

Sept. 13, 1966

C. L. MARTIN

3,272,483

CARBURETOR

Filed June 10, 1965

4 Sheets-Sheet 1

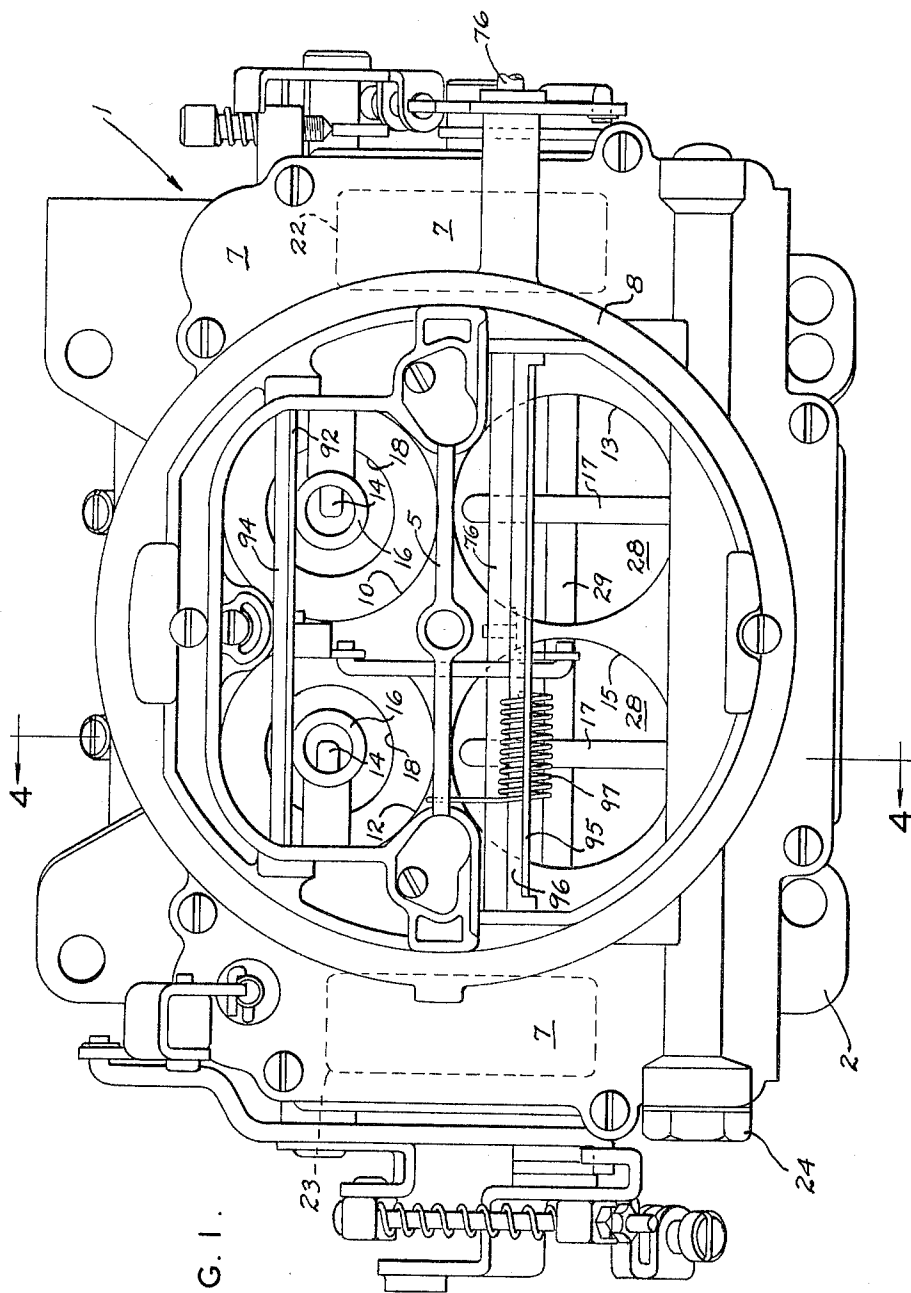


FIG. 1.

INVENTOR.
CHARLES L. MARTIN

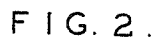
BY *Edward H. Casey*

ATTORNEY

Filed June 10, 1965

CARBURETOR

4 Sheets-Sheet 2



Sept. 13, 1966

C. L. MARTIN

3,272,483

CARBURETOR

Filed June 10, 1965

4 Sheets-Sheet 3

FIG. 4.

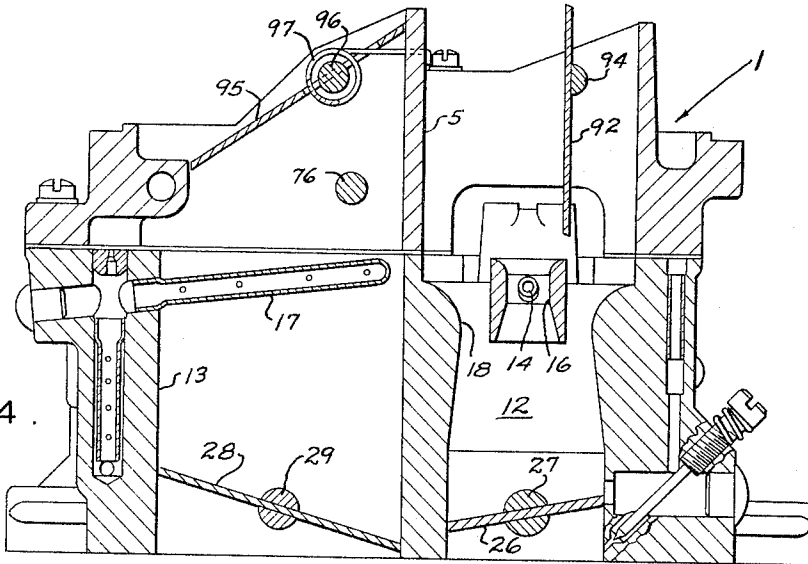


FIG. 5B.

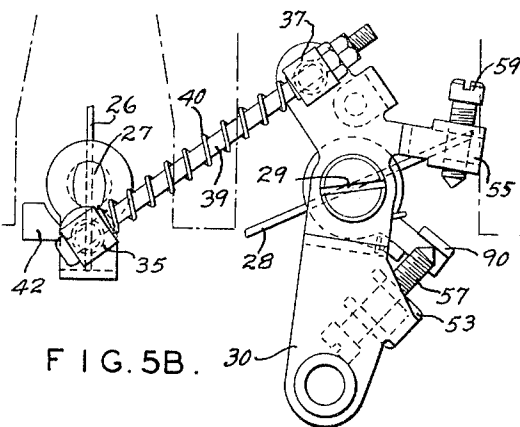


FIG. 5A.

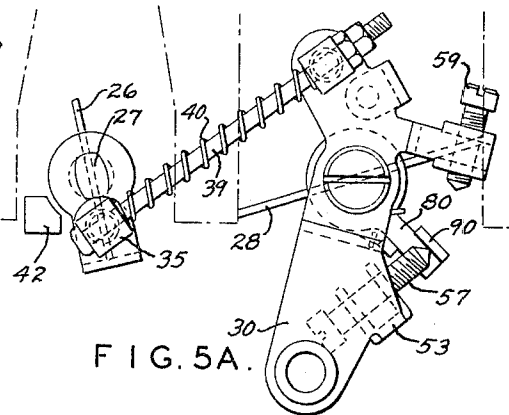


FIG. 5C.

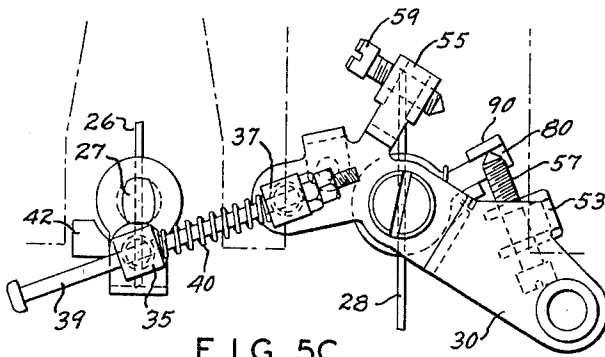
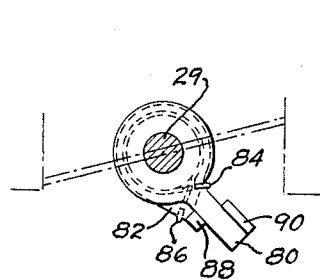


FIG. 6.



Sept. 13, 1966

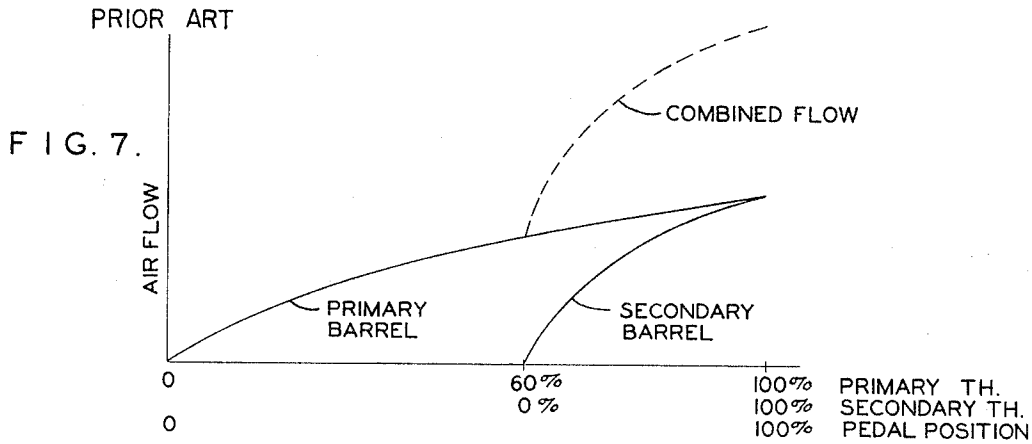
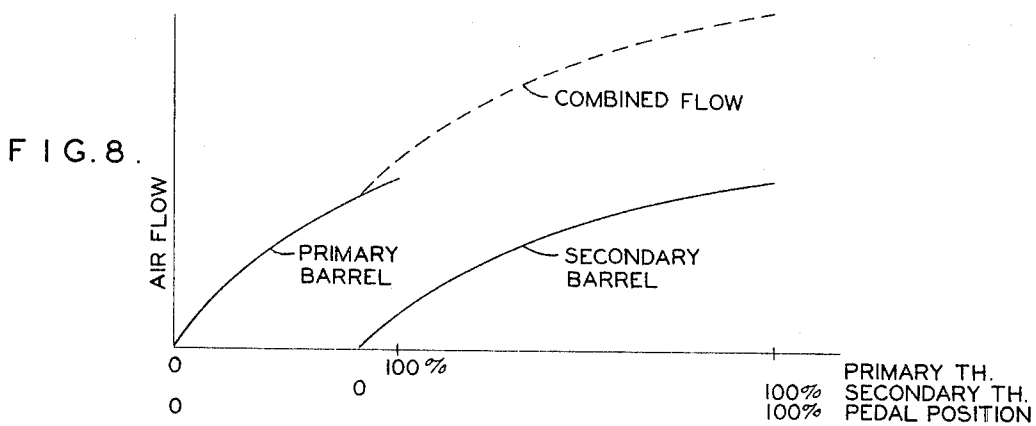
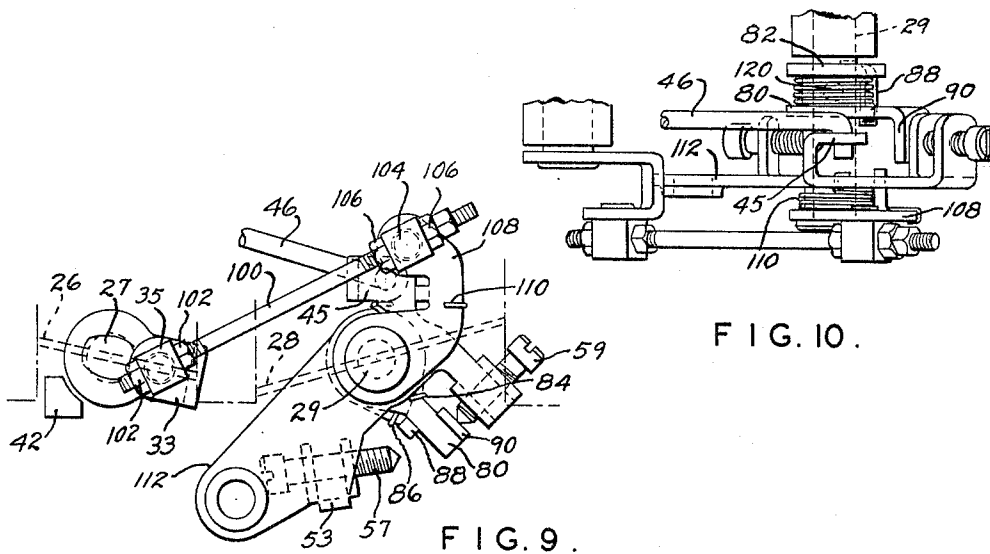
C. L. MARTIN

3,272,483

CARBURETOR

Filed June 10, 1965

4 Sheets-Sheet 4



1

3,272,483

CARBURETOR

Charles L. Martin, St. Louis, Mo., assignor to ACF Industries, Incorporated, New York, N.Y., a corporation of New Jersey

Filed June 10, 1965, Ser. No. 462,981

5 Claims. (Cl. 261—23)

This invention relates to an improvement in multistage, multibarrel carburetors, and in particular to a carburetor of this type of simplified construction and improved performance in the part-throttle to full-throttle engine operating range. In one of its aspects the invention relates to an improved throttle linkage for sequentially opening the primary throttles and secondary throttles.

Multistage carburetors are those which have a plurality of fuel and air mixture passages leading to the intake manifold of an engine. At least one of the mixture conduits, called a primary, is used to supply the fuel mixture to the engine during starting and from low to normal driving speeds under light loads. One or more other mixture conduits, called a secondary, becomes operative when a certain primary throttle opening is reached to provide more fuel and air to the engine for higher speeds or for greater loads at low speeds. Multibarrel, multistage carburetors of this general type are shown and described in U.S. Patent 3,030,085 to L. B. Reed.

In prior art carburetors the throttle shaft of the primary barrels have been directly connected to the accelerator pedal of the automobile. Suitable linkages were then provided from the primary throttle shaft to the secondary throttle shaft to allow the opening of the secondary throttle at the proper time. This type of operation results in the opening of the primary throttles through approximately two-thirds of their total travel after which the secondary throttles begin to open, but the secondary throttles move much more rapidly so that both throttles reach maximum opening at the same time. Where the primary bores are relatively small and the secondary bores are relatively much larger, the just mentioned type of operation results in a very rapid increase in flow capacity of the carburetor once the secondaries begin to open. One result of such operation is a rather strong surge after the secondary throttles begin to open. This could result in a type of operation in highway driving where a very slight movement of the accelerator pedal will result in a large increase in speed and this proves annoying, at least to some drivers. I have devised a new throttle linkage which smooths out the transition from primary to secondary throttle operation and reduces the surge that occurs with slight throttle advances, while yet retaining the large increase in capacity and in flow through the carburetor that is desirable for full throttle operation.

Accordingly, it is an object of the invention to provide a two-stage carburetor with a smooth transition between primary and secondary operation.

It is still another object of the invention to provide a multistage carburetor with improved linkage between the primary and secondary throttles. The invention is described herein with respect to multistage, multibarrel carburetors with a pair of primary mixture conduits or barrels and a pair of secondary mixture conduits or barrels, in which the primaries are controlled by a pair of connected throttles and the secondaries by a separate pair of connected throttles. The invention, however, is applicable to other types of carburetors such as a two-stage, two-barrel carburetor. In the carburetor described below separate pairs of throttles are operated sequentially. The primaries are preferably plain tubes having

2

venturi restrictions and equipped with a choke valve and an automatic control to operate the choke valve. The secondaries may be simple plain tube carburetors with or without venturies and provided with an automatic air valve located upstream of the fuel nozzle in the plain tubes of the secondaries. The improvement herein disclosed provides means for opening the primary throttles throughout their entire operating range and additional means for operating the secondary throttles throughout their complete operating range in such a manner that the secondary throttles will begin to open at a time prior to the full opening of the primary throttles and will continue to open until some time later than the full opening of the primary throttles.

Other objects and advantages of this invention will be apparent to any person skilled in the art, upon a reading of the following detailed description, the claims, and the drawings in which,

FIGURE 1 is a top plan view of a carburetor constructed in accordance with the invention;

FIGURE 2 is a side elevation illustrating the novel throttle linkage of the invention;

FIGURE 3 is a side elevation of the opposite side of the carburetor of FIGURE 1;

FIGURE 4 is a sectional view taken along the lines 4—4 of FIGURE 1;

FIGURES 5a, 5b and 5c are diagrammatic representations of the throttle linkage at different positions;

FIGURE 6 shows a detail of a split lever on the throttle shaft;

FIGURE 7 is a graph of the air flow of a prior art carburetor;

FIGURE 8 is a graph of the air flow through a carburetor according to the invention;

FIGURE 9 is an end view of an alternate throttle linkage; and

FIGURE 10 is a top view of the linkage of FIGURE 9.

In the embodiment of the invention of FIGURES 1 to 4, a carburetor body 1 is provided with flanges 2 by which the carburetor is secured to a suitable mounting pad at the inlets of an intake manifold of an engine. Secured on the carburetor body 1 is a float bowl cover 7 which includes an air horn 8 formed integrally therewith. As shown in FIGURE 1, this is a four-barrel carburetor and has a pair of primary stages comprising a pair of mixture conduits or barrels 10 and 12, respectively. The secondary stage has a pair of mixture conduits or barrels 13 and 15, respectively. The air horn has a central partition 5 (shown in FIGURE 1) dividing the air horn and separating the primary conduits from the secondary conduits. Primary barrels 10 and 12 are identical and one description will be explanatory of both. Each of these barrels has a fuel nozzle 14 opening in a primary venturi 16. Each primary venturi 16 is in turn disposed coaxially within a main venturi 18 (FIGURE 4).

The secondary barrels 13 and 15 are also alike and similar to the primaries, so that a description of one secondary will serve for both. Each secondary barrel 13 has a fuel nozzle 17. The primary and secondary barrels 10 and 13 have their fuel nozzles 14 and 17, respectively, connected with a fuel bowl located at 22, while primary and secondary barrels 12 and 15 have fuel nozzles connected with a fuel bowl located at 23. The fuel bowls and the several fuel circuits are as shown and described in the aforementioned Reed Patent 3,030,085. These fuel bowls are both supplied with fuel from a single inlet connection 24 on the float bowl cover. Primary barrels 10 and 12 are controlled respectively by separate throttle valves 26, such as shown in FIGURE 4, which are mounted on a single throttle shaft 27. Both secondary barrels 13 and 15 similarly have separate manually con-

trolled throttles 28 fixed to and operated by a single throttle shaft 29. Shafts 27 and 29 are rotatably mounted in the body of the carburetor.

One end of the secondary throttle shaft 29 mounts a throttle lever 30 (FIGURE 2) with an eye 31 for connection with a manually operated throttle linkage. Lever 30 is loose on shaft 29. Primary throttle shaft 27 is provided with a lever 33 which is fixed to the end of the shaft. Lever 33 is provided with a swivel 35 and lever 30 is provided with a swivel 37. A connecting rod 39 passes through suitable eyes in swivels 35 and 37 to connect the primary throttles to the secondary throttles. A compression or pusher spring 40 surrounds rod 39 and extends throughout the length of the rod between the two swivels. Rod 39 is held in place by a head at one end and a nut or nuts 41 at the other end. The effective length of rod 39 can be adjusted by nut 41.

When lever 30 is moved (counterclockwise, as shown in FIGURE 2), swivel 37 presses against spring 40 which in turn presses against swivel 35, thus causing arm 33 to rotate shaft 27, opening the primary throttles. When the primary throttle has reached its maximum opening, a stop 42 prevents further rotation and spring 40 then is compressed with any additional movement of lever 30.

A tab 45 on lever 30 is provided to drive link 46 which in turn operates accelerator pump 50 by way of rocker arm 51. Tabs 53 and 55 are provided for holding screws 57 and 59. The function of these screws will be hereinafter explained.

A secondary throttle lockout device is provided to prevent opening of the secondary throttle prior to the time that underhood temperatures have caused the automatic choke mechanism to open the choke of the primary bore to its wide open position. The lockout mechanism is described in detail in the patent to Ott et al., 3,043,572. As shown in FIGURE 3, a dog 60 is fixed to the end of secondary throttle shaft 29 for rotation therewith. The dog 60 has a projecting lug 62 for fitting into a matching slot 64 of a lockout lever 66. The lockout lever 66 is freely pivoted for rotation on a stud 68. Independently pivoted on stud 68 is a fast idle cam 70. The fast idle cam is connected by a link 72 to an arm 74 of a counter-shaft 76 which is connected at its other end to an automatic choke mechanism not shown. A tab 78 on the fast idle cam engages a surface of the lockout lever 66 when the choke is open to move the lockout lever out of the way of lug 62 so that the dog 60 and secondary shaft 29 are then free to rotate.

Referring to FIGURE 6, the remainder of the mechanism necessary in conjunction with the lockout mechanism is shown. The end of the shaft 29 (shown also in FIGURE 2) has a loose lever 80 and a fixed lever 82. A coil spring surrounds the shaft 29 and has an end 84 hooked over the arm 80 and another end 86 hooked over the arm 82. When the secondary throttle is locked out, movement of arm 80 is possible because of the coil spring. When the secondary throttles are unlocked, movement of the arm 80 by way of the coil spring causes movement of arm 82 and hence throttle shaft 29, thus opening the secondary throttles. A tab 88 on arm 82 engages a surface of arm 80 during closing movement to make possible a positive closing of the secondary throttles. The mechanism just described with reference to FIGURE 6 is also known as a split lever and is so named because one portion can move even when the other portion cannot.

When throttle arm 30 (FIGURE 2) is moved to open the throttle, screw 57 is raised toward tab 90 of lever arm 80. When screw 57 contacts tab 90, the secondary throttle will begin to open unless it is locked out. The opening sequence is shown in FIGURES 5a, 5b and 5c. As shown in FIGURE 5a, with primary throttle 26 about 15 degrees from the fully open position screw 57 has just contacted tab 90. Further rotation of throttle arm 30 results in a partial opening of the secondary throttle 28, as shown in FIGURE 5b. At this point the primary

throttle 26 is fully open. Finally, in FIGURE 5c, both the primary and secondary throttles are shown in the fully open position. It is to be mentioned that in the closing sequence, if for any reason the secondary throttle valve does not close promptly, screw 59 will contact the other side of tab 90 and force the secondary throttle into closed position. Screw 57 can be adjusted to cause the secondary throttle to begin the opening sequence either earlier or later than is shown in FIGURE 5a and screw 59 can be adjusted to regulate the positive return of the throttle to closed position.

As is customary, carburetor 1 is provided with a choke valve 92 mounted on a shaft 94 (FIGURE 4) and an air valve 95 mounted on shaft 96. The air valve is biased towards closed position by a coil spring 97. The air valve normally opens in response to demand for air when the secondary throttles are open.

Multistage carburetors have come into widespread use to satisfy the demands of high displacement, high horsepower engines. By use of primary and secondary barrels, it is possible to provide superior performance and economy through the primary barrels for low speed, low load operation, while still retaining the high capacity necessary for high speed heavy loads by way of the secondary barrels. With many prior art carburetors, the primary and secondary throttles were linked together in such a manner that the primary throttles rotated through approximately 60 to 70 percent of their range before the secondary throttles began to open. At this point both throttles moved toward the open position at the same time, with the secondary throttle moving much more rapidly, so that when the primary throttles were fully open the secondary throttles were also fully open. With this arrangement a small amount of movement of the accelerator pedal resulted in a large amount of movement of the secondary throttle, which at times required that a very sensitive control be exercised by the driver.

The foregoing is illustrated in FIGURE 7, where air flow is plotted against throttle position and expressed as a percentage of the fully open position. With any well-designed carburetor, fuel flow is a function of air flow through the carburetor and the power that can be developed by the engine is therefore a direct function of the air flow through the carburetor. In FIGURE 7 the curve marked with the legend "Primary barrel" represents air flow through the primary barrel of a multistage carburetor. The curve marked "Secondary barrel" represents the air flow through the secondary of a multistage carburetor. The dashed line marked "Combined flow" represents the air flow through both barrels of the carburetor.

No exact scale for air flow is used in FIGURES 7 and 8, since the flow will vary according to the size of the carburetor. Further, it is to be mentioned that the additional flow caused by the opening of the secondaries is shown to be equal to that of the primary alone despite the fact that the secondary is larger. This is approximately correct because the manifold depression is less at wide throttle conditions and a smaller volume of air will be drawn into the manifold.

As shown in FIGURE 7, air flow increases from zero throttle opening to a maximum at 100%. The secondary barrel begins to open at a set position of the primary throttle here shown as 60% and, as the secondary throttle opens from zero to 100% of full opening, the flow through the secondary increases. Accordingly, flow of air through the carburetor follows the primary curve up to the beginning of the secondary throttle opening or the 60% line, after which the total flow through the carburetor follows the curve marked "Combined flow." From this it is seen that the rate of increase of air flow through the carburetor increases sharply and markedly when the secondary barrels begin to open. This can result in the sudden surge of power that has been experienced with some prior art carburetors. Where rapid

acceleration or the sudden application of a greatly increased load is experienced, this type of performance may be satisfactory. However, there are certain situations where the initiation of secondary barrel operation occurs at some steady-state cruising speed where a slight advance of the accelerator pedal would cause the secondary barrels to open up slightly but even this slight movement would result in a large change in total air flow and therefore a large change in speed. Some drivers find this to be objectionable.

The throttle linkage herein disclosed makes possible a considerable smoothing out of the air flow curve of a carburetor. With the linkage of the invention it is possible to have a smooth transition from primary only to primary and secondary operation. As shown in FIGURE 8, the linkage of the invention permits primary throttle opening of zero to 100% during a foot pedal travel of only zero to 40% and a secondary throttle operation of zero to 100% while the foot pedal is being moved from 40% to 100%. This results in a curve marked "Combined flow" that approaches the desired curve. The rate of change of air flow with opening of the secondary barrels is not nearly so great as the change in FIGURE 7, and in fact is not only an acceptable curve but a desirable one. It may be noted here that the geometry of the throttle linkage can be altered as desired to permit primary throttle operation over a greater or lesser accelerator pedal travel than that shown in FIGURE 8. Also, the linkage can be modified to allow the secondary throttles to operate over a greater or lesser amount. One such adjustment is provided by means of screw 57, which will control the pedal position at which the secondary throttles will begin to open. Similarly, adjustment of the nut on rod 39 will shorten or lengthen the effective link of rod 39 and this again will affect the amount of overlap of throttle position.

In FIGURES 9 and 10 there is shown an alternate embodiment of my invention. FIGURES 9 and 10 have retained the same numerals as FIGURE 2 insofar as possible. A primary throttle valve 26 is mounted on a shaft 27 and an arm 33 is mounted also on the shaft. Swivel 35 on arm 33 is adapted to receive an end of a rod 100 which is fastened to the swivel to a pair of nuts 102. The other end of rod 100 is received into a swivel 104 and retained in place by a pair of nuts 106. Swivel 104 is mounted on a loose lever 108 pivoted on shaft 29. Loose lever 108 is biased by a spring 110 in such a direction as to urge it in the direction of opening throttle 26. One end of coil spring 110 is hooked over a side of lever 108. The other end of spring 110 is hooked over throttle arm 112. Arm 112 is loosely pivoted on secondary throttle shaft 29. A tab 45 is provided for driving accelerator pump link 46. Thus, when arm 112 is rotated (counterclockwise as shown in FIGURE 9), the spring 110 will cause loose lever 108 to follow along, thus forcing primary throttle 26 open by way of the arm 33 and rod 100. When throttle 26 reaches its full open position as determined by the stop 42, continued movement of arm 112 will be taken up by way of spring 110 which wraps up on the shaft to create slight additional tension.

As explained earlier in connection with FIGURE 2, a screw 57 on a tab 53 mounted on arm 112 picks up a tab 90 of loose lever 80 to open secondary throttle 28 as heretofore explained. In the event secondary throttle 28 is locked out, loose lever 80 will move without opening the throttle, as was explained in connection with FIGURE 6. As shown in FIGURE 10, lever 82, which cooperates with loose lever 80 by way of tab 88, is solid on the shaft 29, being affixed thereto by any convenient means such as a set screw 120. The linkage of FIGURES 9 and 10 will operate substantially the same as that of FIGURES 1 through 4.

While a preferred mode of constructing a carburetor according to the invention has been shown, various

modifications will occur to one skilled in the art. What is claimed is:

1. A multistage carburetor for an internal combustion engine comprising

- (1) a body structure having at least one primary mixture conduit and at least one secondary mixture conduit for the flow of air and fuel mixture therethrough;
- (2) idle and main fuel systems including a main fuel nozzle for said primary conduit;
- (3) a main fuel system including a main fuel nozzle for said secondary conduit;
- (4) manually operated primary and secondary throttles movably mounted on primary and secondary throttle shafts in the respective mixture conduits downstream of said main fuel nozzles for controlling the flow of air-fuel mixture therethrough;
- (5) means for sequentially opening said primary and secondary throttles including
 - (a) a foot pedal actuated lever arm pivotally mounted on the said secondary throttle shaft;
 - (b) a secondary throttle lever fixed to said secondary throttle shaft;
 - (c) a primary throttle lever fixed to said primary throttle shaft;
 - (d) pusher means constituting a connecting rod operatively connected by way of a split lever to said foot actuated lever arm and to said primary lever for urging the latter in a direction to open the said primary throttle, said pusher means and split lever having means to allow the said secondary throttle to continue moving in a direction to open the same after the said primary throttle is fully open.

2. A multistage carburetor for an internal combustion engine comprising

- (1) a body structure having at least one primary mixture conduit and at least one secondary mixture conduit for the flow of an air and fuel mixture therethrough;
- (2) idle and main fuel systems including a main fuel nozzle for said primary conduit;
- (3) a main fuel system including a main fuel nozzle for said secondary conduit;
- (4) manually operated primary and secondary throttles movably mounted on primary and secondary throttle shafts in the respective mixture conduits downstream of said main fuel nozzles for controlling the flow of air-fuel mixture therethrough;
- (5) means for sequentially opening said primary and secondary throttles including
 - (a) a foot pedal actuated lever arm pivotally mounted on the said secondary throttle shaft;
 - (b) a secondary throttle lever fixed to said secondary throttle shaft;
 - (c) a primary throttle lever fixed to said primary throttle shaft;
 - (d) pusher means operatively connected to said foot actuated lever arm and said primary lever for urging the latter in a direction to open the said primary throttle;
 - (e) a tab on said secondary throttle lever and
 - (f) means including adjustable means on said foot pedal actuated lever arm adapted to engage a first surface of said tab whereby to initiate opening of said secondary throttle after said primary throttle has been at least partially opened.

3. The carburetor of claim 2 further comprising a second adjustable means on said foot pedal actuated lever arm adapted to engage a second surface of said tab whereby to positively urge the said secondary throttle toward a closed position upon foot pedal movement.

4. A multistage carburetor for an internal combustion engine comprising

7

- (1) a body structure having at least one primary mixture conduit and at least one secondary mixture conduit for the flow of an air and fuel mixture therethrough;
- (2) idle and main fuel systems including a main fuel nozzle for said primary conduit; 5
- (3) a main fuel system including a main fuel nozzle for said secondary conduit;
- (4) manually operated primary and secondary throttles movably mounted on primary and secondary throttle shafts in the respective mixture conduits downstream of said main fuel nozzles for controlling the flow of air-fuel mixture therethrough; 10
- (5) means for sequentially opening said primary and secondary throttles including 15
 - (a) a foot pedal actuated lever arm pivotally mounted on the said secondary throttle shaft;
 - (b) a secondary throttle lever fixed to said secondary throttle shaft;
 - (c) a primary throttle lever fixed to said primary throttle shaft and 20
 - (d) pusher means constituting a connecting rod operatively connected by way of a split lever to said foot actuated lever arm and to said primary lever for urging the latter in a direction to open the said primary throttle, said pusher means and said split lever having means 25

8

- to allow the said secondary throttle to continue moving in a direction to open the same after the said primary throttle is fully open,
- (e) a tab on said secondary throttle lever and
 - (f) adjustable engaging means on said foot pedal actuated lever arm adapted to engage a first surface of said tab whereby to initiate opening of said secondary throttle after said primary throttle is at least partially open.

5. The carburetor of claim 4 further comprising a second adjustable means on said foot pedal actuated lever arm adapted to engage a second surface of said tab whereby to positively urge the said secondary throttle toward a closed position upon foot pedal movement.

References Cited by the Examiner

UNITED STATES PATENTS

2,609,807	9/1952	Winkler.
2,832,576	4/1958	Henning.
3,030,085	4/1962	Read.
3,043,572	7/1962	Ott et al.

FOREIGN PATENTS

734,667	8/1955	Great Britain.
---------	--------	----------------

HARRY B. THORNTON, *Primary Examiner.*

RONALD R. WEAVER, *Assistant Examiner.*