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WILLIAM H. MUZZY, OF EVANSTON, ILLINOIS, ASSIGNOR TO STEWART-WARNER CORPORATION, OF CHICAGO, ILLINOIS, A CORPORATION OF VIRGINIA

LIQUID-SEALED PUMP

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The purpose of this invention is to provide an improved construction of the nature of a pumping device for supplying fuel to an internal combustion engine. It consists in the elements and features of construction shown and described as indicated in the claims.

In the drawings:

Figure 1 is a vertical section of one form of the invention, the same being shown diagrammatically with respect to its relation to an engine cam by which the pumping means is actuated.

Figure 2 is a view similar to Figure 1 showing a modification.

Figure 3 is a view similar to Figure 1 showing a second modification.

In respect to its general character, the construction shown in all three forms is a piston pump arranged with respect to the fuel source, carbureter and pump actuating means for drawing the fuel from the fuel source in the suction or intake stroke of the pump piston, the piston being positively actuated by connection with an engine cam for said suction intake stroke, spring means being provided for storing energy in said positive suction stroke of the piston for yieldingly actuating the piston in its feeding stroke; so that fuel pressure on the carbureter is limited by the reaction of said spring.

A specific purpose of the invention is to take care of the liquid which passes the piston in its feeding stroke, which is sometimes referred to as "piston leak", by returning the fuel to the inflow passage leading to the pump, thus rendering the pump self-scavenging.

Referring to the drawings: The form of the invention shown in Figure 1 comprises a casing which, as illustrated, is formed by a lower cast head, A, an upper cast head, B, a tubular member, C, connecting said heads and closed at its opposite ends by said heads respectively, and a hood formed by a stamping, D, which serves to enclose a chamber otherwise bounded by the cap member, B, which in addition to the horizontal element which closes the upper end of the cylinder, C,

has a vertically extending web, B¹, which is formed and arranged for being mounted against the engine casing indicated at E, having an aperture, 24, which registers with an aperture, e, in the engine casing, through which registered apertures the lever, 3, hereinafter more particularly mentioned, extends for actuation by a cam, 2, on an engine shaft, 1, within the engine casing.

Within the chamber bounded by the tubular member, C, and its upper and lower caps, A and B, there is mounted the cylindrical pumping chamber or pump cylinder, 14, in which the pump piston, 16, reciprocates vertically, said piston being cup-shaped upwardly open within the cylinder and having its operating stem connected, as seen at 17, at the bottom of the cup form of the piston, and extending up through the pumping chamber, 16, and out through a guide bearing, 10, at the upper end of the pumping chamber, which is closed except as to the said guide bearing and apertures, 11, provided in the top web of said pumping chamber for a purpose hereinafter explained.

Within the pumping chamber, coiled around the piston stem and seated at its lower end in the bottom of the cup form of the piston, is a spring, 15, which reacts at its upper end against the top web of the piston chamber, said spring being compressed to a limited degree in the assembling of the parts, and subject to further compression in the intake or suction stroke of the piston for reacting in the feeding stroke.

The piston is arranged to be actuated by connections comprising the lever, 3, above mentioned, which is fulcrumed on the vertical web, B¹, of the casing member, B, and connected at its inner end by a link, 5, with a second lever, 6, pivotally connected to the upper end of the piston stem, 9, and extending from said pivotal connection to overhang a fibre block, 7, which is mounted on the upper side of the cap of the casing member, B.

The engine cam, 2, it will be observed is arranged with respect to the lever, 3, so as to actuate the lever positively only in one direction, that is to say, the cam having an

active and an idle phase; and for causing the lever to follow the cam in its idle phase, there is provided a spring, 4, within the pump casing reacting at its lower end on the inner arm of the lever and at its upper end on the hood member, D, which is provided with a recess shown at *d*, for seating said upper end of the spring.

From the foregoing description it may be understood that the cam, 2, in its active phase actuates the lever, 3, in the direction for causing the link, 5, at the inner end of said lever to operate the lever, 6, resting for its fulcrum upon the fibre block, 7, and pulling upward on the piston stem at its pivotal connection therewith shown at 9, giving the piston its full intake stroke, and in the process, compressing the spring, 15, for storing energy for the return feeding stroke. The pumping chamber has fuel inflow connection indicated at 22, controlled by an inflow valve, 19, and has fuel discharge connection indicated at 23 leading to the carburetor controlled by an outflow valve, 18. It will be understood that when the carburetor fuel chamber is fully supplied, the piston making its return or feeding stroke under the stored energy of the spring, 15, will make only such portion of its full possible stroke as will serve to supply the engine needs, that is, replace the fuel withdrawn from the carburetor in the running of the engine in the intervals between the feeding strokes of the pump.

It will be seen that in any case in which the piston is prevented from making a full feeding stroke, if the lever, 6, remained lodged and fulcrumed on the block, 7, the lever, 3, would not follow the cam in its idle phase, but would stand spaced from the cam waiting to be encountered or picked up in the succeeding active phase of the cam. But the spring, 4, being provided for reacting on the lever to cause it to follow the cam in the idle phase of the latter, in so acting, causes the lever, 6, to fulcrum at its pivotal connection, 9, with the end of the piston stem, lifting its free end from the block, 7. And it will be understood that by this means there is afforded lost motion between the lever, 3, and the piston to the extent that the piston is prevented from making its full feeding stroke.

The specific purpose of the invention above referred to, consisting in providing for accumulation and return to the fuel inflow passage of the liquid which may pass the piston in the feeding stroke of the latter, is accomplished by encompassing the pumping chamber by the chamber, *c*, bounded by the tubular member, C, of the casing, and the provision of the apertures, 11, at the top of the cylinder, through which liquid leaking past the piston, and thereby remaining in the pumping chamber above the

piston, overflows into the encompassing chamber, *c*, where it accumulates until the valve, 20, which controls a port, 20^a, opening into a passage, 21, which communicates with the fuel inflow passage, 22^a, antecedent to the inflow valve, 19, is opened by the rising of a float, 13, provided in the chamber, *c*, and which is dimensioned for buoyant value for opening the valve upon the liquid accumulated in the chamber, *c*, reaching a predetermined high level.

Upon the opening of the valve, 20, it will be understood that the suction stroke of the piston will operate for drawing the liquid from the chamber, *c*, more readily than it will draw the liquid through the inflow connection, 22; and that as soon as the withdrawal of the liquid from the chamber, *c*, has lowered the liquid therein below said predetermined level, the valve will be closed and thus the liquid will at all times be retained in the chamber, *c*, up to said predetermined level, and cannot accumulate above the level without being withdrawn by the pump in its suction stroke.

Upon considering the construction it will be recognized that in the suction stroke of the pump, suction hold is exerted on the valve, 20, tending to prevent its opening, and that the float, 13, is designed to only raise the weight of the valve, 20, and its stem. This is possible notwithstanding the suction hold because when the pump piston reverses after making an upward or intake stroke, the moving column of gasoline in the pipe, 22, and its connections, when the suction is suddenly stopped will have sufficient momentum to kick the valve, 20, open, whereupon the float will raise the valve out of the path of the suction that will operate through the port, 20, upon the next suction stroke of the piston.

In the construction shown in Figure 2, the lever, 3, is connected directly with the piston stem, 9, for giving the piston its intake stroke in the active phase of the cam, and the spring, 4, of the form shown in Figure 1 for causing the lever to follow the cam in the idle phase of the latter is omitted, which permits the link, 5, and lever, 6, of that form to be disposed with, without modifying the operation of the structure except that the cam in its active phase encounters and picks up the lever which is spaced away from the cam in the idle phase of the latter, with the slight disadvantage that the impact of the cam upon the lever in each revolution as it picks up the latter may be unpleasantly audible.

In this form of the device, the fuel inflow connection, 22, is arranged in alignment with the valve, 20, and port which it controls, and opens into the passage 21^a, leading to the inflow controlling valve, 19^a, at the port, 32; and at the opposite side of the

passage, 21^x, from the port, 20^a, there is provided a valve, 30, carried on the stem of the float which carries the valve, 20, and positioned on said stem for seating the valve, 30, when the valve, 20, is open, and opening the valve, 30, when the valve, 20, is seated. The advantage afforded by this construction is that when the valve, 30, is closed the entire intake to the pump cylinder must be from the float chamber alone so that its scavenging is assured. In certain conditions of operation, as for instance in descending a grade, when the main supply tank may be brought level with or above the level of the pump, the suction of the pump piston will draw gasoline through the supply pipe, 22, rather than through the port, 20^a, because of the pressure in the pipe, 22, created by the elevation of the main tank, and the scavenging action would not take place and the pump would be flooded. Similarly if the car is left standing on a down grade in such position that the main tank is above the level of the pump, the fuel will flow by gravity to the pump and the latter would be flooded and overflow. With the valve, 30, however, included in the construction, the rising of the fuel in the float chamber causes the valve to seat and prevents the flooding of the pump.

The form shown in Figure 3 is designed for reducing the over-all dimensions of the device for economy in cost of production, and for convenience of installation in mounting on the engine, and particularly for facilitating the separation of the auxiliary chamber, and access thereto for attention to the condition of the float and valve, and removing sediment accumulated, without disassembling the entire device as will be necessary in the previous constructions.

Referring to Figure 3 the casing M, has the pump chamber, 100, extending horizontally and opening at the end of the casing at which point the latter is provided with a flange, 101, for mounting on the engine casing indicated at 102 with the open end of the pump casing registered with the aperture, 103, in the engine casing; said flange having an annular boss, 104, dimensioned for protruding into the engine casing aperture, 103, and being interiorly threaded for attaching the tubular extension member of the casing, 105, which protrudes into the engine casing aperture, and at its inner end has a guide bearing, 106, for the stem, 107, of the piston, said stem having a terminal button, 108, for cooperating with the engine cam, 110. A stop collar, 111, secured on the stem, 107, serves for reaction on the piston of one end of the coil spring, 112, which at its opposite end is stopped at the margin of the piston chamber opening which

registers with the engine casing aperture, 103.

At the under side the casing is formed with a flat circular face, 120, at the center of which a passage, 124, forms the discharge end of the fuel intake to the pump chamber, 100, and into the entrance of this passage there is screwed a downwardly projecting pipe, 124^a. In the casing, M, there is provided a duct, 121, leading from a point, 122, in the pumping chamber beyond the position of the fully withdrawn head of the piston, to an opening, 123, in said annular face, 120; and there is provided an auxiliary casing member, N, flanged at its upper end for seating on the flat face, 120, and being there secured to the casing member, M, as indicated by the bolts, 125.

This auxiliary casing member encloses a float chamber, N¹, through which the pipe, 124^a, extends for fitting liquid-tight at its lower end in the entrance to a passage, 126, formed in the bottom of said auxiliary casing, N, and leading laterally to an axial bore, 127, in a downwardly protruding boss, 128, said boss being counterbored and interiorly threaded, as seen at 127^a, for connecting thereto the fuel supply pipe, as indicated at 127^b, from the main fuel tank. The initial bore, 127, of the boss, 128, leads into the float chamber, N¹, and the counterbore, 129, forms a valve seat at the lower side of the passage, 126, and a similar valve seat, 131, is formed at the upper end of the bore, 127, and a stem, 132, is provided carrying at its lower end a valve, 133, for seating at the seat, 130, and at a suitable distance above said valve a second valve, 134, for seating at the seat, 131, said stem being extended through a float, 140, which is mounted slidably on the pipe member, 124^a, and on said stem, the stem, 132, being provided at its upper end with a guide bearing formed by a bore, 142, in the casing member, M. The float, 140, has a range of up and down movement along the stem, 132, between the valve, 134, which is fast on the stem, and a stop pin, 143, above the float at a position permitting the valve, 134, to seat before said stop encounters the face, 120, of the casing member, M.

Upon considering this form Figure 3, it will be recognized that its operation will be substantially the same as that of the previously described forms.

But in this construction it may be recognized that in the absence of preventive means, the liquid which might pass the piston and which it is designed should be recovered in the auxiliary chamber for return to the inflow passage in the suction stroke of the pump, would be liable instead of passing thus to the auxiliary chamber to be drawn into the tubular member, 105, from which it would ultimately be liable to escape

into the cavity of the engine casing (crank case), and to prevent this and ensure that the liquid passing the piston shall reach the auxiliary chamber, N, by way of the duct, 121, there is provided an apron, 135, which is a sheet metal stamping comprising a sleeve member, 136, which extends within the cavity of the cup-shaped piston, being spaced both from the piston stem and from the wall of the piston cavity, said sleeve having an annular flange, 137, which laps the margin of the open end of the pump chamber and the end of the tubular member, 105, and which is held in position by said tubular member when the latter is screwed into the annular boss, 104.

It will be understood that in the form of the invention shown in Figure 1 that the piston is always liquid sealed so that air cannot pass between the piston and cylinder wall upon the suction stroke. This is true because the piston,—as it is also in the other forms,—is of loose fit type requiring no other lubrication than the gasoline, and therefore some of the fuel is forced past the piston on the pressure stroke and accumulates in the upper part of the cylinder, 14, where it is trapped and tends to again pass the piston in the reverse direction on the suction stroke. In the forms shown in Figures 2 and 3, while the gasoline that passes the piston drops into lower chamber, there is always sufficient gasoline left on the walls of the cylinders to partly seal the piston. In the form shown in Figure 2 the operating level of the gasoline in the scavenging chamber is above the upper edge of the piston at all times. The liquid sealing of the piston, as stated above, results from the fact that these pumps are operated at very high speed and the gasoline that passes the piston on the pressure stroke is still present upon the suction stroke.

I claim:

1. A pumping apparatus for supplying fuel to an internal combustion engine comprising a casing having a pumping chamber and a piston reciprocating therein, said chamber having fuel inflow and outflow connections valve-controlled for flow from the fuel source toward the engine intake; an auxiliary chamber extending lower than the pumping chamber having communication at its upper part with the pumping chamber at a point in the latter beyond the fully withdrawn position of the piston in its intake stroke, said auxiliary chamber having communication at its lower part with the pumping chamber inflow passage at a point antecedent to the inflow-controlling valve, a valve controlling the last mentioned communication of the auxiliary chamber seating for preventing flow toward the engine intake, and a float in said chamber connected for operating the last mentioned valve for

opening it upon rise of the liquid in said auxiliary chamber to a predetermined level, and closing it upon subsidence of the liquid to a predetermined low level; the pump inflow connection comprising a duct which extends through said auxiliary chamber, and a valve controlling the inflow connection located therein antecedent to the intake of said duct, said valve being operatively associated with the float for being seated to cut off the inflow connection at a predetermined high level of the liquid in the auxiliary chamber.

2. A pumping apparatus for supplying fuel to an internal combustion engine comprising a casing having a pumping chamber and a piston reciprocating therein, said chamber having fuel inflow and outflow connections valve-controlled for flow from the fuel source toward the engine intake, an auxiliary chamber located below the pumping chamber having communication at its upper part with the pumping chamber at a point in the latter beyond the fully withdrawn position of the piston in its intake stroke, said auxiliary chamber having communication at its lower part with the fuel source and with the pumping chamber intake; valves controlling said communications respectively, and a float in said auxiliary chamber connected for operating both said valves for closing the communication with the fuel source and opening the communication with the pump intake upon the rise of the liquid in the auxiliary chamber to a predetermined high level and reversing said communication upon subsidence of the liquid to a predetermined low level.

3. A pumping apparatus for supplying fuel to an internal combustion engine comprising a casing having a pumping chamber and a piston reciprocating therein, said chamber having fuel inflow and outflow connections valve-controlled for flow from the fuel source toward the engine intake; an auxiliary chamber extending lower than the pumping chamber having communication at its upper part with the pumping chamber at a point in the latter beyond the fully withdrawn position of the piston in its intake stroke, said auxiliary chamber having communication at its lower part with the pumping chamber inflow passage at a point antecedent to the inflow-controlling valve, a valve controlling the last mentioned communication of the auxiliary chamber seating for preventing flow toward the engine intake, and a float in said chamber connected for operating the last mentioned valve for opening it upon rise of the liquid in said auxiliary chamber to a predetermined level, and closing it upon subsidence of the liquid to a predetermined low level; the pump intake connection comprising a duct member extending through the auxiliary chamber

and arranged to serve as a guide for the float.

4. In the construction defined in claim 2, the pump intake connection comprising a duct member leading from a point in the fuel line intermediate the two valves mentioned to the pump chamber intake.

5. A pumping apparatus for supplying fuel to the carbureter of an internal combustion engine comprising a casing having a pumping chamber with inflow and outflow connection valve-controlled for flow from the fuel source toward the carbureter; an auxiliary chamber having free liquid communication with the pumping chamber beyond the retracted position of the piston head in the pumping chamber, for receiving liquid which may pass the piston in the feeding stroke of the latter, said auxiliary chamber having liquid flow communication with the inflow passage antecedent to the inflow controlling valve, whereby liquid leaking past the piston may be returned to the inflow passage in the suction stroke of the piston; valve means normally seating against said return flow, and means controlling said valve means for opening the valve when the liquid accumulated in the auxiliary chamber exceeds a predetermined depth; the auxiliary chamber being formed separate from the pumping chamber and arranged to be coupled thereto at a port at the upper part of the auxiliary chamber, the communication of the auxiliary chamber with the inflow passage of the pumping chamber being afforded by a pipe extending down through said coupling port and having its intake at the bottom part of the auxiliary chamber.

6. A pumping apparatus for supplying fuel to the carbureter of an internal combustion engine comprising a casing having a pumping chamber with inflow and outflow connection valve-controlled for flow from the fuel source toward the carbureter; an auxiliary chamber having free liquid communication with the pumping chamber beyond the retracted position of the piston head in the pumping chamber, for receiving liquid which may pass the piston in the feeding stroke of the latter, said auxiliary chamber having liquid flow communication with the inflow passage antecedent to the inflow controlling valve, whereby liquid leaking past the piston may be returned to the inflow passage in the suction stroke of the piston; valve means normally seating against said return flow, and means controlling said valve means for opening the valve when the liquid accumulated in the auxiliary chamber exceeds a predetermined depth; the pumping chamber being arranged for mounting on the engine casing at an aperture therein, with the open end of the pumping chamber registered with such aperture for extending

the piston stem into the engine casing for deriving actuation from the engine, an annular apron encompassing the piston stem and dimensioned as to its outer diameter for lapping the margin of the aperture in the engine casing for barring the entrance to the engine casing of the liquid leaking past the piston.

7. A pumping apparatus for supplying fuel to the carbureter of an internal combustion engine comprising a casing having a pumping chamber with inflow and outflow connection valve-controlled for flow from the fuel source toward the carbureter; an auxiliary chamber having free liquid communication with the pumping chamber beyond the retracted position of the piston head in the pumping chamber, for receiving liquid which may pass the piston in the feeding stroke of the latter, said auxiliary chamber having liquid flow communication with the inflow passage antecedent to the inflow controlling valve, whereby liquid leaking past the piston may be returned to the inflow passage in the suction stroke of the piston; valve means normally seating against said return flow, and means controlling said valve means for opening the valve when the liquid accumulated in the auxiliary chamber exceeds a predetermined depth; the pumping chamber being arranged for mounting on the engine casing at an aperture in the latter, with the open end of the pumping chamber registered with such aperture for extending the piston stem into the engine casing for deriving actuation of the piston from the engine, the piston being hollow with its end opposite the head open; a device for deflecting the liquid leaking past the piston away from the entrance to the engine casing and into the auxiliary chamber, consisting of a sleeve interiorly dimensioned for loosely encompassing the piston stem, and exteriorly dimensioned for being spaced from the inner wall of the piston cavity, and having an annular flange dimensioned for lapping the margin of the open end of the pumping chamber at its registration with the engine casing aperture.

In testimony whereof, I have hereunto set my hand at Chicago, Illinois, this 26th day of February, 1929.

WILLIAM H. MUZZY.