Dec. 27, 1927. 1,653,885

W. VAN GUILDER

SOLENOID OPERATED FUEL FEEDING DEVICE

Original Filed Oct. 20, 1924

Fig 1

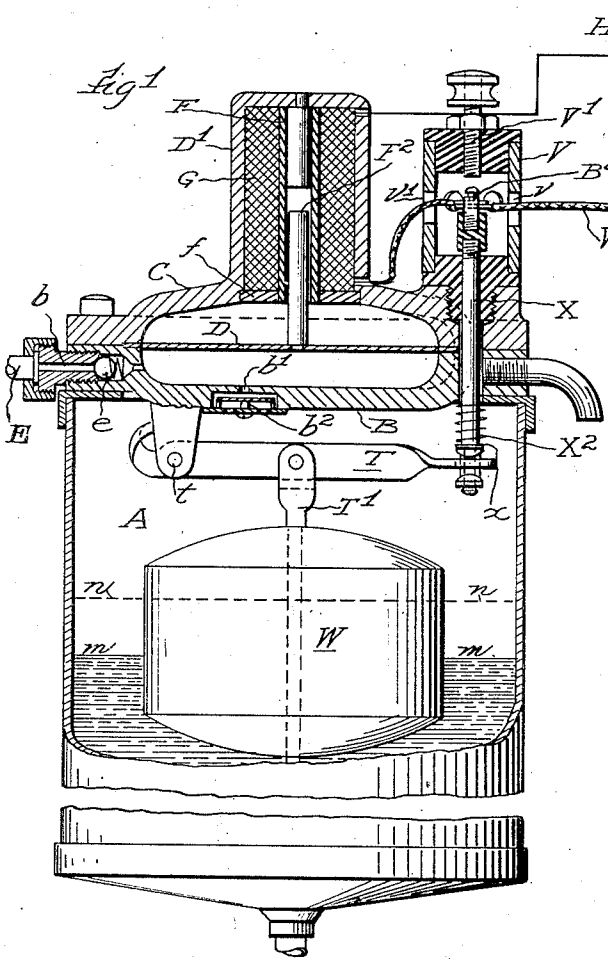


Fig 3

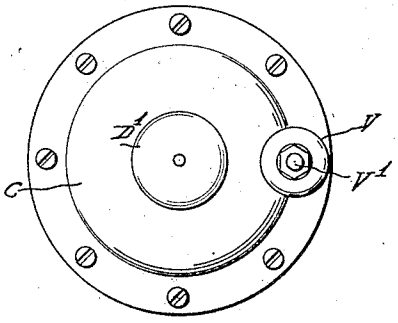


Fig. 2.

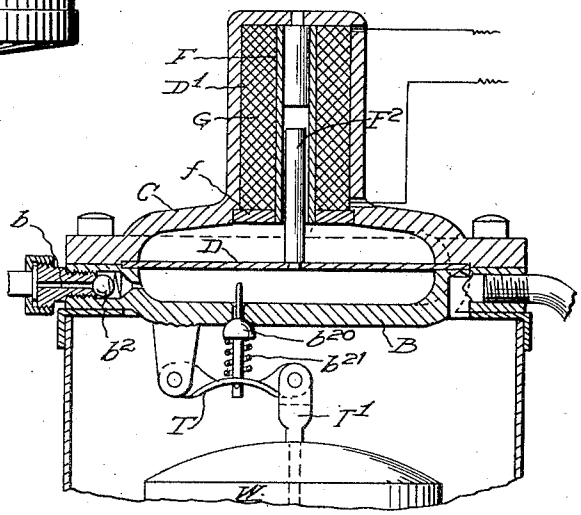
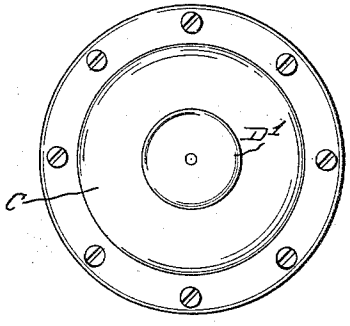


Fig 4



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Patented Dec. 27, 1927. 1,653,885

UNITED STATES PATENT OFFICE.

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SOLENOID-OPERATED FUEL-FEEDING DEVICE.

Application filed October 20, 1924, Serial No. 744,589. Renewed May 12, 1927.

The application is a continuation in part of my application Serial No. 633,751, filed April 21, 1923.

The purpose of this invention is to provide a solenoid operated pumping device for internal combustion engines. It consists in the elements and features of construction shown and described, as indicated in the claims.

In the drawings:

Figure 1 is an axial section of a fuel supply tank and it is equipped with one of the forms of the pumping means constituting this invention.

Figure 2 is a similar view showing another form of said pumping means.

Figure 3 is a top plan view of the form shown in Figure 1.

Figure 4 is a top plan view of the form shown in Figure 2.

The structure shown in the drawings consists of a fuel supply tank designed to be mounted in position to supply fuel to the carbureter by gravity flow, and connected for deriving its own supply from a lower source by pumping means mounted upon and constituting structurally part of said fuel supply tank. The pumping means consists of a diaphragm pump whose diaphragm is vibrated by reciprocation of the core of a solenoid whose energizing circuit is periodically interrupted to produce such reciprocation of the core and vibration of the diaphragm.

A is the fuel accumulation chamber of the fuel supply tank having its top formed of two plates, B and C, clamped together in mounting them upon the top of the body, A, of the accumulation chamber, and marginally binding between them the flexible diaphragm, D. The lower half of the diaphragm chamber which is formed by registering recesses on the inner sides of the two plates, B and C, has a fuel inlet port, b, connected with a fuel supply pipe, E, which leads from a low level fuel source not shown. This inlet port, b, desirably is provided with a check valve, e, opening for inflow of the fuel into the diaphragm chamber below the diaphragm, and seating in the opposite direction to prevent back flow toward the low level fuel source. This chamber member, B, has also a port, b^1, for delivery of the fuel into the accumulating chamber A. This port is provided with a one-way seating valve, b^2, opening for delivery of the fuel by gravity from the diaphragm chamber to the accumulating chamber, A. It may be provided with a light spring, b^{21}, for holding it normally seated upwardly, but such spring may be dispensed with by making the valve as shown in the form of a light disk stopped at its open position so near to its seat that it will be seated by the suction resulting from the retraction of the diaphragm by the solenoid core. The upper member, C, of the diaphragm chamber is extended at its center to form a housing, D^1, of a solenoid comprising the solenoid tube, F, and winding, G, which are retained in the housing by an annular foot plate, f. The reciprocating core, F^2, of the solenoid is attached at its lower end to the center of the diaphragm, D; and at the normal position of the diaphragm the core extends into the diaphragm tube only part way toward the position to which the solenoid when energized tends to draw it. That is, so that upon energizing the solenoid the core is retracted and the diaphragm is up-lifted at its center, causing a sectional in-pull of liquid fuel through the pipe, E, and past the check valve, e; and upon the interruption of the solenoid circuit and release of the core, the subsidence of the diaphragm to normal position causes or permits the outflow past the check valve, b^2, of the liquid fuel thus drawn into the diaphragm chamber below the diaphragm.

The solenoid winding is shown connected at one end with the ignition coil of the engine, indicated at H, and at the other end with one contact segment of the timer indicated at L, so that the solenoid circuit is energized coincidentally with the ignition of the selected one of the cylinders of the engine, and is interrupted during the period of ignition of the remaining cylinders. It may be understood that any convenient form of commutator arrangement may be employed for interrupting the energizing of the solenoid.

From the upper plate, C, of the diaphragm chamber which constitutes the cap or cover of the accumulating chamber, A, there is extended a circuit shunting or solenoid cutout chamber, V, into whose upper end there is set an insulated contact screw, V^1, to which

one of the circuit wires leading to or from the solenoid winding is connected, so that said screw is in the solenoid energizing circuit. From a selected segment of the timer, L, the circuit wire, V^3, is extended through apertures, v, v^1, in the wall of the chamber, V, to reach the lower end of the solenoid winding, said wire being connected within the chamber, V, to a terminal, B^4, which is insulatedly mounted upon the upper end of a thrust rod, X, which extends down through the cap comprising the plates, B and C, of the accumulating chamber, and within that chamber is operably connected with a lever, T, fulcrumed at t, and supporting by means of a link, T^1, a float, W, positioned in the chamber, A, so as to be upheld by the liquid accumulated in that chamber to a predetermined depth.

From the foregoing description it will be understood that the operation of the construction described as shown in Figure 1 is as follows: The engine being in operation, the solenoid circuit is alternately energized and deenergized, causing the core, F^2, to be retracted and uplift the diaphragm and release it in the intervals between the energizing, thereby pumping the liquid up from the low level source into the diaphragm chamber below the diaphragm from which in the intervals of de-energizing of the solenoid permitting recession of the diaphragm, the liquid flows into the accumulation chamber, A, and may accumulate therein until the float, W, is lifted far enough to cause the level, T, to actuate the rod, X, thrusting the insulated contact cap, B^4, up into contact with the contact screw, V^1, thereby cutting out the portion of the circuit in which the solenoid is energized and closing the circuit directly from the timer segment to the ignition coil, and preventing any action of the solenoid so long as the liquid level in the accumulating chamber remains high enough to maintain the contact between the parts, B^4 and B^1. The pumping operation will thereby be interrupted until enough fuel is withdrawn from the accumulating chamber, A, to supply the engine to permit the float to fall far enough to separate the contacts, B^4 and B^1, and permit the solenoid to be alternately energized and de-energized by the connection with the timer circuit. The purpose of the spring, X^2, which is shown interposed on the rod, X, between the cover member, B, and the abutment, x, which affords the engagement of the lever, T, with said rod, X, is to yieldingly resist the upward movement of the float and cause it to become submerged to a predetermined depth beyond the point of normal balance indicated by the liquid level in full line at m, m, on Figure 1, until the liquid has risen to the level indicated by the dotted line, n, n; so that when the pumping operation is interrupted by cutting out the solenoid as described, it shall not be resumed until the liquid level has fallen the distance indicated between the two levels, m, m, and n, n.

In the form shown in Figure 2 the means for grounding the solenoid energizing circuit and temporarily defeating the operation of the solenoid is dispensed with and instead of thus defeating the operation of the solenoid, the lever, T, is connected with the valve, b^{20}, corresponding to the valve, b^2, of Fig. 1, so that at the high position of the float at which in the form shown in Fig. 1 the solenoid circuit is grounded, the valve, b^{20}, is held seated by the buoyant effort of the float with sufficient force to resist both the resilient reaction and the gravity action of the diaphragm, D, in the intervals of energizing the solenoid; so that while the diaphragm will continue to be alternately upheld and released by the solenoid, it will in fact remain at the position to which it is uplifted by the solenoid core, and no pumping action will result so long as the float, W, holds the valve, b^2, seated; but upon sufficient withdrawal of fuel from the chamber, A, to permit the float to drop and release the valve, b^2, the operation of the solenoid will cause resumption of the pumping action. In order that the float may be sufficiently submerged to uphold the valve, b^{20}, adequately for the purpose indicated, a spring, b^{21}, is interposed between the lever, T, and the valve, b^{20}, which spring will yield to compression while the liquid accumulates in the chamber, A, for submerging the float, W, until the resistance of the spring holding the valve seated exceeds the force of gravity and that exerted by the resiliency of the diaphragm for delivering liquid from the diaphragm chamber past the valve, b^{20}. In this form the spring, b^{21}, operates with the same effect as the spring, X^2, as in the form shown in Figure 1, viz, to cause an interval between the suspension and resumption of the pumping while the liquid level falls in the accumulating chamber from the high level to which it rises while the spring is being compressed, to the lower level at which the float is in balanced condition as to its submergence.

I claim:

1. A device for a fuel feed tank for internal combustion engines comprising in combination with a fuel-receiving chamber and an accumulating chamber into which the receiving chamber is adapted to discharge, the receiving chamber having inlet and outlet ports valve controlled for one-way movement of the fuel through said chamber, one wall of said receiving chamber being movable for enlarging and reducing said chamber; a solenoid mounted at the outer side of said receiving chamber having

a reciprocable core operatively connected to said movable wall for moving it to alternately enlarge and reduce the receiving chamber, for pumping fuel therethrough into the accumulating chamber; means for interrupting the solenoid circuit to arrest the pumping, comprising a shunt circuit by-passing the solenoid having a normally open gap, and means operated by the liquid accumulated in the accumulating chamber for carrying one of the contacts at said gap and moving the same to close the gap upon the rise of fuel in the fuel accumulating chamber to a predetermined high level.

2. In a construction for the purpose indicated, comprising a receiving chamber and an accumulating chamber and solenoid-operated means for pumping liquid fuel through the receiving chamber into the accumulating chamber, in combination with the solenoid-energizing circuit, a shunt circuit for by-passing the solenoid, said shunt circuit comprising separable contacts, one of which is mounted exteriorly of both chambers and the other of which is carried by a connection extending into the accumulating chamber and operated for closing the shunt circuit by the accumulation of liquid in said chamber to a predetermined high level.

3. A device for a fuel feeding apparatus for internal combustion engines comprising in combination, a fuel receiving chamber having inlet and outlet ports valve-controlled for one-way movement of fuel through said chamber, one wall of said chamber being movable for enlarging and reducing said chamber; a solenoid mounted on said receiving chamber having a reciprocable armature operatively connected to said moving wall for moving it to alternately enlarge and reduce the chamber, a main circuit through which the solenoid is energized comprising an interrupter for alternately opening and closing the circuit to alternately energize and de-energize the solenoid for reciprocating the armature, separate means for interrupting the circuit to arrest the pumping upon adequate supply of fuel to the engine served comprising a part movable for alternately opening and closing the circuit, and operating connections to said part controlled by the fuel supplied by the pump.

4. In the construction defined in claim 3, the circuit in which the solenoid is energized being in shunt with the ignition circuit of the engine served, whereby the interrupter of the ignition circuit causes the solenoid to be alternately energized and de-energized for reciprocating the solenoid armature, said ignition circuit having a gap between the connections of the shunt circuit therewith, the separate means for opening and closing the circuit being means for opening and closing said gap, whereby the closing of the gap short-circuits the solenoid for arresting the pumping, and the opening of the gap causes the solenoid to be energized for pumping.

5. A fuel feeding apparatus for internal combustion engines comprising in combination, a fuel receiving chamber having inlet and outlet ports valve-controlled for one-way movement of fuel through said chamber, one wall of said chamber being movable for enlarging and reducing said chamber; a solenoid mounted on said receiving chamber having a reciprocable armature operatively connected to said moving wall for moving it to alternately enlarge and reduce the chamber; the engine ignition circuit and the interrupter thereof, the solenoid winding being in circuit with the timer of the ignition circuit, whereby the energizing of the solenoid is interrupted correspondingly with interruptions in the ignition circuit; and separate means for closing and opening the circuit to arrest and resume the pumping comprising a part movable for that purpose, and operating connections to said part controlled by the fuel supplied by the pump.

6. A device for a fuel feed tank for internal combustion engines comprising in combination a fuel receiving chamber having inlet and outlet ports valve-controlled for one-way movement of fuel through said chamber, one wall of said chamber being movable for enlarging and reducing said chamber; a solenoid mounted at the outer side of said chamber having a reciprocable armature operatively connected to said moving wall for moving it to alternately enlarge and reduce the chamber, the solenoid winding being in circuit with the timer of the ignition circuit of the engine, whereby it is interruptedly energized, the circuit connections including a shunt circuit comprising the solenoid winding and having a normally open gap and means whose operation is governed by the quantity of liquid discharged from said chamber for closing the gap upon the discharge of a predetermined quantity.

7. In a construction for the purpose indicated comprising a receiving chamber and an accumulating chamber and solenoid-operated means for pumping liquid fuel through the receiving chamber into the accumulating chamber, the solenoid winding being in circuit with the timer of the ignition circuit of an internal combustion engine, whereby the solenoid is interruptedly energized, the circuit connections including a shunt circuit comprising the solenoid winding, and separable contacts, one of which is mounted exteriorly of both chambers, and the other of which is carried by a connection extending into the accumulating chamber and operated for closing the shunt circuit by the accumulation of liquid in said chamber to a predetermined high level.

8. A construction for the purpose indicated comprising a receiving chamber, and

solenoid operated means for pumping liquid fuel through said chamber; a shunt circuit for by-passing the solenoid comprising two contacts separable to form a gap between them, both of which are mounted exteriorly of said receiving chamber; means whose operation is governed by the quantity of liquid discharged from the said chamber for closing the gap between the contacts upon the discharge of a predetermined quantity, the solenoid winding being in circuit with the timer of the ignition circuit of the engine served, the circuit connection with the timer being made with one contact segment only of the timer, whereby the interruptions in the energizing of the solenoid occur once only in each cycle of the engine.

In testimony whereof, I have hereunto set my hand at Chicago, Illinois, this 17th day of October, 1924.

WALTER VAN GUILDER.