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FUEL FEEDING DEVICE FOR INTERNAL COMBUSTION ENGINES

Original Filed May 31, 1923

Fig 1.

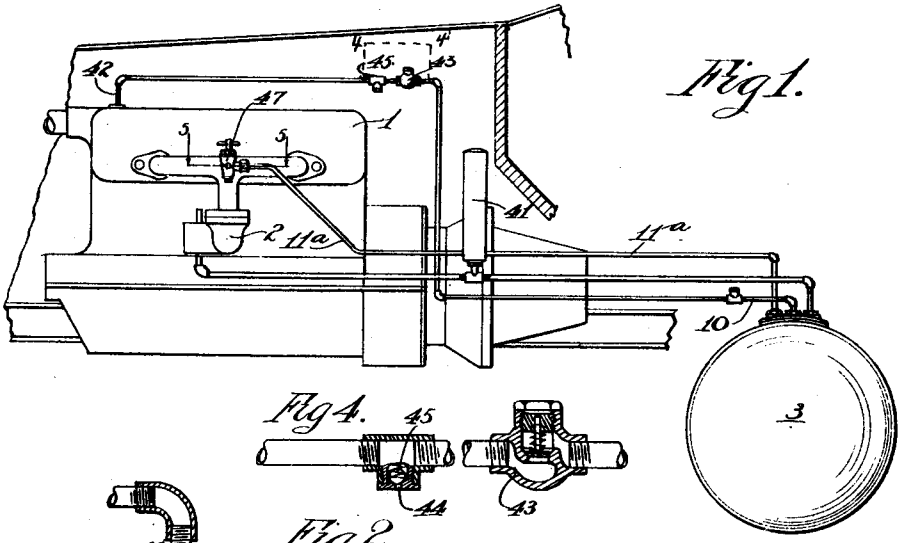



Fig 4.




Fig 2.

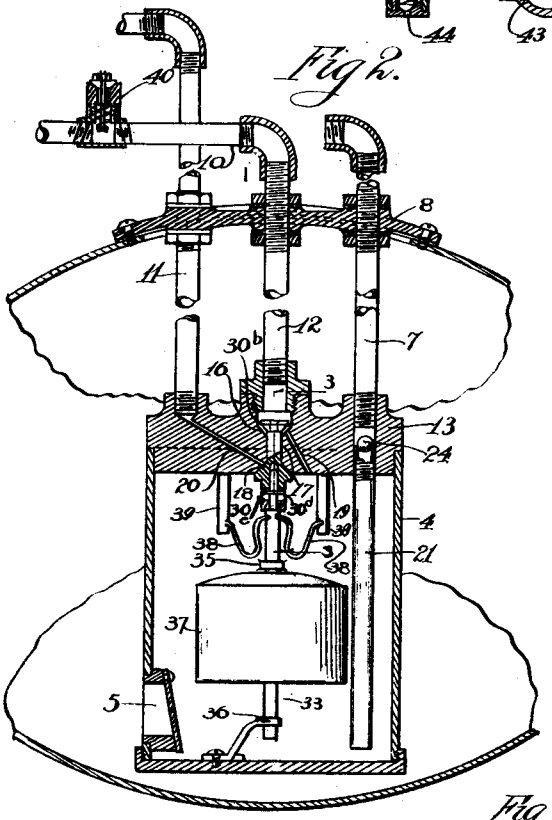



Fig 3.

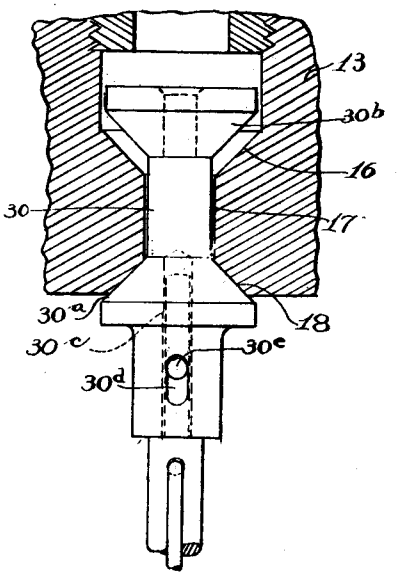



Fig 5.




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# UNITED STATES PATENT OFFICE.

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## FUEL-FEEDING DEVICE FOR INTERNAL-COMBUSTION ENGINES.

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The purpose of this invention is to provide an improved construction of a fuel feeding device for internal combustion engines adapted for feeding fuel to the carbureter from a main supply tank at a lower level than the carbureter by a limited gaseous pressure operating upon a limited quantity of liquid fuel in a relatively small container which derives supply by gravity from the main tank. It consists in the elements and features of construction shown and described, as indicated in the claims.

In the drawings:

Figure 1 is a diagrammatic view showing the relative position of the several parts of the fuel feeding system from the main tank to the carbureter upon an automobile and the engine thereof.

Figure 2 is a vertical section through the main supply tank and the fuel container therein from which fuel is fed by pressure to the carbureter.

Figure 3 is a section at the line, 3—3 on Figure 2.

Figure 4 is a vertical axial section of the portion of the pipe line from the engine to a pressure pipe line for supplying super-atmospheric pressure to the fuel feeding device comprised between the points, 4—4, on Figure 1.

Figure 5 is a detail section at the line, 5—5, on Figure 1.

In the drawings the automobile engine to be served is shown at 1 with the carbureter thereon at 2, the main fuel supply tank at the rear of the vehicle is shown at 3. In the main fuel supply tank there is suspended by means of the several pipes which constitute its fuel discharge connection and its atmospheric and super-atmospheric connections, a relatively small container which is positioned near the bottom of the main supply tank and has a fuel inlet valve, 5, opening inwardly for admitting the fuel by gravity from the supply in the main tank. From the top plate, 13, of the container, 4, a pipe, 7, leads out through the cap, 8, from which the container is suspended by its pipe connections in the main tank, for conducting fuel to the carbureter. 10 is a pipe leading from a source of super-atmospheric pressure entering the cap, 8, and continued below the cap in the main tank by the pipe section, 12, which is connected to the top plate, 13, of the container, 4, said connection being made at a valve chamber, 15, formed in said top plate, 13, said valve chamber having an upwardly-facing seat, 16, around the guide-way, 17, of the double-headed valve hereinafter mentioned, and below said guide-way there is formed a downwardly-facing seat, 18. Through the seat, 16, the super-atmosphere pressure port, 19, leads into the container cavity and from the seat, 18, a duct, 20, leads out through the top plate, a vent pipe, 11, being connected thereto and extending thence up through the cap, 8, to which it is secured for assisting in suspending the container from the cap, 8, within the main tank. The fuel delivery pipe, 7, is screwed into the upper side of the top plate, 13, and a terminal section of said fuel pipe, 21, is screwed into the lower side of said top plate, a downwardly seating check valve, 24, having a seat provided for it at the upper end of said terminal section, 21, for retaining the fuel delivered against backflow in the intervals of the pressure by which it is discharged toward the carbureter. A valve member, 30, having oppositely-facing valves, $30^a$ and $30^b$, is mounted for reciprocation with respect to the oppositely-facing valve seats, 16 and 18, for closing respectively the super-atmospheric pressure inlet port and the atmosphere inlet port. The valve member, 30, is connected with a stem, 33, mounted for vertical guidance in the container and connected with the valve member by extending into an axial bore, $30^c$, thereof across which bore there is formed a longitudinal slot, $30^d$, through which a pin, $30^e$, is inserted for engaging the stem, 33, with the valve member, with a range of longitudinal play or lost motion afforded by said slot. On the stem, 33, there is mounted for sliding between stops, 35 and 36, a float, 37. Snap springs, 38, 38, engaged at their outer ends with lugs, 39, 39, projecting downwardly from the top plate, 13, are engaged at their inner ends at opposite sides of the float and valve guide stem 33, the points of engagement of the snap springs with the stem being such that at the critical position of the snap springs the stem stands with the pin, $30^e$, at the lower end of the slot, $30^d$, when the valve head, $30^b$, is at seated position, the slot length being such that the pin stands at the upper end of said slot when the valve, $30^a$, is at seated position.

The operation of the structure described for supplying fuel to the carbureter is as follows:

The main tank being supplied with fuel to any depth which will cause it to flow into the container, 4, for filling the same to the predetermined high level thereof, said chamber being empty and the valve member at the lower position, being the position at which the atmospheric pressure inlet is open and the super-atmospheric pressure inlet is closed, the container will be thus filled by gravity flow past the inlet valve, 5, causing the float, 37, to be lifted, encountering the stop, 38, and lifting the stem, 33, which moves in the valve member while the pin, 30$^e$, travels upward in the slot, 30$^d$, and the snap springs are moved to the critical point which is reached at the same time that the pin reaches the upper end of the slot. The snap action thereupon lifts the stem a further distance causing it to lift the valve member and seat the valve head, 30$^b$, unseating the valve head, 30$^a$, thereby cutting off the atmospheric pressure and admitting super-atmospheric pressure.

The super-atmospheric pressure now admitted forces the liquid out of the container chamber and up through the fuel delivery pipe, 21, past the check valve, 24, and on to the carbureter. When the liquid level has fallen in the container chamber so that the float encounters the lower stop, 36, of the stem, 33, and the liquid level is still further lowered so as to cease to buoy the float, and its weight is carried on the stem, this weight is sufficient to overcome the resistance of the snap springs, the stem is lowered until the snap springs reach the critical point, and thereupon the snap action further retracts the stem downward, and the pin, 30$^e$, having in the movement which brought the snap springs to the critical point, reached the lower end of the slot, 30$^c$, said snap action completes the retracting movement of the stem and unseats the valve head, 30$^b$, seating the valve head, 30$^a$, thereby cutting off super-atmospheric pressure and admitting atmospheric pressure; thereupon the chamber will be again filled with fuel by gravity from the main tank and the cycle of operation will be repeated. If at any time in the phase of the action of the device at which the valve is open for admitting super-atmospheric pressure, the carbureter should be fully supplied and unable to receive a further supply, the discharge of liquid from the container, 4, will be halted until the condition at the carbureter is such as to admit further supply.

In order that the pressure exerted for lifting the fuel to the carbureter may not be such as to force the carbureter float chamber inlet valve, a pressure-limiting safety valve may be provided at any convenient point on the super-atmospheric pressure line. Such a device is shown conventionally at 40.

In order to insure continuous flow of fuel to the carbureter during the periods of filling of the chamber, 4, by gravity from the main tank, there is desirably provided at some convenient point on the fuel line, 10, leading to the carbureter, a stand-pipe or upwardly-extending chamber, closed except as to its connection at the bottom with the fuel line. Such stand-pipe chamber, 41, is most desirably located just in front of the dash where it may be secured to the dash, as shown in Figure 1. The operation then is that during the periods of discharge from the chamber, 4, the liquid is forced up into the chamber, 41, until the air above the liquid therein is compressed to the degree determined by the adjustment of the safety valve, 40; and the quantity of liquid thus accumulated under pressure in the stand-pipe chamber above the level of the carbureter connection is available for feeding the carbureter during the filling intervals of the chamber, 4.

A desirable means for affording pressure for operating this fuel feeding device in the manner described is to connect the pipe line, 10, with one cylinder of the engine, as shown at 42, in Figure 1 and to provide in said pipe line a check valve, 43, opening in the direction of the pressure operating through the line during the pressure phase of the cycle of the engine cylinder which is thus connected, a restricted air inlet being provided as seen at 44, situated anterior to said check valve, 43, said air inlet being provided with an inwardly-opening check valve, 45. The resultant operation is that at the pressure phase of the engine cylinder thus connected, the air in the pipe line is driven onward toward the chamber, 4, and checked against returning during the suction phase by the check valve, 43, while at said suction phase of the cylinder air is sucked in past the check valve, 45, and occupies the pipe line from that point back toward and even to the engine cylinder connection so that the air thus sucked in is actuated by the engine gases at the next pressure phase of the engine cylinder, and operates as a yielding piston to drive the air in advance of it onward past the check valve, 43, to the chamber, 4. In this operation if the check valves are located at a sufficient distance from the engine, the engine gases will not in any instance pass the check valve, 43, but will only be reciprocated in the pipe line between the engine connection and the check valves, operating, as stated above, as a yielding piston for compressing and driving air into the chamber, 4.

Under some circumstances it may be found desirable to increase the rapidity of the process of filling the chamber, 4, by gravity from the main tank; and this may be done by producing sub-atmospheric pressure instead of atmospheric pressure in said chamber for causing or permitting it to be thus filled by

gravity. Such sub-atmospheric condition may be obtained by connecting the pipe, 11, to the intake manifold of the engine as indicated by the extension, 11ª, of said pipe shown in Figure 1. In case this extension is provided, it will be useful to make the connection of the pipe, 11ª, to the intake manifold by means of a three-way cock, such as illustrated at 47, the cock body having one of its fluid ways connected to the intake manifold, another to the pipe, 11ª, the third being open to the atmosphere, the valve member, 47ª, of the cock having a right-angle passage which at the position of the cock shown in Figure 1 connects the pipe, 11ª, to the manifold, while at the position 90 degrees turned from that shown, the pipe, 11ª, is connected to the atmosphere. The operator, by choice of adjustment of the turn-cock determines whether the chamber, 4, shall be exposed to atmospheric or to sub-atmospheric pressure at the filling period.

I claim:

1. A fuel feeding device for internal combustion engines and the like, comprising in combination with a main fuel supply tank at a lower level than the engine carbureter, a relatively small container positioned with its fuel-receiving cavity extending above the low liquid level of the main supply tank and connected for fuel inflow from the lower part of said main supply tank to the lower part of said container; a fuel conduit leading from the lower part of the container for supplying the carbureter; a conduit from a source of super-atmospheric pressure connected with the upper part of the cavity of said container; a conduit from the upper part of the container cavity leading to the engine intake, whereby suction may be operative for producing sub-atmospheric pressure in said container; valve means operated by change of level of the liquid in the container for alternating the dominance of super-atmospheric pressure and said sub-atmospheric pressure, for permitting the container to fill from the main supply tank by gravity and atmospheric pressure in said main supply tank during the dominance of sub-atmospheric pressure in the container, and to cause the container to be discharged toward the carbureter during the dominance of super-atmospheric pressure.

2. In the construction defined in claim 1 foregoing, the source of super-atmospheric pressure being a cylinder of the engine to be served; a pipe line connected to said cylinder and to the container; a check valve in said pipe line opening in the direction of pressure from the engine cylinder and seating against reverse flow, said pipe line having an air inlet anterior to said check valve, and an inwardly opening check valve at said air inlet.

3. In the construction defined in claim 1, foregoing, the container being mounted within the main supply tank toward the lower part of the cavity thereof, and the conduits for connection with source of super-atmospheric pressure and with the engine intake respectively, consisting of pipes extending from the top of said container, a cover plate for covering an aperture in the top of said main supply tank, said pipes being connected to said plate, whereby said pipes serve as a means of suspending the container in the tank from the cover plate thereof.

4. In combination with the construction defined in claim 1, foregoing, a three-way cock in the conduit leading to the engine intake adapted at one adjustment to afford communication with said intake and at another adjustment to close said communication and open communication with the atmosphere.

In testimony whereof, I have hereunto set my hand at Chicago, Illinois, this 24 day of May, 1923.

LEONARD H. WHEELER.