United States Patent

[11] 3,628,773

[72] Inventors **Ellsworth A. Kehoe**
Rochester;
Donald D. Stoltman, Henrietta, both of N.Y.

[21] Appl. No. **784,973**
[22] Filed **Oct. 3, 1968**
[45] Patented **Dec. 21, 1971**
[73] Assignee **General Motors Corporation**
Detroit, Mich.
Continuation of application Ser. No. 504,961, Oct. 24, 1965, now abandoned. This application Oct. 3, 1968, Ser. No. 784,973

[54] **CARBURETOR**
4 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** ..... **261/23 A,** 261/50 A
[51] **Int. Cl.** **F02m 7/16**
[50] **Field of Search** 261/23.1, 41.1, 41.3, 50.1; 123/127

[56] **References Cited**

UNITED STATES PATENTS

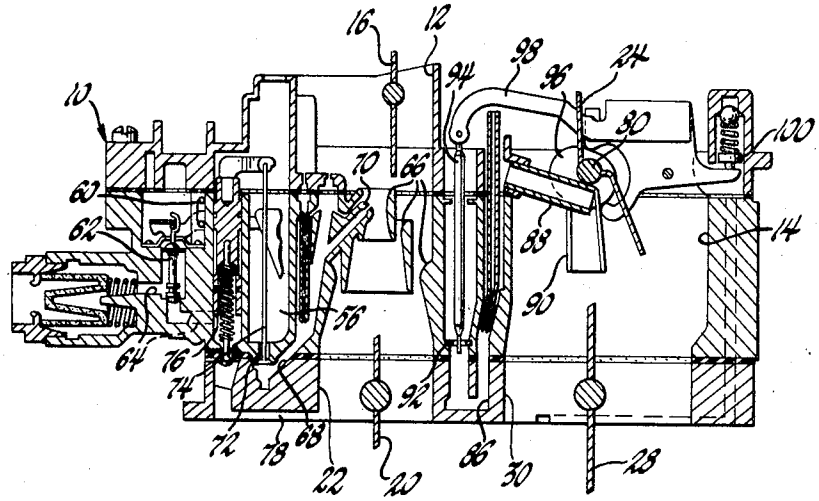
2,832,576	4/1958	Henning	261/23
3,013,778	12/1961	Carlson et al.	261/23
3,030,085	4/1962	Read	261/41
3,053,240	9/1962	Mick	123/119
3,272,482	9/1966	Carlson	261/23
3,279,767	10/1966	Stoltman	261/23
3,317,195	5/1967	Bickhaus et al.	261/23 (.1)
3,317,196	5/1967	Smith	261/23 (.1)
2,457,570	12/1948	Leibing	261/39
2,827,269	3/1958	Kittler	261/23 (.1)

FOREIGN PATENTS

833,178	4/1960	Great Britain	261/23.1

Primary Examiner—Frank W. Lutter
Attorneys—A. F. Brillio, J. L. Carpenter and C. K. Veenstra

ABSTRACT: A four barrel, multiple stage carburetor has a pair of small plain tube primary mixture conduits transversely spaced on opposite sides of a small, centrally located fuel bowl and a pair of large air valve secondary mixture conduits transversely spaced across the rear of the fuel bowl.



PATENTED DEC 21 1971

3,628,773

SHEET 1 OF 2

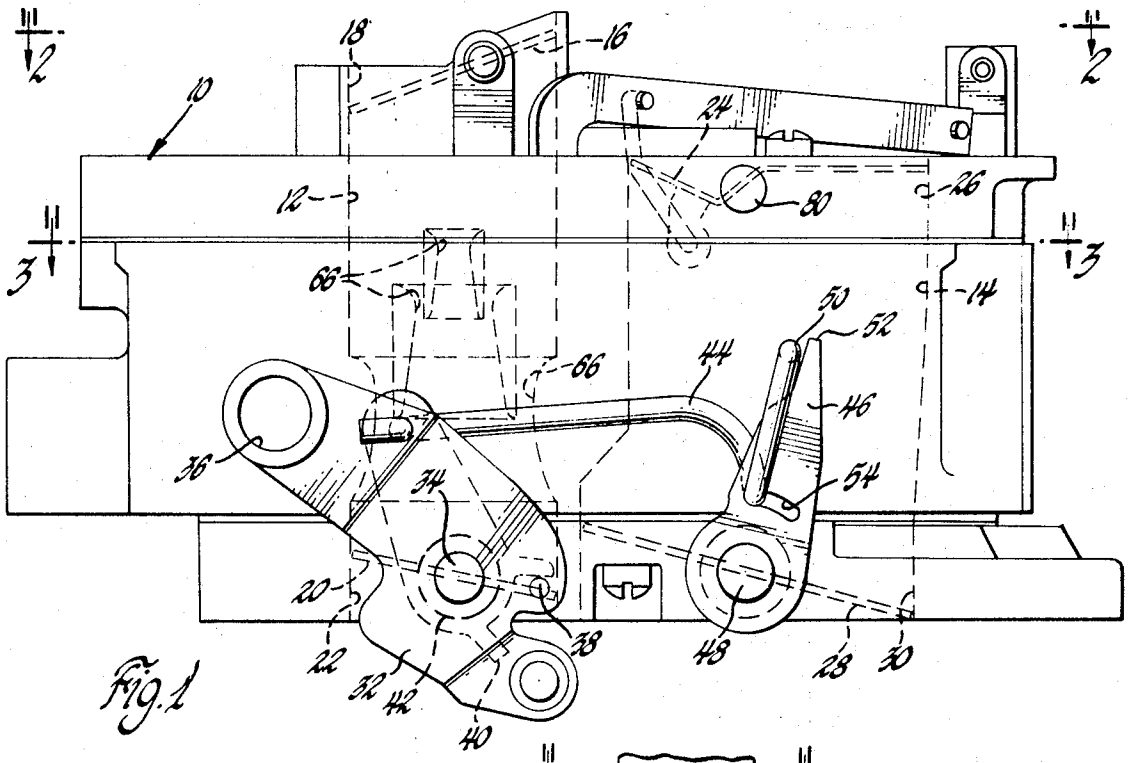


Fig. 1

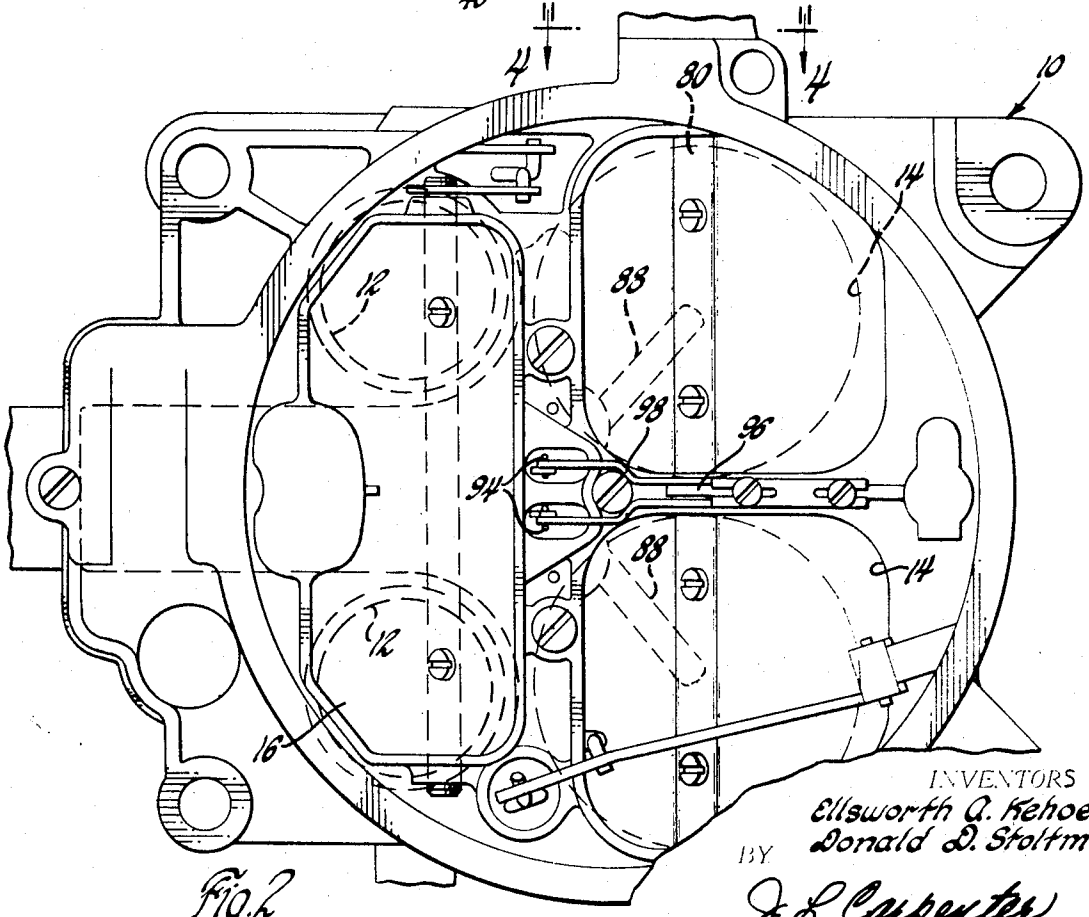


Fig. 2

INVENTORS
Ellsworth A. Kehoe &
Donald D. Stoltman

BY
J. L. Carpenter
ATTORNEY

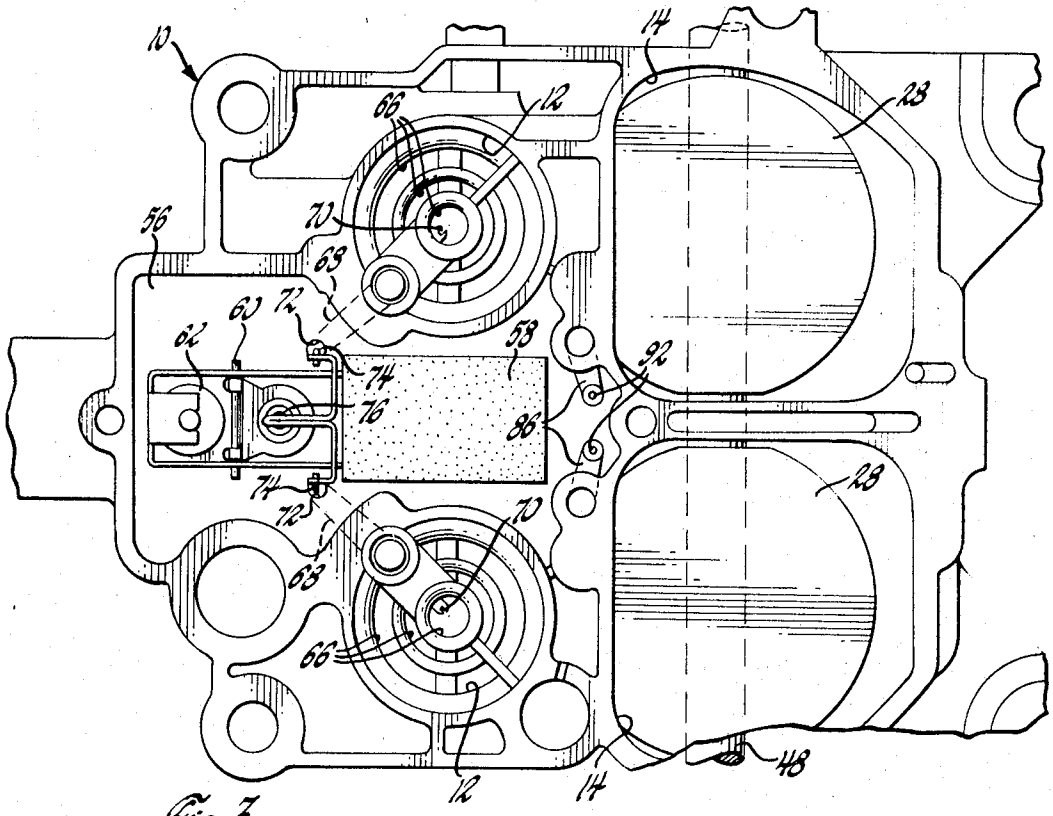


Fig. 3

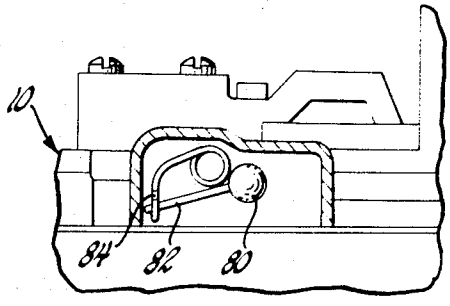


Fig. 4

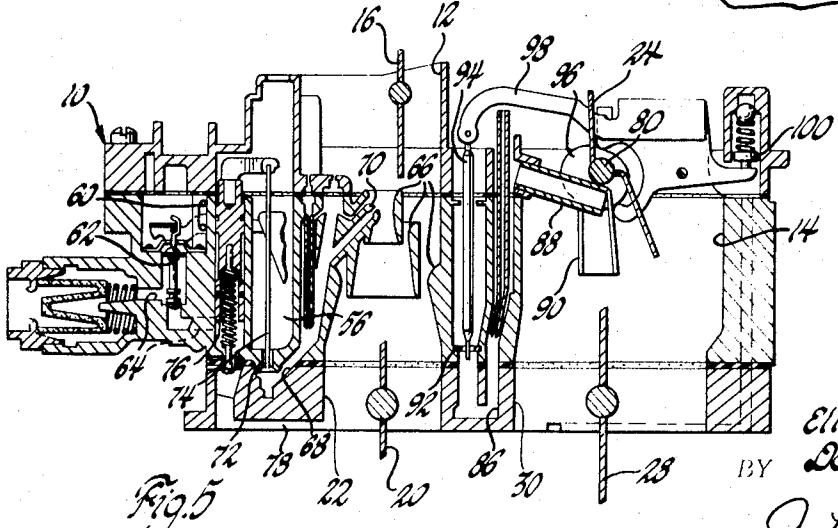


Fig. 5

INVENTORS
Ellsworth A. Kehoe &
Donald B. Stoltman
BY
J. L. Carpenter
ATTORNEY

CARBURETOR

This application is a continuation of copending application Ser. No. 504,691, filed Oct. 24, 1965 and now abandoned. Because of the demand for engines of large displacement, it has become necessary to develop a carburetor of increased airflow capacity. It is now known that this cannot be accomplished most efficiently by merely increasing the diameter of the present plain tube carburetor mixture conduits since an increase in the area of a venturi, which meters fuel in a plain tube carburetor, reduces the sensitivity of fuel metering in the low airflow ranges. Thus, an alternative means of metering fuel is a highly desirable component of a carburetor having capacity for high airflows.

In an air valve carburetor, which meters fuel past a metering rod positioned by an airflow sensing valve, the metering signal is not limited by a fixed area of the mixture conduit. Therefore, the air valve carburetor may be as large as required and thus provides means for accurate metering of fuel over a wide range of airflow rates.

Nevertheless, venturi metering of fuel is extremely sensitive in the low airflow ranges of engine operation, and the sensitivity of fuel metering is improved as the diameter of the venturi is reduced. Such reduction, of course, restricts the airflow capacity.

This invention provides a carburetor embodying fuel metering means combining these conflicting considerations in a compact design which has proven to be highly efficient throughout a greatly increased range of engine airflow rates. This carburetor includes a primary stage having a pair of small diameter mixture conduits in which fuel is metered by the depression in a venturi, and a secondary stage having a pair of large diameter mixture conduits in which fuel is metered past metering rods positioned by an airflow-sensing valve. Such an arrangement provides sensitive metering of the fuel in the primary stage when engine airflow rates are low and yet provides a carburetor with large capacity for high rates of airflow.

The details as well as other objects and advantages of this invention are disclosed in the following description and in the drawings in which:

FIG. 1 is a side elevational view of a carburetor showing the throttle linkage for sequentially actuating the primary and secondary stages of the carburetor;

FIG. 2 is a top plan view of the carburetor of FIG. 1 illustrating the relative sizes and positions of the primary and secondary mixture conduits;

FIG. 3 is a plan view of the carburetor with the air horn section removed and looking generally along line 3—3 of FIG. 1, illustrating the configuration of the fuel bowl;

FIG. 4 is a sectional view along line 4—4 of FIG. 2 illustrating the spring which controls the air valve opening movement; and

FIG. 5 is a schematic sectional view through the metering elements of the primary and secondary stages.

Referring first to FIG. 1, the carburetor 10 has a pair of primary mixture conduits 12 and a pair of secondary mixture conduits 14. A choke valve 16, controlled in the conventional manner, is disposed in the inlet 18 to primary mixture conduits 12. A throttle valve 20 is disposed in the outlet 22 from each mixture conduit 12. An air valve 24 is disposed in the inlet 26 to each secondary mixture conduit 14, and a throttle valve 28 is disposed in the outlet 30 from each secondary mixture conduit 14.

It will be noted that the diameter of secondary throttle valves 28 is significantly greater than that of primary throttle valves 20. In operation, it has been found that the pressure drop across secondary throttle valves 28 between atmospheric pressure on the upstream side and manifold vacuum on the downstream side creates a substantial vertical force on the secondary throttle shaft and increases the frictional resistance to initial opening movement of the secondary throttles. The throttle linkage described below overcomes this frictional resistance so that a smooth and gradual increase in the rate of engine airflow may be obtained.

A primary throttle lever 32 is secured to the primary throttle shaft 34 and includes an opening 36 by which connection may be made to an accelerator pedal (not shown). A pin 38 is carried by lever 32 which, after predetermined opening movement of primary throttle level 32, contacts a tang 40 on a lever 42 rotatably mounted about shaft 34. Subsequent opening movement of primary throttle lever 32 produces clockwise rotation of lever 42. A link 44 secured to lever 42 contacts a secondary throttle lever 46 secured to the secondary throttle shaft 48. Initial clockwise rotation of lever 42 moves link 44 toward the right whereupon the upper portion 50 of link 44 contacts the extended arm 52 of secondary throttle lever 46 to produce initial opening movement of secondary throttles 28. This initial cracking of secondary throttle valves 28 reduces the pressure drop and overcomes the frictional load on throttle shaft 48. During this initial opening of secondary throttle valves 28, link 44 slides through a slot 54 in lever 46. When link 44 contacts the end of slot 54, a shorter lever arm is provided on secondary throttle lever 46 and secondary throttles 28 are opened at an increased rate.

Referring momentarily to FIG. 3, it will be noted that the pair of primary mixture conduits 12 are transversely disposed on opposite sides of a single fuel bowl chamber 56 and that secondary mixture conduits 14 are transversely disposed at the end of fuel bowl 56. A float pontoon 58 in fuel bowl 56 is located substantially at the center of the carburetor and pivots about a pin 60 to regulate an inlet valve 62 which, as shown in FIG. 5, controls fuel flow through the inlet 64 to fuel bowl chamber 56. By locating pontoon 58 in the center of the carburetor, its response to surges of fuel in bowl 56 is reduced and the inlet valve 62 is held on its seat.

Referring further to FIGS. 3 and 5, a venturi arrangement 66 is disposed in each primary mixture conduit 12 to provide a pressure signal indicative of the primary airflow. A pair of fuel passages 68 extend from fuel bowl 56 and terminate in nozzles 70 discharging into each of the small venturis 66. The rate of discharge of fuel into venturis 66 is directly controlled by the pressure therein. Additionally, a metering orifice 72 disposed in each passage 68 at the bottom of fuel bowl 56 is regulated by a metering rod 74. Metering rods 74 are positioned by a piston 76 responsive to manifold vacuum applied through a passage 78. Under conditions of low pressure in mixture conduits 14 below throttle valves 20, piston 76 holds metering rods 74 in orifices 72 to restrict the orifice area and provide an economy mixture. At pressures above a predetermined value, piston 76 is raised by a spring to withdraw metering rods 74 from orifices 72 and provide an enriched mixture for power operation.

Still referring to FIG. 5, it will be noted that air valves 24 and throttle valves 28 provide the only restrictions to secondary airflow through mixture conduits 14. The operation of the secondary stage is fully disclosed and described in U.S. Pat. No. 3,279,767 issued in the name of D. D. Stoltman. Therefore its operation will be only briefly described here.

Air valves 24 are secured on a shaft 80 and are opened by vacuum in mixture conduits 14 as throttle valves 28 are opened. As shown in FIG. 4, shaft 80 carries a pin 82 around which a spring 84 is looped. As air valves 24 are opened, pin 82 pulls against spring 84 to bias the air valves to a closed position. Spring 84 slides along pin 82 so that a constant pressure is created in mixture conduits 14 below air valves 24 throughout the range of air valve opening movement. A pair of fuel passages 86 extend from fuel bowl 56 and terminate in nozzle arrangements 88–90 which discharge fuel in an even dispersion throughout each mixture conduit 14. Flow through passages 86 is controlled by metering orifices 92 and metering rods 94 associated therewith.

A cam 96 mounted on air valve shaft 80 moves a follower 98 which, as air valves 24 open, withdraws metering rods 94 from orifices 92 to increase fuel flow into secondary mixture conduits 14. As described in the above-mentioned U.S. Pat. No. 3,279,767, metering cam 96 has an upper economy scheduling portion and a lower power scheduling portion. Fol-

lower 98 is positioned by a manifold vacuum-responsive piston 100 to control metering rods 94 so that an economy mixture is provided when the pressure in mixture conduits 14 below throttle valves 28 is below a predetermined value and so that an enriched mixture for power operation is provided when the pressure is above a predetermined value.

It will thus be appreciated that this invention provides a multiple stage carburetor which combines a small primary stage having a venturi to provide efficient fuel metering when the engine requires only a low rate of airflow with a large secondary stage in which the fuel metering means does not restrict the high capacity for airflow and yet in which fuel is efficiently metered over a wide range of airflow rates.

We claim:

1. A multiple stage internal combustion engine carburetor comprising a small primary mixture conduit with capacity for airflow at only relatively low rates, a large secondary mixture conduit with capacity for airflow at relatively high rates, means to supply fuel to said mixture conduits, primary and secondary fuel metering means respectively associated with said primary and secondary mixture conduits wherein only said primary fuel metering means includes venturi means disposed in said primary mixture conduit to regulate fuel flow thereto in accordance with airflow therethrough and wherein said secondary fuel metering means includes an air valve disposed in said secondary mixture conduit, means controlling said air valve whereby its rotative position is determined by and is a measure of the rate of airflow through said secondary mixture conduit, a fuel nozzle discharging into an unrestricted portion of said secondary mixture conduit downstream of said air valve, a metering rod regulating fuel flow through said nozzle, and means connecting said air valve and said metering rod to position said metering rod in accordance with air valve position whereby fuel flow through said nozzle is regulated in accordance with the rate of airflow through said secondary mixture conduit, and wherein said carburetor further comprises primary and secondary throttle valves respectively disposed in said primary and secondary mixture conduits, and means to sequentially open said primary and secondary throttle valves.

2. A multiple stage internal combustion engine carburetor comprising fuel bowl means, a primary mixture conduit, a primary throttle valve disposed in said mixture conduit, venturi means disposed in said mixture conduit, a primary fuel passage extending from said fuel bowl means and terminating in a nozzle discharging in said venturi means, a secondary mixture conduit including an inlet for secondary airflow and a mixture outlet, a secondary throttle valve disposed in said mixture outlet, an air valve rotatably disposed in said secondary mixture conduit, means controlling said air valve whereby its rotative position is determined by and is a measure of the rate of secondary airflow, a secondary fuel passage extending from said fuel bowl means and terminating in a secondary nozzle discharging in said secondary mixture conduit downstream of said air valve, a metering orifice in said secondary fuel passage, a metering rod varying the effective area of said orifice, means connecting said metering rod and said air valve to withdraw said rod from and increase the effective fuel discharge area of said orifice during opening rotation of said air valve, and means to sequentially open said primary and secondary throttle valves, said secondary mixture conduit being otherwise unrestrictive to airflow and having an airflow capacity substantially exceeding the airflow capacity of said primary mixture conduit whereby the carburetor combines a large capacity for airflow with sensitive fuel metering in the low airflow ranges.

3. The carburetor of claim 2 wherein said means connecting said metering rod and said air valve includes a cam positioned by said air valve and a follower connected to said metering rod and positioned by said cam for controlling the position of said rod relative to said metering orifice.

4. The carburetor of claim 2 which further includes a primary metering orifice in said primary fuel passage, a primary metering rod controlling the effective area of said primary orifice, and means controlling said primary metering rod in response to the pressure in one of said mixture conduits downstream of the associated throttle valve to provide a relatively restricted effective area of said primary orifice at pressures below a predetermined value and to provide a relatively unrestricted effective area of said primary orifice at pressures above a predetermined value.

* * * * *