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FUEL SUPPLY SYSTEM

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Fig. 1.

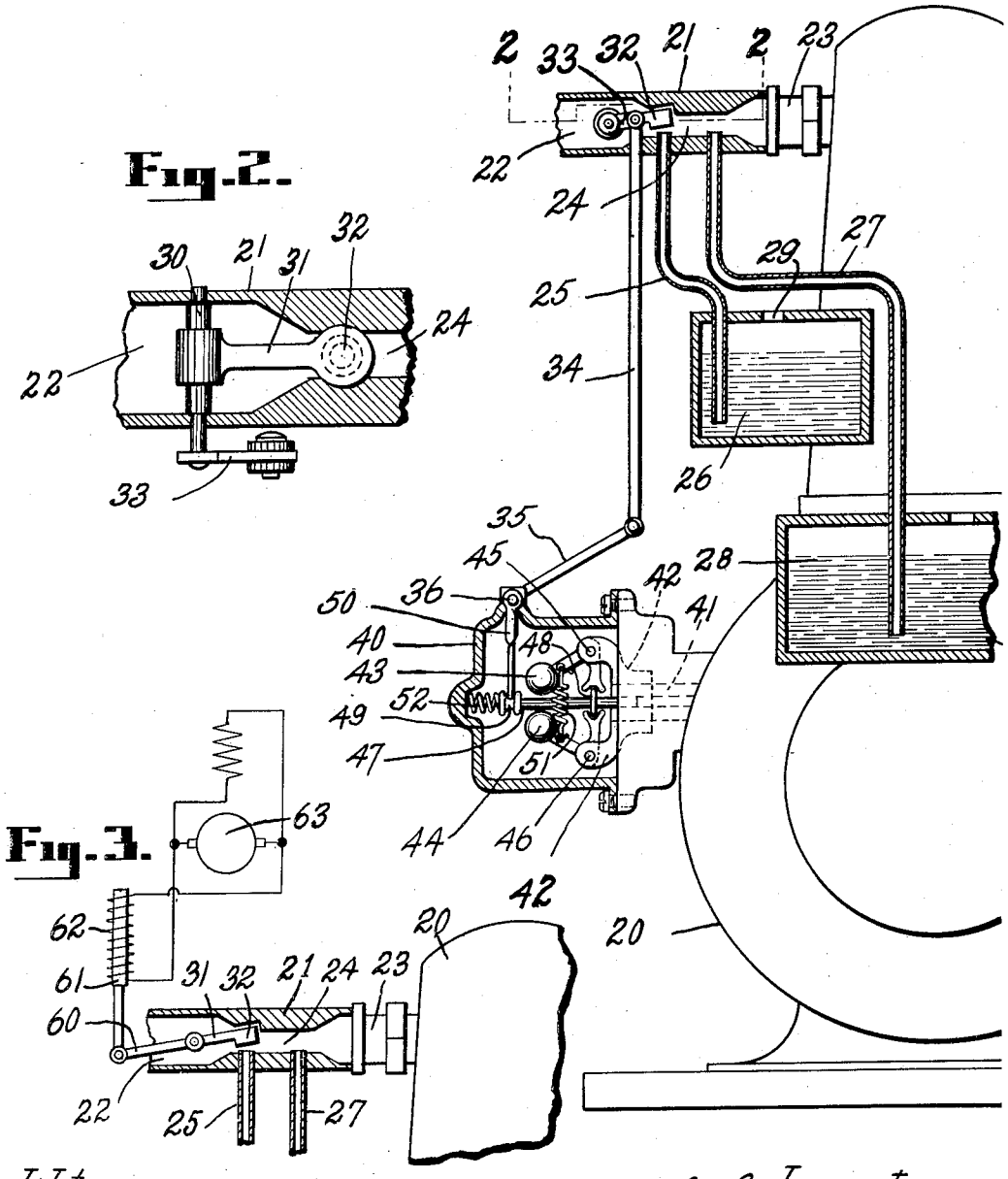


Fig. 2.

Fig. 3.

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FUEL-SUPPLY SYSTEM.

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This invention relates to fuel supply system for internal combustion engines and the like.

One of the objects of the invention is to provide for delivery priming fuel to the engine to facilitate the starting operation, and, after the engine has become self-operative to provide for delivering running fuel to the engine, together with means which will automatically control the delivery of the priming fuel or the running fuel to the engine. It will be understood that the term priming fuel includes any high grade fuel such as high grade gasoline and that the running fuel may be any fuel of lower grade such as kerosene.

It is an object to automatically control the flow of priming or running fuel to the engine according to operating conditions.

More particularly, it is an object to provide means which will operate automatically, if conditions are not correct for the normal operation of the engines on the running fuel, to repeatedly supply priming fuel until engine conditions are correct for operation on running fuel.

Other and further objects of the present invention will be apparent from the following description, reference being made to the accompanying drawings.

In the drawings:

Fig. 1 is an end view of an internal combustion engine provided with the fuel supply system, certain parts of the system being shown in section.

Fig. 2 is a sectional view taken on line 2—2 of Fig. 1 showing also a plan view of the valve mechanism.

Fig. 3 is a fragmentary sectional view of some of the parts shown in Fig. 1, but showing a modified form of the invention.

Referring to the drawings, 20 designates an internal combustion engine provided with a mixing chamber 21 having an open outer end 22, and connected to the engine at the inner end by means of the pipe 23. The mixing chamber 21 is provided with restricted or Venturi passage 24. Communicating with said passage 24 is a fuel supply pipe 25 extending down to a level near the bottom of the fuel tank 26 containing priming fuel. The pipe 27 also extends from Venturi passage 24 downwardly to a level near the bottom of a supply tank 28 containing the running fuel. Within the passage 22 of the mixing chamber 21 is journaled a shaft 30 upon which is fixed an arm 31, the free outer end of which carries a valve 32 positioned within the Venturi passage and adapted to close the upper end of pipe 25. A lever arm 33 is secured upon the outer end of the shaft 30 and is connected by a link 34 to lever arm 35 mounted upon shaft 36 which is journaled upon a casing 40 supported by the engine.

A shaft 41 is mounted for rotation upon the engine and adapted to be driven thereby by gearing not shown. Yoke 42 is mounted for rotation upon shaft 41, and carries centrifugal members 43 and 44 pivotally mounted thereoen at 45 and 46, respectively. A rod 47 is slidably supported by the shaft 41 and is provided with a plain collar 48 and a grooved collar 49. The collar 48 is adapted to cooperate with the forked arms of the centrifugal members 43 and 44, and the collar 49 cooperates with the lever 50 mounted on shaft 36. Spring 51 is connected between centrifugal members 43 and 44 to resist the outward movement thereof. Spring 52 cooperates with the inside of the end wall of casing 40 and the shaft 47 to resist the outward movement of the shaft 47. Said spring 52 cooperates with spring 51 to maintain the centrifugal members 43 and 44 normally in position as shown in Fig. 1.

The operation of the device is as follows:

A quantity of priming fuel such as gasoline is placed in the tank 26 and a quantity of lower grade fuel such as kerosene is placed in tank 28. When the engine is at rest the valve 32 and control mechanism associated therewith is in position as shown in Fig. 1, the engine can then draw up fuel from either tank 26 and 28 by the suction action thereof. The engine is started manually, or by any starting device, not shown. As the piston of the engine is reciprocated air will be drawn into the passage 22 and flow through the Venturi passage 24 into the engine thereby causing the fuel to rise in pipes 25 and 27 by virtue of partial vacuum created in the passage 24. Since the distance through which the fuel must be elevated from tank 26 to the passage 24 is less than the distance to which the fuel must be elevated from tank 28, the priming fuel will be supplied to the engine at the Venturi passage while the running fuel is still maintained at a level below the Venturi passage. After the engine becomes self-operative and

has reached a predetermined speed, the centrifugal members 43 and 44 will overcome the action of springs 51 and 52 and fly outwardly from the rod 47 and cause the outward movement of rod 47 away from the engine. This outward movement will be transmitted to the levers 50 and 35, the link 34, lever 33, arm 31, thereby causing the valve 32 to be pulled down upon the upper end of pipe 25 which serves as a valve seat. When this action occurs the supply of priming fuel will be arrested or cut off and the sucking action of the engine will be confined to the pumping of fuel from the tank 28 up through pipe 27. Then the engine will continue to normal operation on the lower grade of fuel. Should the engine not be in proper condition to operate on the running fuel, as for example, the engine might not be sufficiently warm, the speed of the engine will diminish and valve 32 will open to permit more priming fuel to be delivered to the mixing chamber. Then the engine will speed up again and finally the point will be reached when the running fuel will be delivered. This process will be automatically repeated until conditions are correct for the normal operation of the engine on running fuel.

Referring to Fig. 3 in which a modified form of the invention is disclosed, the valve 32 is operated by a lever arm 60 connected with a solenoid armature 61 cooperating with a solenoid 62 which is connected with a generator 63 driven by the engine by any convenient means not shown. In this manner, instead of being controlled by an intervening mechanical device, such as the centrifugal governor described, the valve 32 is controlled through an intervening electrical device dependent upon the speed developed by the engine.

It will be noted that the tank 26 need not be made very large since the quantity of priming fuel used at the start is small in comparison with the quantity of running fuel used during the usual run of the engine. Therefore it is possible to locate the priming fuel tank 26 at a point close under the mixing chamber. By reason of the location of the tank 26, the distance through which the fuel used at the starting of the engine is to be raised can be made much less than the distance from the mixing chamber to the tank containing the running fuel, which is much larger and can be more advantageously placed at a lower elevation. Thus while the engine is moving comparatively slowly and the degree of vacuum in the Venturi passage 24 is not very great, the sucking force required to bring the priming fuel up to the point of delivery will be correspondingly small. While the sucking action of the engine under these conditions will be sufficient to elevate the priming fuel to the point of delivery in the mixing chamber, said action will not be sufficient to raise the running fuel to that point. This condition does not make it necessary to provide a valve for the upper end of pipe 27 to insure cutting off of running fuel while the priming fuel is being delivered to the engine. But when the engine becomes self-operative and the speed increases to a certain amount the pumping action of the engine will be sufficient to pump fuel from the bottom of the tanks 26 and 28. When this occurs it is necessary to provide some means such as the valve mechanism described for preventing the flow of priming fuel to the mixing chamber.

While I have shown as a means for cutting off the flow of priming fuel a valve located in the Venturi passage, it is to be understood that this valve might be located anywhere in the pipe 25 or might be a valve which would close off the tank 26 from the atmosphere as by closing opening 29.

While I have described a system in which the priming fuel and running fuel tanks are located at different levels below the mixing chamber, if this arrangement were not desirable the tanks could be located above the engine and valves for controlling the passage of fuel through both delivery pipes could be provided and arranged to be actuated by a centrifugal device or other means, such as disclosed in the modified form, depending on the speed developed by the engine.

Where the difference between the specific gravities of the priming fuel and the running fuel is sufficiently great, and the priming fuel is the lighter, the tanks 26 and 28 may be placed on the same level. As the engine starts, the priming fuel, being lighter will first be sucked up by the pumping action of the engine; then after the engine has become self-operative, the suction of the engine will be sufficient to elevate the heavier fuel, and the supply of lighter fuel will be cut off automatically.

By varying the construction of the inlets from the priming fuel pipe 25 and the running fuel pipe 27 into the Venturi passage 24 and the relation of said inlets to the passage, the desired result may be accomplished in a variety of ways, for example, the location of these inlets or nozzles with respect to the Venturi passage may be varied, the shape and size of the inlets may be varied, and the longitudinal configuration of the Venturi passage may be formed in such a way that it will be easier for the engine to draw in the priming fuel into the mixing chamber than the running fuel. All these varieties which may be employed to secure the desired result referred to are well known to those skilled in the art, and one example

is given for the purpose of illustration. In order to make it easier for the priming fuel to reach the engine, than for the running fuel, the inlet of the running fuel pipe 27 into the mixing chamber may be located at a position relatively to the Venturi passage where the suction would be less than the effective suction at the inlet of the priming fuel pipe into the Venturi passage. This location would be at a section of the passage 24 where the diameter is larger than at the section where the pipe 25 enters said passage 24 and at a position more removed from the engine than pipe 25.

While the priming fuel pipe only has been provided with a valve it is apparent that the running fuel pipe could be provided with a valve which would be closed at the start but which would be opened upon the closing of the priming fuel valve.

Where gravity is not relied on to cause the flow of the fuels to the mixing chamber, the provision of valves to shut off the priming fuel pipe and to open the running fuel pipe is not essential to the operation of the present invention. The priming fuel tank may be provided with a limited amount of priming fuel, and instead of cutting off the flow of priming fuel to the engine when the engine has reached a certain speed, this priming fuel may be allowed to flow into the mixing chamber and mix with the running fuel. The engine will then run on a mixture of running and priming fuel until the priming fuel is exhausted when the engine will operate on running fuel alone.

While the form of mechanism herein shown and described constitutes a preferred embodiment of one form of the invention, it is to be understood that other forms might be adopted, and various changes and alterations made in the shape, size, and proportion of the elements therein without departing from the spirit and scope of the invention.

What I claim is as follows.

1. In a fuel supply device, the combination with an engine having a mixing chamber; of a conduit for delivering priming fuel to the engine from a fuel level below the mixing chamber; of a conduit for delivering running fuel to the engine from a fuel level below the mixing chamber; and means responsive to engine speed for arresting the delivery of priming fuel to the engine at a predetermined engine speed, said second-mentioned conduit being open continuously during the operation of the engine.

2. In a fuel supply device, the combination with an engine having an air intake passage; of a conduit passing through the wall of said passage for delivering priming fuel thereto; of a conduit opening into said passage for delivering running fuel thereto; and means in said passage for arresting the delivery of priming fuel through said first-mentioned conduit, said second-mentioned conduit being open continuously during the operation of the engine.

3. In a fuel supply system, the combination with an engine having a mixing chamber including a Venturi passage; a priming fuel tank located below the mixing chamber at a certain level; a running fuel tank located below the level of the priming fuel tank; means for delivering priming fuel to the Venturi passage; means for delivering running fuel to the Venturi passage; and automatic means including a valve located in the Venturi passage and operable at a predetermined speed to close the priming fuel delivery pipe and thereby cutting off the supply of priming fuel while permitting the running fuel to flow to the engine.

4. The combination with the cylinder of an internal-combustion engine having an intake port, of a charge-forming device communicating therewith, comprising a carbureting chamber, a reservoir adapted to contain a supply of running fuel wholly disposed below said carbureting chamber and communicating therewith, a second reservoir adapted to contain a supply of priming fuel wholly disposed below said carbureting chamber and also communicating with said chamber, and means operating with the engine for automatically maintaining open communication between said reservoirs and said carbureting chamber during engine starting and thereafter automatically choking off the supply priming fuel to said carbureting chamber.

In testimony whereof I affix my signature.

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