F. WEINBERG.

FUEL SUPPLY APPARATUS FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED MAR. 26, 1915.

1,153,660.

Patented Sept. 14, 1915.

2 SHEETS—SHEET 1.

Fig. 1

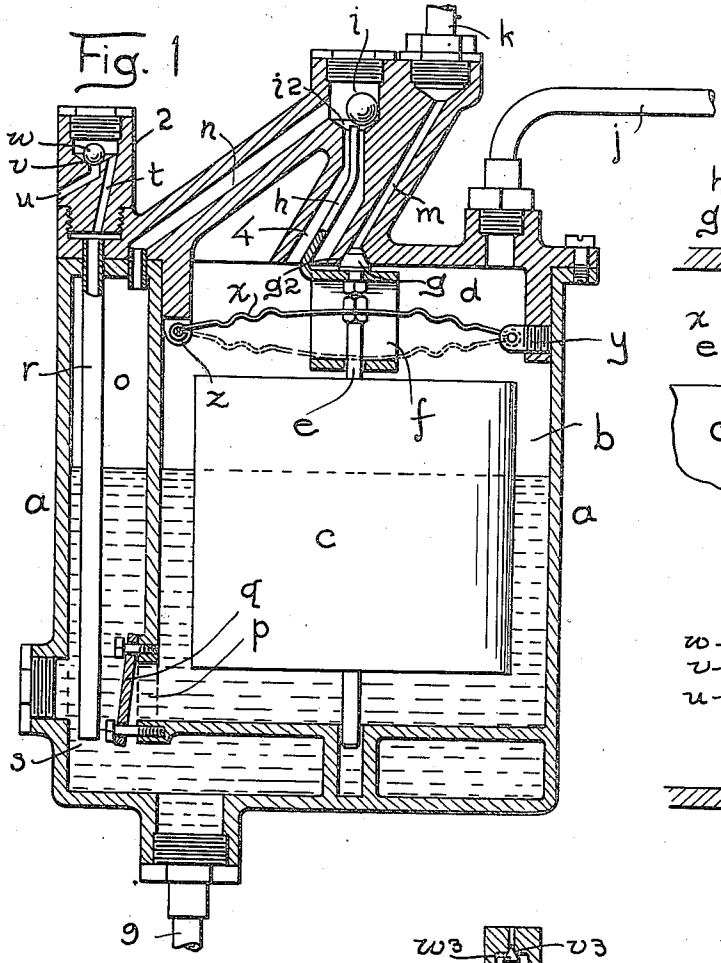


Fig. 2

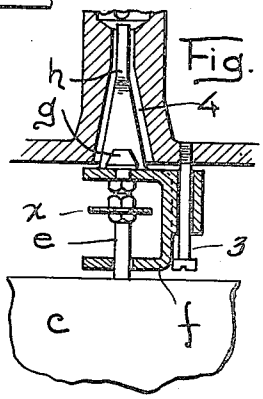
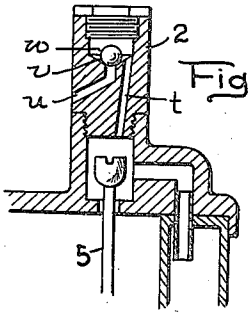


Fig. 3



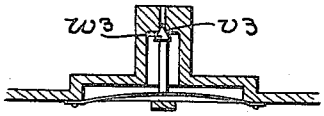


Fig. 6

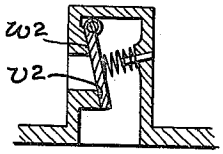
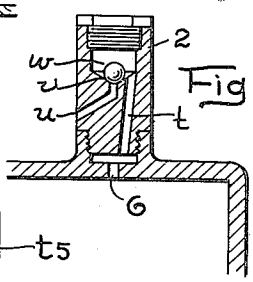


Fig. 5

Fig. 4



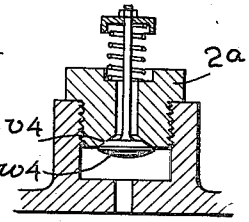
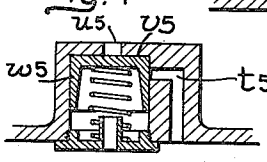


Fig. 8

Fig. 7



WITNESSES

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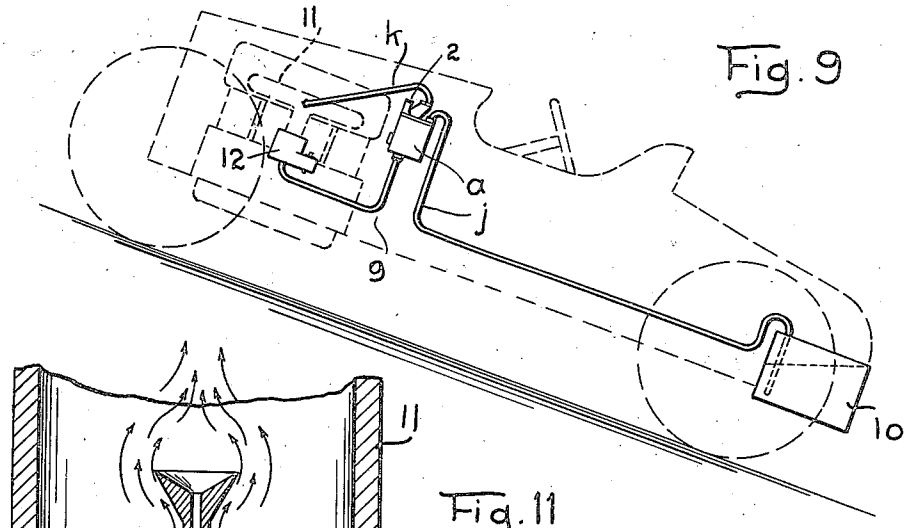

Fig. 9

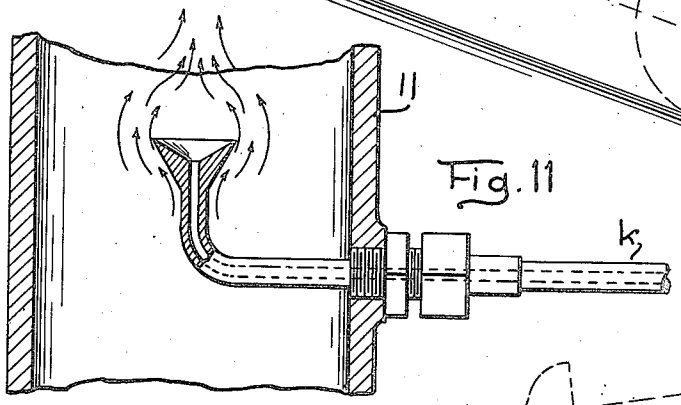

Fig. 11

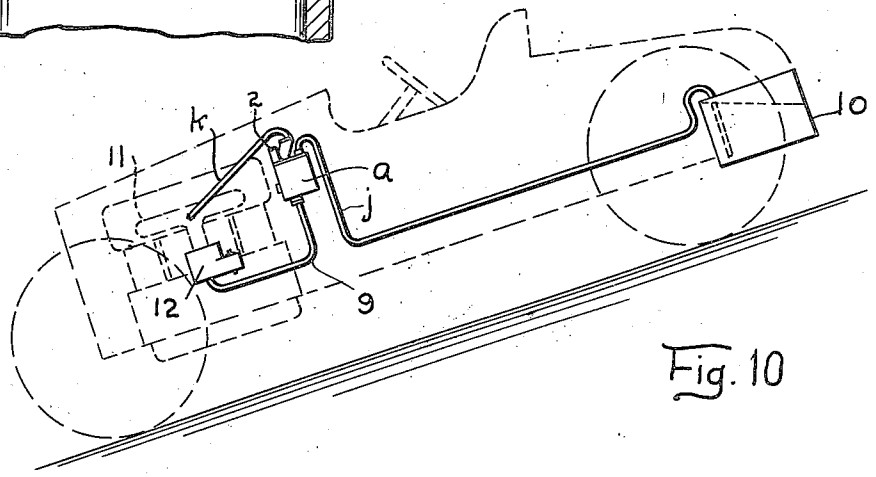

Fig. 10

WITNESSES

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FUEL-SUPPLY APPARATUS FOR INTERNAL-COMBUSTION ENGINES.

1,153,660. Specification of Letters Patent. Patented Sept. 14, 1915.

Application filed March 26, 1915. Serial No. 17,141.

To all whom it may concern:

Be it known that I, FREDERICK WEINBERG, a citizen of the United States, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Fuel-Supply Apparatus for Internal-Combustion Engines, and declare the following to be a full, clear, and exact description of the same, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to apparatus for supplying liquid fuel and an object of my improvements is to provide an improved apparatus for feeding hydrocarbon to be used in an internal combustion engine upon an automobile.

In the accompanying drawings, Figure 1 is a sectional elevation of an apparatus embodying my invention. Fig. 2, is a sectional detail view. Figs. 3, 4, 5, 6, 7 and 8 show modified forms of a portion of said apparatus. Figs. 9 and 10 are elevations showing the apparatus which is the subject of this application in place upon an automobile, the automobile being shown in different positions in said two figures to illustrate the operation of said improved apparatus. Fig. 11 is a detail view showing the ejector nozzle in the intake pipe.

12, Figs. 9 and 10, is a carbureter, and 11 is the intake manifold of an internal combustion engine.

a is an inclosed tank located at a higher position than the carbureter 12 and connected with said carbureter by a pipe 9 so that the liquid will flow by gravity from the tank *a* to said carbureter aided by the pressure of evaporation of the fuel. *b* (Fig. 1) is an inclosed compartment within the tank *a*.

c is a float adapted to reciprocate vertically in the compartment *b* when actuated by the liquid in said compartment.

e is a stem coaxial with the float *c* and extending vertically upward therefrom.

f is a sliding piece passed over a guide 3 so as to make a sliding fit (Fig. 2).

g is a valve upon the piece *f*.

x is a leaf spring corrugated as shown and supported at its ends at points somewhat closer together than the normal length of the unflexed spring. One end of the spring is pivoted to a stationary support at *z*. *y*, is an adjustable screw threaded plug, the other end of the spring *x* is pivoted to the outer end of the plug *y*, said plug may be screwed out or in the screw threaded cavity in which it engages to adjust the distance between the end supports of the spring *x*.

m is a passage slanting as shown.

4, is a second passage slanting for a part of its length in the same direction and extending parallel and adjacent to the passage *m*.

g^2 is a valve seat at the inner end of the passage *m*.

i^2 is a valve seat at the upper end of the passage 4.

i is a ball valve adapted to engage automatically upon the seat i^2. It may be fastened to the stem *h*. The valve seat i^2 is vertically over the valve seat g^2.

n is a passage forming a continuation of the passage 4 and acting in connection therewith to put the air space *o* of the tank *a* into connection with the air space *d* of the compartment *b* within said tank when the ball valve *i* is displaced from its seat, as shown in Fig. 1.

h is a push rod extending from the sliding piece *f* up into the passage 4 and acting when said piece is at the upper end of its travel to displace the ball valve *i* from its seat, as shown in Fig. 1 of the drawings. At this position of the sliding piece *f* the valve *g* engages upon the valve seat g^2 and closes the passage *m*.

j, is a pipe opening into the air space *d* of the compartment *b* and leading from a supply reservoir 10.

k is a pipe communicating with the passage *m* and at its other end opening to the intake manifold of the engine (Figs. 1 and 10).

p, is an opening joining the compartment *b* with the interior of the tank *a* outside of said compartment beneath the level of liquid in said tank and compartment.

q, is an outwardly opening non-return valve controlling the opening *p*.

r is a pipe extending through the cover of the tank *a* and extending downwardly toward a point *s* where it opens to the interior of the tank *a*, beneath the level of liquid in said tank. The position of the lower end of the pipe *r* determines the head acting to discharge the liquid from the tank *b* and the liquid seals the end of the pipe *r*.

2, is a screw-threaded plug which is adjusted above the pipe r in a screw-threaded cavity forming an extension of said pipe.

t is a passage extending to the lower end of the plug 2 and communicating with the pipe r.

u is a passage opening to the outer air from the plug 2.

v is a valve seat around the inner end of the passage u and w is a ball valve adapted to engage on said valve seat to close the passage u; the valve w opens toward the interior of the tank a. Instead of the ball valve w a spring or gravity controlled leaf valve w^2 (Fig. 5) may be used engaging upon a valve seat v^2 or a spring actuated conical valve w^3 may engage upon the valve seat v^3 (Fig. 6) or a piston valve w^5, spring actuated, may be used to put the passages u^5 into connection with the passage t^5 (Fig. 7). The valve w^5 may engage upon the valve seat v^5 when required. Or a modified screw-threaded plug 2^a, with an ordinary conical spring controlled puppet valve w^4 engaging upon a valve seat v^4 may be employed (Fig. 8).

A utility of the non-return valve w and its modifications is illustrated in Figs. 9 and 10. If the automobile is ascending a steep hill, as shown in Fig. 9, there would be a tendency for the gasolene to descend toward and into the reservoir 10 through the pipe j. This tendency will be counteracted by the fact that the pipe j enters the top of the tank a at a considerable distance above the liquid level, in which tank a partial vacuum will be drawn. When the automobile is descending a grade, as shown in Fig. 10, the tendency will be for the liquid hydrocarbon to run down into the tank a and this will be counteracted by the valve w which will prevent the escape of air and therefore hold the excess of liquid back from entering the tank a. Figs. 3 and 4 show this valve as it may be adjusted to devices hitherto used. In Fig. 3 is shown the mechanism of a device in which two compartments are joined by a passage controlled by a float actuating valve 5. The passage uniting these two compartments being in such device open to the outer air. If the plug 2 is adjusted, as shown in Fig. 3, to close the opening between said passage and the outer air, then such apparatus will embody my invention and secure the objects thereof to an extent. Fig. 4 shows a similar adjustment where the valve 5 is not used but instead thereof a very small permanent opening which has heretofore been connected directly with the outer air is employed. The adjustment is the same as that just described in Fig. 3 and the object of my invention is thereby secured.

As shown in Fig. 11 the ejector nozzle for producing a vacuum which nozzle extends in the direction of the flow of the gas mixture in the intake pipe is hollowed in the direction of the flow of the gasolene mixture and is conical toward the flow of air in the pipe k. This nozzle is suction producing and the suction increases with the speed of the gas mixture flowing toward the engine cylinders. The suction upon said nozzle is due to the inertia of the passing air as distinguished from the change of static pressure due to the adjusting of the throttle valve. The valves i^2 and g are obviously opened and closed successively and not simultaneously.

What I claim is:

1. In an apparatus of the kind described, an inclosed chamber, a second inclosed chamber, a passage leading from the lower portion of said first inclosed chamber to said second inclosed chamber, a nonreturn valve in said passage opening toward said second inclosed chamber, a vacuum producing passage communicating with said first inclosed chamber, apparatus in said first inclosed chamber actuated by the liquid therein adapted to close said vacuum passage and open communication between the air spaces of said chambers or to close said communication and open said suction passage, a passage from said second inclosed chamber to the outer air, an inwardly opening nonreturn valve in said passage, and a supply pipe for gasolene opening into the first named chamber for the purpose described.

2. In an apparatus of the kind described, an inclosed chamber, a second inclosed chamber, a communication between said chambers, a vacuum producing passage opening into said first named chamber, a valve seat in said passage, a valve seat in the communication between said chambers, said valve seats being located one above the other, a single integral piece adapted to actuate both of said valves, and means for reciprocating said piece.

3. In an apparatus of the kind described, a valve actuating piece, an approximately straight spring having its ends secured at points a distance apart less than the length of said spring so that said spring shall be bowed between its ends, said spring being corrugated, said piece engaging said spring intermediate said points for the purpose described.

4. In an apparatus of the kind described, an inclosed chamber, a second inclosed chamber, a communicating passage adapted to convey liquid from the first named chamber to the second chamber, a supply pipe communicating with said first chamber, a vacuum producing passage communicating with said first chamber, a passage extending between the air spaces of said chambers, means for closing said suction passage and opening said communicating passage or closing said communicating passage and opening said suction passage, and a pipe extend-

ing through the upper part of said second chamber and extending below the level of the liquid in said chamber.

5. In an apparatus of the kind described, an inclosed chamber, a second inclosed chamber, a communicating passage adapted to convey liquid from the first named chamber to the second chamber, a supply pipe communicating with said first chamber, a vacuum producing passage communicating with said first chamber, a passage extending between the air spaces of said chambers, means for closing said suction passage and opening said communicating passage or closing said communicating passage and opening said suction passage, a pipe extending through the upper part of said second chamber and extending below the level of the liquid in said chamber, a passage adapted to put the upper end of said pipe into communication with the outer air, and an inwardly opening nonreturn valve in said passage.

6. In an apparatus of the kind described, a slanting passage *m*, a second slanting passage 4 approximately parallel to the passage *m*, a valve seat at the lower end of the passage *m*, a valve seat at the upper end of the passage 4, a valve adapted to engage upon each of said seats, a reciprocating piece, said reciprocating piece connecting with the valve adapted to close the passage *m* and extending to the valve at the upper end of the passage 4, said valves being located approximately in line with each other and in line with the reciprocation of said piece.

7. In a vacuum feed system, the combination of an inclosed auxiliary liquid supply chamber, a supply tank located horizontally at a distance from said chamber and connected therewith by a liquid supply conduit, means for producing a vacuum in said chamber, a passage passing through the wall of said chamber and adapted to permit air to enter the same, and an automatic inwardly opening non-return air valve in said passage.

8. In an apparatus of the kind described, a valve actuating piece, an approximately straight spring having its ends secured at points at a distance apart less than the length of said spring so that said spring shall be bowed between its ends, and an adjustable piece to which one of said ends is secured adapted to adjust the distance apart of the securing points, said valve actuating piece engaging said spring intermediate its ends.

9. In combination with an explosion engine and a carbureter through which the same is supplied with liquid fuel, a main supply tank located below the plane of the engine intake but liable to be raised in and above the plane of the engine intake, a supplemental closed fuel supply receptacle extending, for containing liquid, normally above the level of such tank but liable to be in positions below the level of such tank, a liquid conduit connecting the tank and said receptacle, a suction conduit communicating at one end with the upper part of the receptacle, a nozzle communicating with said suction conduit and with the engine intake at a point intermediate the choke of the carbureter and the intake valve of said engine, a liquid feed connection from receptacle to carbureter, an automatic means for varying the vacuum in said receptacle, said nozzle being so located in said intake that a vacuum shall be created therein by the inertia of the passing gases.

10. The combination with a main liquid supply tank, of a liquid fuel receptacle located in a plane above said tank but liable to be lowered into the plane of said tank or below the same, a conduit leading from said tank to said receptacle, an auxiliary receptacle, a conduit leading from said fuel receptacle for discharge therefrom into said auxiliary receptacle, exhaust means for reducing the pressure in said first fuel receptacle below that of the atmosphere, a valve controlling the communication between said first fuel receptacle and said exhaust means, a valve controlling the communication between said first fuel receptacle and said auxiliary receptacle, and means for automatically unseating said first valve and seating said second valve successively when the liquid in said first receptacle reaches a predetermined low level and for successively seating the first valve and unseating the second valve when the liquid in said first receptacle reaches a predetermined high level.

11. In a vacuum feed system, a vacuum chamber, an intake pipe for an internal combustion engine, a passage connecting said chamber and said intake pipe, said passage terminating in a nozzle extending into said intake pipe and adapted to be acted upon by the inertia of the current of gases passing the open end of said passage in said intake pipe to produce a vacuum in said chamber.

12. In a vacuum feed system, a vacuum chamber, an intake pipe for an internal combustion engine, a passage connecting said chamber and said intake pipe, said passage terminating in an ejector nozzle extending into said intake-pipe and adapted to co-act with the passing current of gas to produce a vacuum in said chamber, said ejector nozzle having an enlarged end made conical in the direction in which the gases come to said nozzle.

13. In a vacuum feed system, a vacuum chamber, an intake pipe for an internal combustion engine, a passage connecting said chamber and said intake pipe, said passage terminating in an ejector nozzle extending into said intake-pipe and adapted to co-act

with the passing current of gas to produce a vacuum in said chamber, said ejector nozzle having an enlarged end made conical in the direction in which the gases come to said nozzle, and hollowed out upon the side toward the flow of gaseous mixture.

14. In a vacuum feed system, a vacuum chamber, an intake pipe for an internal combustion engine, a passage connecting said chamber and said intake pipe, said passage terminating in an ejector nozzle extending into said intake-pipe and adapted to co-act with the current of gas passing the open end of said nozzle to produce a vacuum in said chamber, the delivery end of said nozzle being enlarged.

15. In a vacuum feed system, an inclosed chamber adapted to supply liquid fuel by gravity, a pipe communicating with the outer air extending through the upper end of said chamber and toward the bottom of said chamber below the level of the liquid in said chamber.

In testimony whereof, I sign this specification.

FREDERICK WEINBERG.