

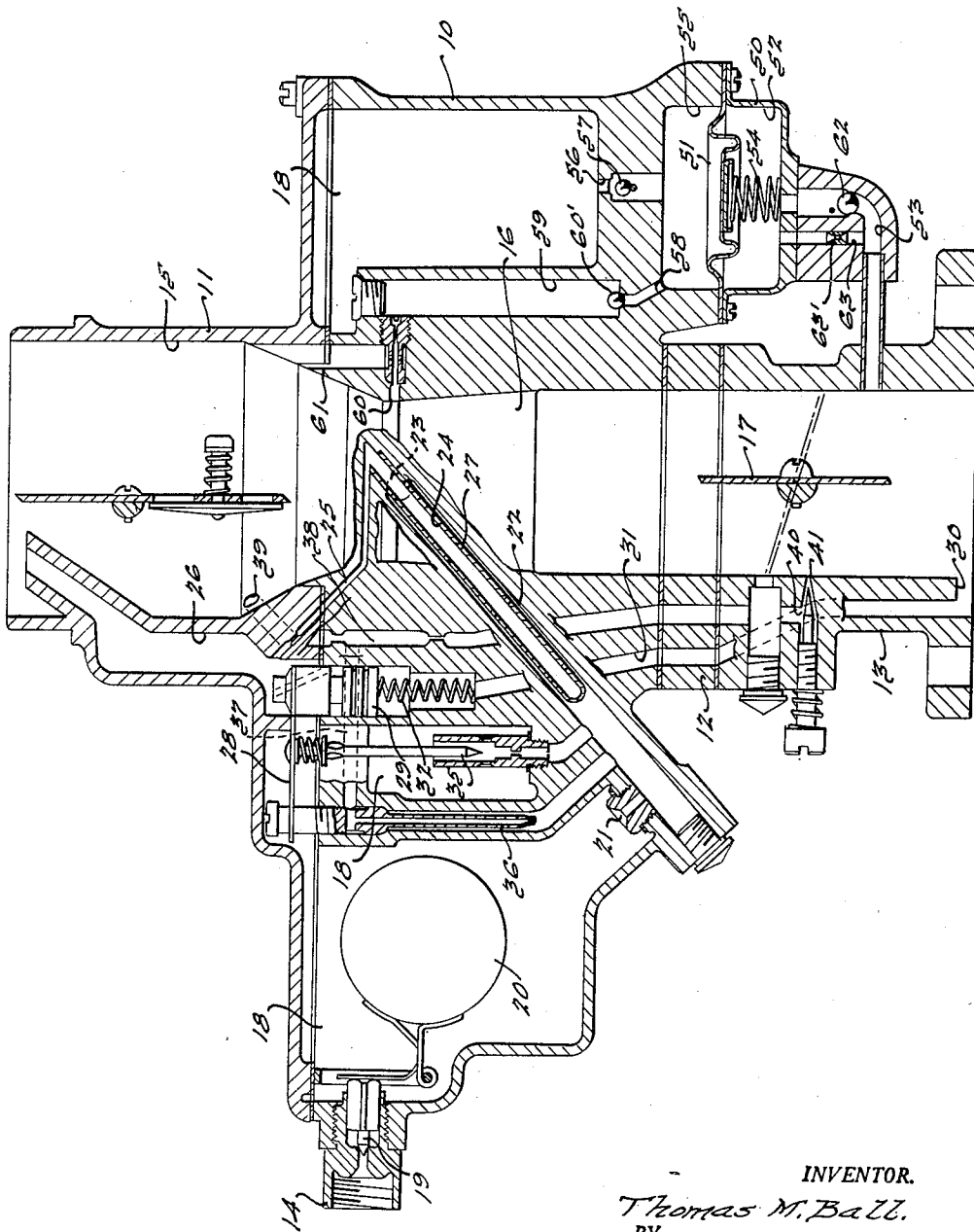
May 8, 1951

T. M. BALL

2,551,719

CARBURETOR

Filed May 10, 1946



INVENTOR.

Thomas M. Ball.

BY

Harness and Harris

ATTORNEYS,

UNITED STATES PATENT OFFICE

2,551,719

CARBURETOR

Thomas M. Ball, Detroit, Mich., assignor to
Chrysler Corporation, Highland Park, Mich., a
corporation of Delaware

Application May 10, 1946, Serial No. 668,795

5 Claims. (Cl. 261—34)

1

My invention relates to improvements in carburetors for internal combustion engines.

More particularly the invention relates to improvements in vacuum operated accelerating pumps adapted to limit the response of the pumps to certain manifold vacuum drops so that fuel pumping will not be initiated on occasions when it is undesirable.

Vacuum operated accelerating pumps have heretofore had the undesirable characteristic of pumping fuel whenever a drop in manifold vacuum pressure occurs. Manifold vacuum not only drops as an incident to engine acceleration when fuel pumping is desired but also drops during a period of unstable idling when additional fuel injection tends to stall the engine as, for example, when the idling engine "rolls" due to the presence of a too rich fuel mixture. A discharge from the accelerating jet at this time increases the amplitude of the roll which again reduces the manifold vacuum and induces a new jet discharge. The engine idling becomes progressively worse until a stall is obtained. The additional fuel injection is in effect synchronized with the engine fluctuations and accentuates the tendency to stall.

Some internal combustion engines are timed to have the intake and exhaust valves concurrently open for a short interval. This is commonly known as "overlap." In these engines there is a rapid fluctuation of manifold vacuum during the period of overlap which would operate the existing vacuum pumps when not desired.

I have observed that successive drops in manifold vacuum occurring during engine accelerating are spaced to repeat after a relatively long interval of time while the drops in manifold vacuum caused by engine roll or overlap are repeated in quick succession. It is an object of my invention to provide a means to utilize this distinction to limit the discharge of fuel from the pump to the drops in manifold vacuum which by the elapsed time between their recurrence signal that a fuel discharge is desirable.

The term "manifold vacuum" as used herein is intended to refer to the partial vacuum which is present in varying degrees in the manifold under engine operating conditions. The term "drop in vacuum" refers to an increase in absolute pressure in the manifold.

In the drawings:

The single figure is a sectional elevational view of a down draft carburetor with my improved vacuum operated accelerating pump incorporated therein.

Referring to the drawing, the carburetor com-

2

prises an assembly of a body 10, an air horn 11, an insulator 12, and a body flange 13. The body flange 13 is secured to the engine intake manifold (not shown). A nipple 14 is adapted to be connected by a fuel line (not shown) to a source of supply of fuel such as a fuel pump (not shown). The air horn 11 is provided with a tubular part 15 which serves as an air inlet to a fuel mixture passage 16. The egress of the fuel mixture to the engine intake manifold is controlled by throttle valve 17.

The body portion of the carburetor is provided with a fuel reservoir 18. The intake of fuel from the nipple 14 is controlled by a needle valve 19 which is operated by a conventional float mechanism 20 which predetermines the fuel level in the reservoir.

The main fuel injection means controls the mixture with air of fuel passing through metering jet 21. Tubular passage 22 connects jet 21 with mixture chamber 16 at orifice 23. Tubular passage 24 connected via ducts 25 and 26 to atmosphere is concentrically disposed within passage 22 and provided with a plurality of holes 27 in its side walls. Air entering tubular passage 24 escapes through holes 27 and mixes with fuel in passage 22.

A conventional mechanism 28 is adapted to vary the fuel mixture ratio in response to the degree of vacuum in a manner that is well known to those familiar with the art. This mechanism includes a spring loaded piston 29 adapted to reciprocate in response to variations in manifold vacuum transmitted through orifice 30 and passage 31. A valve 35 controls the flow of liquid fuel to the fuel mixture passage 16. Valve 35 is operatively connected to piston 29 to reciprocate therewith. When manifold vacuum is relatively great piston 29 is pulled down and valve 35 substantially closed. When manifold vacuum is relatively small, spring 32 lifts piston 29 opening valve 35 to permit an additional discharge of liquid fuel from reservoir 18 into passage 22.

Liquid fuel for engine idling is drawn by manifold vacuum from passage 22 through idling tube 36 connected through passage 37 to passage 38. The latter passage has orifice 39 open to the atmosphere and orifice 40 operatively connected to idling jet 41.

A vacuum operated accelerating pump is generally indicated at 50. This pump includes a diaphragm 51 extending across a chamber 52 which is connected to the fuel mixture passage and manifold vacuum by a passage 53. A spring 54 bearing between the diaphragm 51 and the

3

lower wall of the chamber 52 urges the diaphragm to its upper position. A chamber 55 above diaphragm 51 is connected to fuel reservoir 18 by an orifice 56. A ball check valve 57 permits the entrance of fuel from reservoir 18 but prevents fuel from reentering reservoir 18 when diaphragm 51 rises. Passages 58 and 59 connect chamber 55 with accelerating jet 60. Passage 61 supplies air to jet 60 and a ball check valve 60' prevents a reverse flow of fuel from the passage 59 to the chamber 55.

In the operation of the vacuum operated pump thus far described the pump is charged when sufficient manifold vacuum exists to hold diaphragm 51 down against the force of spring 54. However, when manifold vacuum decreases, as for example, as the throttle is opened to produce engine acceleration, the spring 54 is able to force diaphragm 51 upwardly thus forcing liquid fuel through passages 58 and 59 and jet 60 to augment the supply of fuel to the engine.

I have provided a ball check valve 62 and by-pass 63 to prevent the above supplemental fuel discharge from occurring when the interval between successive drops in manifold vacuum is of relatively short duration. By-pass 63 connecting passage 53 and chamber 52 is restricted by a metering orifice 63'. The check valve 62 seals the larger passage against the withdrawal of air from chamber 52 through the larger passage so that a relatively long time interval is required to withdraw the air from chamber 52 although the entrance of air to chamber 52 is readily permitted by the upwardly opening ball check valve 62. If manifold vacuum fluctuates rapidly, a temporary increase in vacuum is not transmitted to chamber 52 because of the relatively long time interval required for restricted by-pass 63 to apply an increase in vacuum to chamber 52. Thus fluctuations in rapid succession of manifold vacuum are not accompanied by accelerating jet discharges. Under normal driving conditions acceleration is not required in such quickly repeated cycles but manifold vacuum drops are quickly repeated when incidental to engine roll or valve overlap.

It will, therefore, be evident that when a series of fluctuations in manifold vacuum follow in rapid succession my device will eliminate the related fuel discharges for all except the first drop in vacuum in the series. The initial entrance of air past check valve 62 causes this first discharge but diaphragm 51 cannot be retracted for a considerable length of time predetermined by the metering orifice 63', so succeeding vacuum drops occurring in quick succession are ineffectual. When relatively long time intervals occur between successive drops in manifold vacuum, as for example, as an incident to engine acceleration, the jet discharges will occur in the normal manner.

I claim:

1. In an internal combustion engine provided with an intake manifold and a carburetor having a fuel reservoir, means to meter fuel from said reservoir to said manifold, an accelerating pump having a fluid flow connection with said reservoir operable independently of said metering means, said pump having a chamber from which air is withdrawn by manifold vacuum, means forming a passage connecting said chamber with a source of manifold vacuum, a one-way valve in said passage adapted to permit air to flow into said chamber, spring means operable to actuate said pump in response to decrease in

4

manifold vacuum, means forming a second passage of relatively small cross section and connecting said chamber with a source of manifold vacuum, whereby the withdrawal of air from said chamber in response to restored manifold vacuum is restricted and repetition of said pump actuation in response to a subsequent decrease in manifold vacuum cannot occur for a limited time interval.

2. In an internal combustion engine provided with a carburetor having a fuel reservoir, means to meter fuel from said reservoir to said engine, an accelerating pump for said carburetor comprising a housing having a chamber therein, an element movably mounted in said housing and dividing said chamber into a fuel section and a vacuum section, said fuel section having a fluid flow connection with said reservoir other than through said metering means and said element being adapted to pump fuel to said engine when moved in a first direction from an initial position, a spring urging said element to move in said first direction, means forming a passage having at least a portion thereof of restricted cross section, said passage connecting said vacuum section to a source of manifold vacuum to create a partial vacuum in said vacuum section and to overcome said spring when sufficient vacuum exists in said vacuum section, and means forming a one-way communication between said vacuum section and a source of manifold vacuum to relieve the vacuum of said vacuum section and permit said element to move in said first direction as an incident to a drop in manifold vacuum, said restricted cross section of said first passage serving to retard the return of said element to said initial position so that the frequency of operation of said pump is limited.

3. A carburetor adapted for association with an internal combustion engine provided with an intake manifold, said carburetor having a fuel reservoir, means to meter fuel from said reservoir, an accelerating pump having a fluid flow connection with said reservoir operable independently of said metering means, said pump having a chamber which is adapted to have air withdrawn therefrom by manifold vacuum, means forming a passage adapted to connect said chamber with a source of manifold vacuum, a one-way valve in said passage adapted to permit air to flow into said chamber, spring means operable to actuate said pump in response to decrease in manifold vacuum, means forming a second passage of relatively small cross section and operable to connect said chamber with a source of manifold vacuum when said carburetor is associated with an internal combustion engine whereby the withdrawal of air from said chamber in response to restored manifold vacuum will be restricted and repetition of said pump actuation in response to a subsequent decrease in manifold vacuum cannot occur for a limited time interval.

4. In an internal combustion engine provided with an intake manifold and a carburetor having a fuel reservoir, means to meter said fuel from said reservoir to said manifold, a pump comprising a housing having fuel and air chambers therein, said fuel chamber having a fluid flow connection with said reservoir operable independently of said metering means, a diaphragm separating said chambers and a spring located in said air chamber and reacting on said housing and acting on said diaphragm to urge it in

5

6

a first direction to an extended position adapted to force fuel from said fuel chamber to said manifold, said housing having an air passage connecting said air chamber to a source of manifold vacuum whereby manifold vacuum is permitted to urge said diaphragm in a second direction to a retracted position, at least a portion of said air passage having a small cross section adapted to permit only a restricted flow of air from said air chamber whereby a substantial interval of time is required to create a predetermined partial vacuum in said air chamber, and said housing having a one-way second air passage connecting said air chamber to a source of manifold vacuum and adapted to permit a substantially unrestricted flow of air from said source to said air chamber to permit said spring to move said diaphragm in said first direction when manifold absolute pressure increases.

5. In an internal combustion engine provided with an intake manifold and a carburetor having a fuel reservoir, means to meter fuel from said reservoir to said manifold, a pump comprising a fuel portion and a vacuum portion, said fuel portion having a jet outlet to said carburetor and a fluid flow connection with said reservoir other than through said metering means, second means to force fuel from said fuel portion to said outlet,

a third means forming a one-way passage adapted to permit air to travel in one direction from said manifold to said pump vacuum portion and fourth means forming a second passage having at least a portion thereof of relatively small cross section and connecting said pump vacuum portion to a source of manifold vacuum to permit relatively limited travel of air from said pump vacuum portion to said manifold, said second means being operative only when assisted by the supply by said one-way passage of air to said pump as an incident to a vacuum drop in said manifold, the relatively small cross section of said second passage delaying the restoring of a vacuum in said pump whereby the frequency of operation of said second means is limited.

THOMAS M. BALL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,035,636	Chandler	Mar. 31, 1936
2,240,515	Partington	May 6, 1941
2,355,346	Weber	Aug. 8, 1944
2,363,223	Bonnier	Nov. 21, 1944