel tank not

shown on the drawing. A check valve 26 is provided in the passage 25, said check valve being operable to permit fuel to flow from the main fuel tank through the passage 25 into the pump but will prevent fuel flowing from the pump back into the tank. A cylinder 27 is interposed between both ends 22 and 23 inside the casing 21. A portion of the bottom end cover 23 projects up into the cylinder 27 and forms what may be termed the stationary core of the magnet winding 28 which surrounds the cylinder 27. Holes 29 are provided in this core which provide communication between the chamber above the check valve 26 and the inside of the cylinder 27. The piston 30 slidably positioned in the cylinder 27 has a check valve 31 at its upper end, said check valve controlling communication between the space in the cylinder above the piston and the interior hollowed out portion of the piston. Interposed between the piston and a projection 32 formed on the bottom cover 23 there is a spring 33 which normally tends to hold the piston in its upper position in the cylinder. However, when the coil 28 is energized by permitting current to flow therethrough, the core portion of the cover 23 will become energized and attract the piston, moving it downwardly in the cylinder against the affect of the spring 33. Upon the upward movement of the piston by means of the spring 33, the check valve 31 will be forced down against its seat and the check valve 26 will be lifted thereby permitting fuel to flow from the fuel tank through the passage 25, past the check valve 26, through openings 29 into the hollowed out portion of the piston, tending to fill this portion of the piston. On its downward travel by magnetic attraction, the piston will cause pressure to be exerted upon the valve 26, closing the same, this pressure causing the valve 31 to be operated, thereby permitting fuel inside the piston to flow past the valve 31 into the space above the piston and within the cylinder 27, through the passage way 24 to the carburetor.

The engine driven circuit controlling means for causing the pump to be operated includes the pump timer which is adapted to operate or cause pulsations of the pump at a certain ratio relative to a cycle of engine operation and the ignition timer which will

cause the ratio between the pulsations of the pump and a cycle of engine operation to be increased, over those caused by the pump timer.

5 The pump timer designated by the numeral 35 comprises a single lobe cam 36 mounted on and driven by the shaft 37 shown in dotted lines. This shaft may be connected and driven by the engine in any
10 suitable manner. A contact arm 38 fulcrumed at the point 39 carries a contact 40, said contact being adapted to be moved into engagement with a stationary contact 41, once during each revolution of the cam 36.

15 The ignition timer designated by the numeral 42 comprises a cam 43 provided with a plurality of lobes 44. This cam is also mounted on and driven by the engine driven shaft 37. A contact arm 45 fulcrumed at the point 46 carries a contact member 47 which is adapted to be moved into engagement
20 with the stationary contact 48 four times during one revolution of the cam 43. It may be stated here that the lobes on the cam 43 will vary directly with the number of cylinders of the engine, so that in six-cylinder engines, six lobes will be provided, eight-cylinder engines, eight lobes and etc.

25 The engine has a generator 50 connected thereto which is adapted to charge the storage battery 51 when the generator is being driven by the engine at a sufficient rate of speed to cause a current output therefrom.

30 The means responsive to the generator output to change the ratio between the cycles of pump and engine operation includes a relay 52 which comprises a frame 53 supporting a core 54. An armature 55 is also supported by the frame 53 fulcrumed at the point 56. One end of the armature is adjacent to the free end of the core 54 while the other end of the armature carries a contact
35 element 57 adapted to engage with the stationary contact 58. A spring 59 tends to hold the armature in its normal position away from the end of the core 54. Two windings 60 and 61 are associated with the core 54, these windings having a common connection to the wire 62, the winding 60, however, being grounded while the winding 61 is connected with the armature 65 in any
40 suitable manner. The function of this relay is to connect the storage battery 51 when the generator is driven at a sufficient speed to provide a current output for charging the battery. After arriving at this predetermined speed, or more specifically, when the output of the generator reaches a predetermined value, current will first flow
45 from the generator, through the wire 62, winding 60, back to the generator via the ground connections. This will cause the core 54 to become energized and attract the armature 55 against the effect of the spring 59
50 to hold it in normal position, thus move-

ment of the armature 55 toward the core 54 will cause the contact 57 to engage with the contact 58. Now current will flow from the generator through the wire 62, coil 61, to armature 55, thence across the contacts 57 and 58, through the wire 62 to the battery 51 and back to the generator via the ground connections. Current flowing through the coil 61 will cause said coil to so energize the core 54 so that the armature 55 will be held
55 in this contact closing position as long as the generator is providing a sufficient amount of current to build up magnetism in the core 54 to overcome the effect of the spring 59.

60 The means responsive to the output of the generator, or more specifically, the relay includes means to change the ratio between the cycles of pump and engine operation so that when the generator output is of a sufficient value to charge the battery, the circuit operating the pump will be controlled by the regular pump timer. However, when the output of the generator is not sufficient to charge the battery, or more specifically, when the current output of the generator is insufficient to hold the relay in contact
65 closing position, the pump circuit is controlled by the ignition timer.

70 This aforementioned means comprises a common contact arm 70 secured to a projection 71 formed on the armature. The contact arm 70, however, is insulated from said armature.

75 When the generator output is insufficient to charge the battery, the relay armature will assume a position as is shown on the drawing. Here the contact arm 70 is in engagement with the stationary contact 72 which in turn is connected with the contact arm 45 of the ignition timer by means of a wire 73. Thus it will be seen that while the engine is driving the generator at a speed where the output of the generator is sufficient to charge the battery, the pump operating circuit will be as follows: from the battery 51, through the wire 62, through wire 74, across the regular ignition switch 75, which closes the circuit between the source of electrical energy and the ignition coil 76. After having passed through the switch 75, current will flow through wire 77, through the pump operating coil or winding 28, wire 78, to the common contact arm 70, thence through contact 72, wire 73, contact arm 45 of the ignition timer, across the contacts 47 and 48, back to the battery via the ground connections. It will be seen that when these connections to the pump are made, four distinct pulsations of the pump will be obtained for each revolution of the engine driven shaft 37, upon which the ignition timer cam 43 is mounted. Thus the ratio between the pump pulsations and the operation of the engine driven shaft 37 will
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be four to one in the present embodiment of the invention.

Assuming that the speed of the engine has increased and that the generator 50 is being driven at a sufficient speed to cause the relay to connect the generator with the battery, the operation of the relay to complete this connection will have shifted the common contact arm 70 out of engagement with the stationary contact 72 and into engagement with the stationary contact 80. The pump circuit will be completed through the following path: from the contact 58 through which the charging current to the battery is now flowing current will flow through the wire 74, across the ignition switch 75, through wire 77, pump controlling winding 28, wire 78 to the one contact arm 70, through contact 80 to the contact arm 38 of the pump timer 35, across contacts 40 and 41 back to the generator via the ground connections. From this it may be seen that upon each revolution of the engine driven shaft 37, the contacts 40 and 41 will be engaged and broken once so that one pulsation will be given the pump for each single revolution of the engine driven shaft 37.

Thus the relay 52 while being operated to either close or open the circuit between the generator and the storage battery by a predetermined high or low generator current output respectively, will automatically bring into effect either the regular pump timer or the ignition timer to decrease or increase the ratio between the pump pulsations and a cycle of engine operation respectively.

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 fuel supply device for an internal-combustion engine comprising in combination, an electromagnet pump; a plurality of means for causing the pump to be energized intermittently at different frequencies relative to engine operations; and means controlled by the speed of the engine for selecting one of said pump-controlling means.

2. A fuel supply device for an internal-combustion engine comprising in combination, an electromagnet pump; a plurality of means for causing the pump to be energized intermittently at different frequencies relative to engine operations; and engine-controlled means for selecting one of said pump-controlling means.

3. A fuel supply device for a multicylinder internal-combustion engine comprising in combination, an electromagnet fuel pump; engine driven circuit controlling means for causing the pump to be operated; and including interrupters, one of which is operated more frequently than the other

during a complete engine cycle; and means for selectively connecting the interrupters with the pump.

4. A fuel supply device for an internal combustion engine comprising in combination, an engine driven generator; an electric fuel pump; engine driven circuit controlling means for causing the pump to be operated; and means responsive to the output of the generator, adapted to control the circuit connections to the circuit controlling means to change the ratio between the pump pulsations and the cycle of engine operation.

5. A fuel supply device for a multi-cylinder internal combustion engine comprising in combination, an electric fuel pump; engine driven circuit controlling means for causing the pump to be operated, and including interrupters one of which is operated more frequently than the other during an engine cycle; means brought into effect during a predetermined portion of the speed range of the engine, to shift the pump circuit from the more frequently operated interrupter to the less frequently operated one during acceleration and to reverse the shift during deceleration.

6. A fuel supply device for an internal combustion engine comprising in combination, an engine driven generator; an electric fuel pump; engine driven circuit controlling means for causing the pump to be operated and including interrupters one of which is operated more often than the other during an engine cycle; means brought into effect when the output of the generator decreases to a predetermined value to cause the interrupter which operates more often to operate the pump; and means for connecting the pump with the circuit interrupter which operates less frequently per cycle of engine operation when the generator output increases to a predetermined value.

7. A fuel supply device for an internal combustion engine comprising in combination; an electric pump; an engine driven generator; a storage battery; engine driven circuit interrupters, one of which operates more often than the other during an engine cycle; automatic controlling means for connecting the generator with the battery at a predetermined speed of the engine; means associated with said automatic controlling means for substantially simultaneously connecting the pump to the interrupter which operates less frequently, and for connecting the pump with the interrupter which operates more frequently per engine cycle when the said controlling means operates to disconnect the generator from the battery.

8. A fuel supply device for an internal combustion engine pump, an engine driven generator; a storage battery; an electrical relay controlled by the output of the generator for connecting said generator with the

battery when the output of the generator reaches a predetermined value; engine driven timers including make and break devices in one of which the said device is adapted to be operated more frequently per engine revolution than in the other; and means associated with the relay for connecting the pump with the timer that is operated more frequently, when the relay is affected to discontinue the flow of current from the generator to storage battery and adapted to connect the pump with the timer less frequently operated when the relay is affected to close the circuit connections between the generator and storage battery.

9. A fuel supply device for an internal combustion engine provided with an electric generator, comprising in combination, a storage battery; a relay controlled by the generator for connecting said generator with the battery when the output of the generator reaches a predetermined value; an electric fuel pump; an engine driven ignition timer including an interrupter adapted to be operated a predetermined number of times per engine revolution; an engine driven pump timer including a circuit interrupter adapted to be operated less frequently per engine revolution than the ignition interrupter; a relay operated switch for connecting the fuel pump with the ignition timer when the engine is operating at such a slow speed that the generator output will not affect the relay to close the circuit between the generator and the battery, and adapted to connect the fuel pump with the pump

timer when the engine is operating at a sufficiently high speed to cause the generator output to affect the relay to close the circuit between the generator and the battery.

10. A fuel supply device for an internal combustion engine provided with an electric generator; comprising in combination, a storage battery, a generator controlled relay for closing the circuit between the generator and the battery when the output of said generator has reached a predetermined value; an electric fuel pump; ignition and pump circuit interrupters including operating devices mounted on a common engine driven shaft, the ratio of operation between the ignition interrupter and revolutions of said shaft being a predetermined value while the ratio of operation between the pump interrupter and said shaft revolutions is of a lesser value; and a switching device associated with the relay for connecting the fuel pump with the ignition timer when the speed of the engine causes the generator output to reach a predetermined value where said relay will be operated to disconnect the generator from the battery, this switching device also being adapted to connect the pump with the pump timer when the engine drives the generator at a predetermined increased speed where the current output will cause the relay to operate to close circuit connections between the generator and battery.

In testimony whereof I hereto affix my signature.

JOHN H. HUNT.