

Sept. 24, 1957

C. V. MORTON

2,807,448

CARBURETOR

Filed Sept. 27, 1954

2 Sheets-Sheet 2

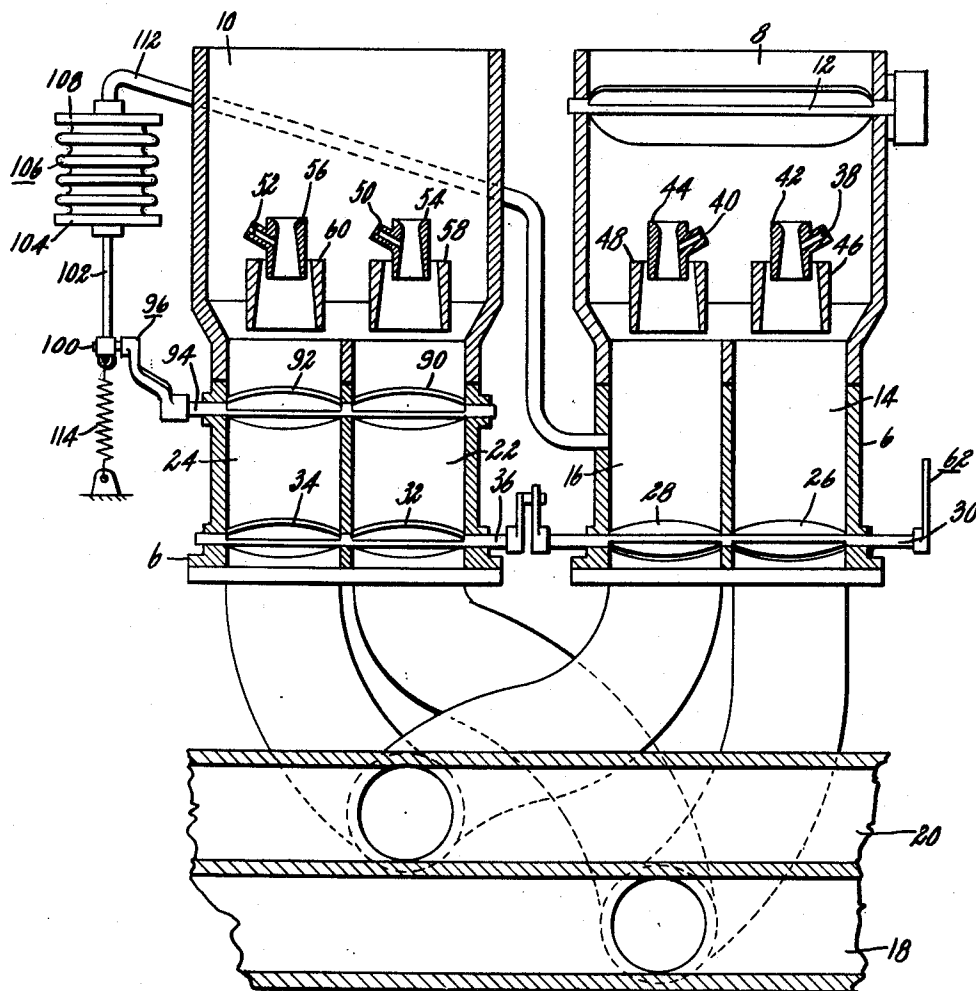


Fig. 2

INVENTOR.
CRAIG V. MORTON

BY *George H. Strickland*
HIS ATTORNEY

2,807,448

CARBURETOR

Craig V. Morton, Dayton, Ohio, assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application September 27, 1954, Serial No. 458,539

11 Claims. (Cl. 261—23)

This invention relates to carburetors and particularly to carburetors of the compound type having a plurality of mixture passages for supplying fuel mixture to the engine which become effective sequentially. Such carburetors may have one primary mixture passage and one secondary mixture passage or may have two of each and only the primary passage or passages is or are operative at relatively low speeds while all the passages are operative at relatively high speeds.

Compound carburetors of this character are generally provided with a primary throttle or a plurality of primary throttles and a single secondary throttle or a plurality of secondary throttles, the secondary throttle or throttles being operated by the primary through the medium of an operating linkage extending from a primary throttle shaft to a secondary throttle shaft. A lost motion connection is provided in this operating linkage so that the secondary throttle shaft is not operated until there has been a considerable opening movement of the primary throttle or throttles.

The extent of opening movement of the primary throttle shaft before movement of the secondary throttle shaft starts is variable with different installations, but usually opening movement of the secondary shaft does not start until there has been sufficient opening of the primary throttle or throttles to correspond to a vehicular speed of 40 M. P. H. or more, on a level.

The throttle operating mechanism is generally so constructed that after the secondary throttle shaft starts to move, its rate of movement is faster than that of the primary throttle shaft so that the entire movement of the secondary throttle shaft takes place while the primary throttle shaft moves from the position above referred to to a position corresponding to wide open throttle position. This is done so that when the primary throttle or throttles reach fully open position, the secondary throttle or throttles occupy the same position.

It has been found that under certain operating conditions, as when the engine is operating relatively slowly with the secondary throttle or throttles in closed position, and there is a rapid opening movement of the primary throttle shaft to a relatively wide open throttle position, the opening movement of the secondary throttle or throttles is of such great extent and so rapid that the mixture becomes temporarily too lean for satisfactory engine operation. This is due to the fact that when any throttle valve is opened to a considerable extent and rapidly, the increase in air flow is much more rapid than the increase in fuel flow, due to inertia. Thus, a large quantity of air is drawn into the mixture passage before a corresponding amount of fuel is supplied to such passage, obviously resulting in the formation, temporarily, of a weaker than normal fuel and air mixture. It is to prevent the formation of such a mixture in the ordinary conventional carburetor that the usual and well-known accelerator pump is provided.

In a compound carburetor having a plurality of mixture passages the conventional pump will not fully take

care of the condition above referred to. If made large enough to supply enough fuel to prevent leaning under the circumstances referred to, the pump would supply too much fuel upon most opening movements of the primary throttle shaft, so that if the pump was effective to provide a rich enough mixture under the particular conditions referred to, too rich a mixture would be provided under other conditions.

It is, therefore, the primary purpose of the present invention to provide means which will be effective to prevent leaning of the mixture under the particular operating conditions referred to, but which will not be effective to provide too rich a mixture under other operative conditions, and will insure that a mixture of proper proportions of fuel and air will be supplied to the engine under all operating conditions which may be encountered in the normal operation of the engine.

According to the present invention, this object is obtained by the provision of an auxiliary throttle valve in the secondary mixture passage or passages, in addition to the secondary throttle, which is responsive to variations in suction in a primary mixture passage on the anterior side of the primary throttle, so that such valve is moved toward open position solely by the effect of increase in suction in the primary mixture and at a rate which is considerably slower than the movement of either the primary or secondary throttle. By the provision of this valve, the admission of air is retarded so that increase in air flow is comparable to increase in fuel flow and the mixture proportions remain substantially the same during any throttle movement.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Figure 1 is a side elevation of a carburetor embodying the present invention; and

Figure 2 is a diagrammatic view, partly in section, illustrating the present invention.

There is shown in Fig. 1 a side elevation of a carburetor which, except for the addition of the present invention, is of substantially the same construction as shown in the pending application of Elmer Olson et al., S. N. 264,136, filed December 29, 1951, now Pat. No. 2,771,282, dated Nov. 20, 1956. Since the specific construction of the carburetor is of no material importance so far as the present invention is concerned, the structural details of the carburetor are not shown and reference may be had to the above application for disclosure of such details.

The carburetor in which the present invention is embodied comprises three separate castings 2, 4 and 6 positioned above each other and separated by suitable gaskets. The casting 2 is an air inlet casting through which air is admitted to be mixed with fuel in mixing chambers which are formed in the casting 4 which also contains a constant level fuel chamber, not shown, which supplies fuel to the mixing chambers, while the casting 6 on which casting 4 is supported, is the throttle body or outlet casting 6 which is supported on the intake manifold of the engine to which it is connected in the usual way.

As indicated in the diagrammatic view, the air inlet is divided into two parts 8 and 10, the inlet 8 being controlled by a choke valve 12 which is automatically controlled in the manner disclosed in the above application, and the inlet 10 is unrestricted.

Air entering inlet 8 flows through two primary mixture passages 14 and 16 which communicate, respectively, with two passages 18 and 20 in the manifold while air entering inlet 10 flows through two secondary mixture pas-

sages 22 and 24 which also communicate, respectively, with passages 18 and 20. It will be apparent from the foregoing that each manifold passage receives fuel mixture from one primary mixture passage and one secondary mixture passage. Flow of mixture from the primary mixture passages into the manifold is controlled by primary throttle valves 26 and 28 secured to a throttle 30 suitably journaled for rotation in casting 6, while flow of mixture from the secondary mixture passages is controlled by secondary throttle valves 32 and 34 secured to a throttle shaft 36 also journaled in the casting 6, which is operated by the shaft 30 through the medium of operating connections more fully described later.

Fuel from the fuel chamber, previously mentioned, is supplied through conduits, not shown, to passages 38 and 40 which connect with primary venturi tubes 42 and 44, respectively, in which a primary mixture of fuel and air is formed, and tubes 42 and 44 discharge into larger venturi tubes 46 and 48, respectively, in which the primary fuel mixture is mixed with additional air. These larger tubes may be formed by the walls of the mixture passages, as shown in application S. N. 264,136, now Pat. No. 2,771,282, dated Nov. 20, 1956, or they may be separate tubes which discharge into the mixture passages, as shown herein. If the latter construction is employed, the mixture discharged from tubes 46 and 48 is mixed with additional air in the mixture passages 14 and 16 into which the tubes discharge.

A similar means for introducing fuel into the secondary mixture passages is employed, fuel being delivered by passages 50 and 52 to primary venturi tubes 54 and 56, respectively, that discharge into larger venturi tubes 58 and 60 which, in turn, discharge into mixture passages 22 and 24.

As already stated, no choke valve is provided in the secondary air supply passage 10, such a valve being unnecessary because the secondary throttles are closed and the secondary mixture passages are ineffective when starting and when operating in the lower speed range.

Flow of combustible mixture from the primary mixture passages to the engine is controlled, as already indicated, by primary throttles 26 and 28 while the secondary throttles 32 and 34 control the flow of mixture from the secondary mixture passages. The mechanism for operating these throttle valves is best shown in Fig. 1 and includes an arm 62 which is supported on the primary throttle shaft 30 but can rotate thereon. Surrounding the shaft 30 is an operating spring 64 one end of which is secured around a pin 66 which projects from shaft 30 while the other end 68 of the spring engages a lateral extension 70 which projects from the arm 62, as shown in Fig. 1, so that the spring forms a resilient operating connection between the shaft 30 and arm 62.

The arm 62 has an arcuate slot 72 formed therein and the bent-over end 74 of an operating link 76 is received in such slot and prevented from disengagement therefrom by a cotter pin which is positioned in a hole in the port 74 or by any suitable means. The other end of the link 76 is pivotally connected to an arm 78 secured to the flattened end 80 of shaft 36 so that movement of arm 78 rotates shaft 36. A spring 82, one end of which is connected to the arm 78 and the other end of which is connected to a pin 84 extending from the casting 4 normally holds the secondary throttle valves in closed position.

The operation of this mechanism is substantially as follows. At normal operating temperatures, the arm 62 is moved with the primary throttle valves by spring 64, as such valves are moved toward open position. After a predetermined opening movement of the primary throttle valves the end of slot 72 engages the end 74 of operating link 76 and further movement of the primary throttles effects opening movement of the secondary throttles. As already stated, movement of the secondary throttles is more rapid than that of the primary throttles because of the geometry of the operating connections, this arrange-

ment being provided so that the primary and secondary throttles reach full open position simultaneously. The spring 64 is provided because the choke valve operates a means, not shown, which prevents any opening of the secondary throttles at operating temperatures below some predetermined temperature. If the primary throttles are opened at such low temperatures beyond the position at which the end of slot 72 engages the end 74 of the operating link 76, the arm 62 will cease to move, but the spring 64 permits the primary throttles to move on further toward open position.

The spring 64 is, of course, stronger than the spring 82, but it does not interfere with the operation of the latter in holding the secondary throttles closed when the engine is not operating because the conventional throttle return spring is stronger than spring 64 and holds the primary throttles closed, thus preventing the spring 64 from opposing the action of spring 82 in closing the secondary throttles. As more fully shown in the aforementioned application, upon return of the primary throttles to closed position, the pin 66 engages a part of the lateral projection 70 to restore arm 62 to the position shown in Fig. 1. It will be noted that the arm 78 has a laterally projecting lug 86 which extends over a toe 88 on the arm or plate 62. If, for any reason, the spring 82 fails to return the secondary throttles to closed position, engagement of toe 88 with lug 86 will effect the closing of such throttles.

Attention is also called to the fact that there may be a series of holes in arm 78 to receive the lower end of link 76, so that the position of the upper end of the link in slot 72 may be adjusted to vary the extent of primary throttle movement before movement of the secondary throttles begins.

The mechanism so far described is all substantially the same as that more fully disclosed in application S. N. 264,136, now Patent No. 2,771,282, dated November 20, 1956, and the improvement which constitutes the present invention will now be described.

According to the present invention, there are provided in the secondary mixture passages at a point anterior to the secondary throttles and posterior to the venturi tubes 58 and 60, two balanced auxiliary valves 90 and 92, positioned in the mixture passages 22 and 24, respectively and both secured to a single operating shaft 94, suitably journaled for rotation in the walls of the casting 6. Secured, in any suitable way, to one end of the shaft 94 outside the casting 6 is an operating arm 96 having a slot 98 adjacent the free end thereof in which a pin 100 suitably secured to the lower end of an operating link 102 is pivotally connected. The upper end of the link 102 is connected to an end plate 104 of a fluid-tight bellows 106 which has an upper end plate 108. The plate 108 has a laterally extending portion which is secured by a screw 110 to the under side of a projecting portion of the casting 4 and a conduit 112 connects the interior of the bellows with the interior of the primary mixture passage 16, in the casting 6 anterior to the primary throttle 28, suitable fluid-tight connections being provided where the conduit connects with the bellows and the casting 6. A spring 114, one end of which is connected to the arm 96 and the other end of which is suitably anchored to the casting 6 normally holds the valves 90 and 92 in closed position.

It will be apparent that whatever degree of partial vacuum or engine suction is maintained in the mixture passage 16, at the point where the conduit connects with such passage, will be communicated to the interior of bellows 106, exerting a force to collapse the bellows and move the valves 90 and 92 toward open position. It should be understood, however, that the force exerted by spring 114 is insufficient to prevent any opening of such valves when the primary throttles are open only sufficiently to effect operation of the engine in the lower part of the speed range. It should also be understood that since the valves 90 and 92 are balanced, the open-

5

ing of such valves is in no way affected by the opening of the secondary throttles 32 and 34 and the only force which is effective to move the valves 90 and 92 toward open position is that exerted by the partial vacuum maintained in the primary mixture passage 16 at the point of connection of conduit 112 therewith.

If the engine is operating with the primary throttles only partly open and the secondary throttles as well as valves 90 and 92 closed, and the primary throttles are then moved suddenly to a relatively wide open position, the secondary throttles will be moved substantially immediately to a position approximating that of the primary throttles. If the valves 90 and 92 were not provided, there would be an immediate in-rush of air without a corresponding quantity of fuel, which would lean the mixture to such an extent that the engine operation would not be satisfactory. However, valves 90 and 92 permit this undesirable leaning of the mixture under the circumstances referred to. When the primary throttles are moved to a relatively wide open position, the suction effective on the bellows 106 is, of course, greatly increased and the valves 90 and 92 will ultimately be moved to a relatively wide open position. However, the increase in the force exerted by the bellows on the valves 90 and 92 is not immediate, such force being built up relatively slowly because of the relatively small size of the conduit 112 by means of which the suction is communicated to the bellows. Therefore, the opening of valves 90 and 92 is retarded and the valves open at such a rate that the increase in air flow through the secondary mixture passages is substantially comparable to the increase in fuel flow and the proportions of air and fuel in the mixture supplied to the engine remain about the same.

In the drawings, a compound carburetor having two primary mixture passages controlled by two primary throttles and two secondary mixture passages controlled by two secondary throttle valves is shown, but the invention is applicable to a carburetor having only one primary and one secondary mixture passage. It will be also understood that the sudden increase in air flow through the primary mixture passage following a sudden opening of the throttle valves such as has been described, is compensated for by the conventional accelerator pump with which the carburetor is provided, but which is not shown nor described herein.

While the embodiment of the present invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A compound carburetor having a primary mixture passage providing combustible mixture for engine operation at all speeds, a secondary mixture passage providing fuel mixture for relatively high speed engine operation only, primary and secondary throttle valves in said primary and secondary mixture passages, respectively, manually operable means for actuating said throttle valves sequentially, an automatically operable auxiliary valve in said secondary mixture passage, and means responsive to suction in the primary mixture passage for operating said auxiliary valve.

2. A compound carburetor having a primary mixture passage providing combustible mixture for engine operation at all speeds, a secondary mixture passage providing fuel mixture for relatively high speed engine operation only, primary and secondary throttle valves in said primary and secondary mixture passages, respectively, manually operable means for actuating said throttle valves sequentially, an auxiliary valve positioned in said secondary mixture passage anterior to the manually operable secondary throttle, and means responsive to suction in the primary mixture passage for automatically operating said auxiliary valve.

3. A compound carburetor having a primary mixture passage providing combustible mixture for engine oper-

6

ation at all speeds, a secondary mixture passage providing fuel mixture for relatively high speed engine operation only, primary and secondary throttle valves in said primary and secondary mixture passages, respectively, manually operable means for actuating said throttle valves sequentially, an automatically operable auxiliary valve in said secondary mixture passage, and means responsive to the suction maintained in the primary mixture passage anterior to the manually operated primary throttle for operating said auxiliary valve.

4. A compound carburetor having a primary mixture passage providing combustible mixture for engine operation at all speeds, a secondary mixture passage providing fuel mixture for relatively high speed engine operation only, primary and secondary throttle valves in said primary and secondary mixture passages, respectively, manually operable means for actuating said throttle valves sequentially, an automatically operable auxiliary valve in said secondary mixture passage, said auxiliary valve being balanced with respect to the force exerted by the fluid flowing through said mixture passage so that such fluid exerts no force tending to open said valve, a suction operated member operatively connected to said auxiliary valve and effective to move said valve toward open position, and means for communicating the suction maintained in the primary mixture passage to said suction operated member.

5. A compound carburetor having a primary mixture passage providing combustible mixture for engine operation at all speeds, a secondary mixture passage providing fuel mixture for relatively high speed engine operation only, primary and secondary throttle valves in said primary and secondary mixture passages, respectively, manually operable means for actuating said throttle valves sequentially, an automatically operable auxiliary valve in said secondary mixture passage, said auxiliary valve being balanced with respect to the force exerted by the fluid flowing through said mixture passage so that such fluid exerts no force tending to open said valve, a suction operated member operatively connected to said auxiliary valve and effective to move said valve toward open position, and a suction conduit extending from said member to a point in said primary mixture passage anterior to the manually operated primary throttle.

6. A compound carburetor having a primary mixture passage providing combustible mixture for engine operation at all speeds, a secondary mixture passage providing fuel mixture for relatively high speed engine operation only, primary and secondary throttle valves in said primary and secondary mixture passages, respectively, manually operable means for actuating said throttle valves sequentially, an automatically operable auxiliary valve in said secondary mixture passage, and means responsive to suction in the primary mixture passage for operating said auxiliary valve, said means including a suction operated bellows operatively connected with said auxiliary valve and a restricted suction conduit connecting said bellows with the primary mixture passage so that the action of the bellows and the movement of the auxiliary valve thereby are delayed with respect to changes in suction in the primary mixture passage.

7. A compound carburetor having a primary mixture passage providing combustible mixture for engine operation at all speeds, a secondary mixture passage providing fuel mixture for relatively high speed engine operation only, primary and secondary throttle valves in said primary and secondary mixture passages, respectively, manually operable means for actuating said throttle valves sequentially, an automatically operable auxiliary valve in said secondary mixture passage, and means responsive to suction in the primary mixture passage for operating said auxiliary valve, said means including a suction operated bellows operatively connected with said auxiliary valve and operative to move such valve toward open position upon increase in suction effective on the bellows, a

conduit connecting the bellows with the primary mixture passage anterior to the manually operated primary throttle so that the suction effective on the bellows increases as the primary throttle is opened, said conduit being so restricted that any increase in suction in the bellows is delayed with respect to increase in suction in the primary mixture passage and opening of the auxiliary valve is delayed relative to the opening of the primary throttle.

8. A compound carburetor having a primary mixture passage providing combustible mixture for engine operation at all speeds, a secondary mixture passage providing fuel mixture for relatively high speed engine operation only, primary and secondary throttle valves in said primary and secondary mixture passages, respectively, manually operable means for actuating said throttle valves sequentially, an automatically operable auxiliary valve in said secondary mixture passage, a suction operated member operatively connected to said auxiliary valve and effective to open the latter when the suction on said member increases, means for communicating the suction of the primary mixture passage anterior to the primary throttle to said suction operated member so that the suction effective on said member increases as the primary throttle is opened and a spring opposing the operation of said suction operated member with sufficient force to prevent opening of said auxiliary valve until the primary throttle is opened beyond the low speed range.

9. A compound carburetor having a primary mixture passage providing combustible mixture for engine operation at all speeds, a secondary mixture passage providing fuel mixture for relatively high speed engine operation only, primary and secondary throttle valves in said primary and secondary mixture passages, respectively, an operating linkage between the primary and secondary throttle valves including a lost motion connection, so that the secondary throttle is not opened until the primary throttle has made a predetermined opening movement and thereafter is moved simultaneously with the primary throttle, a suction operated auxiliary valve in said secondary mixture passage, means responsive to variations in suction in the primary mixture passage for operating said auxiliary valve, and means for causing the operation of said auxiliary valve to be always delayed relative to operation of the primary throttle.

10. A compound carburetor having a plurality of primary mixture passages which provide combustible mixture for engine operation at all speeds, a plurality of secondary mixture passages which provide combustible mixture for relatively high speed engine operation only, a plurality of simultaneously operated primary throttles controlling the flow of mixture through the primary mix-

ture passages, a plurality of simultaneously operated secondary throttles controlling the flow of mixture through the secondary mixture passages, an operating linkage between the primary and secondary throttles including a lost motion connection whereby opening of the secondary throttles is effected only after the primary throttles have been moved a predetermined distance toward open position, an auxiliary valve in each of the secondary mixture passages and means for automatically operating said auxiliary valves simultaneously including a single suction operated member operatively connected to both auxiliary valves and a suction conduit connected to one of said primary mixture passages so as to communicate the suction maintained in said primary mixture passage to said suction operated member, and effective to move said auxiliary valves toward open position upon increase of suction in the primary mixture passage at the point of connection of said suction conduit therewith.

11. A compound carburetor having a plurality of primary mixture passages which provide combustible mixture for relatively high speed engine operation only, a plurality of simultaneously operated primary throttles controlling the flow of mixture through the primary mixture passages, a plurality of simultaneously operated secondary throttles controlling the flow of mixture through the secondary mixture passages, an operating linkage between the primary and secondary throttles including a lost motion connection whereby opening of the secondary throttles is effected only after the primary throttles have been moved a predetermined distance toward open position, an auxiliary valve in each of the secondary mixture passages and means for automatically operating said auxiliary valves simultaneously including a single suction operated member operatively connected to both auxiliary valves and a suction conduit connected to one of said primary mixture passages anterior to the primary throttle therein so that the suction effective on said suction operated member is increased and the auxiliary valves are moved toward open position upon opening movement of the primary throttle valves.

References Cited in the file of this patent

UNITED STATES PATENTS

1,904,634	Teeter	Apr. 18, 1933
1,929,193	Teeter	Oct. 3, 1933
2,315,183	Bicknell et al.	Mar. 30, 1943
2,390,019	Winkler et al.	Nov. 27, 1945
2,420,925	Wirth	May 20, 1947
2,434,192	Braun	Jan. 6, 1948
2,647,502	Braun	Aug. 4, 1953