

June 27, 1967

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3,328,008

CARBURETOR

Filed Sept. 23, 1965

3 Sheets-Sheet 1

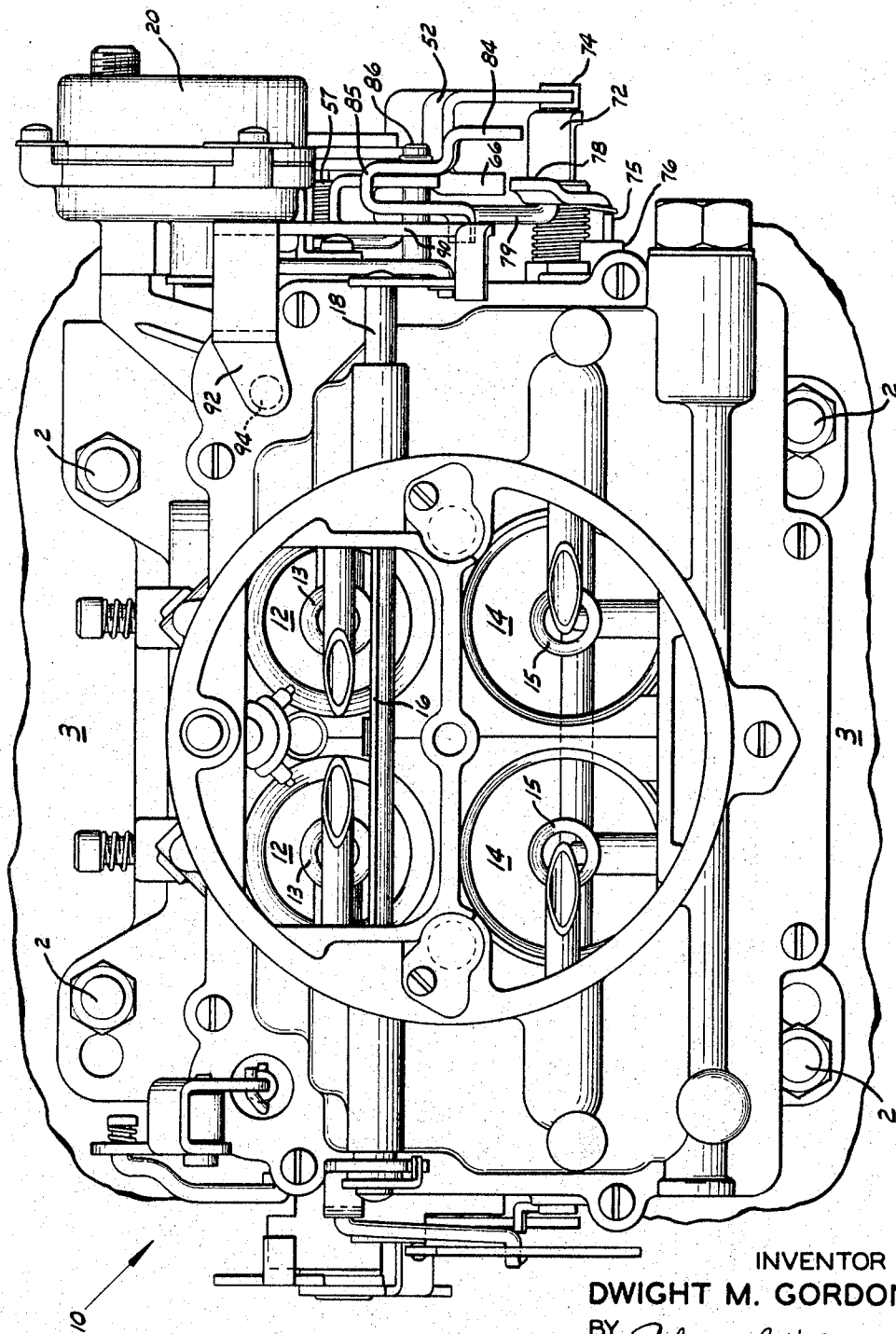


FIG. 1.

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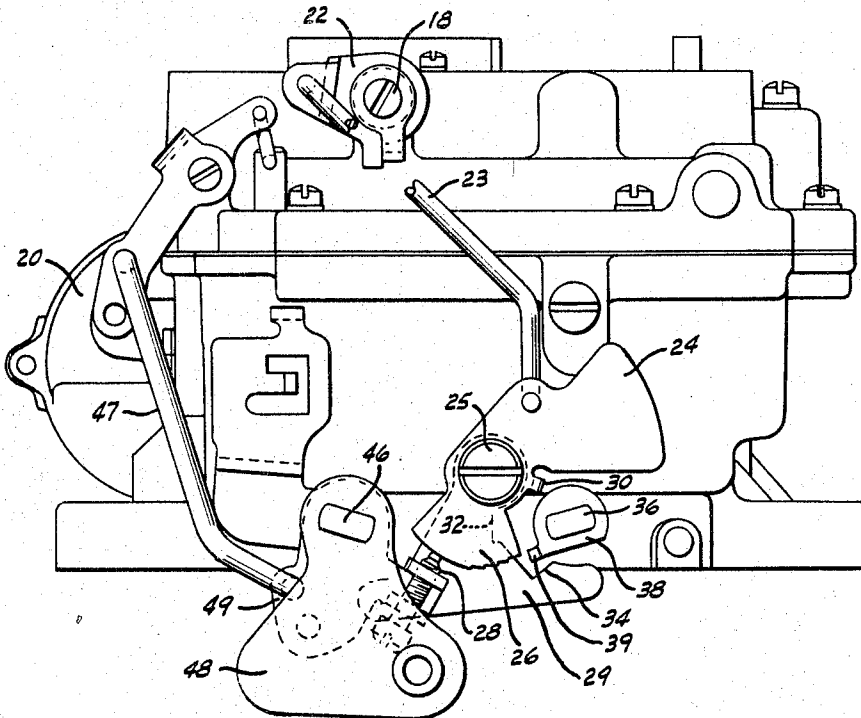


FIG. 2.

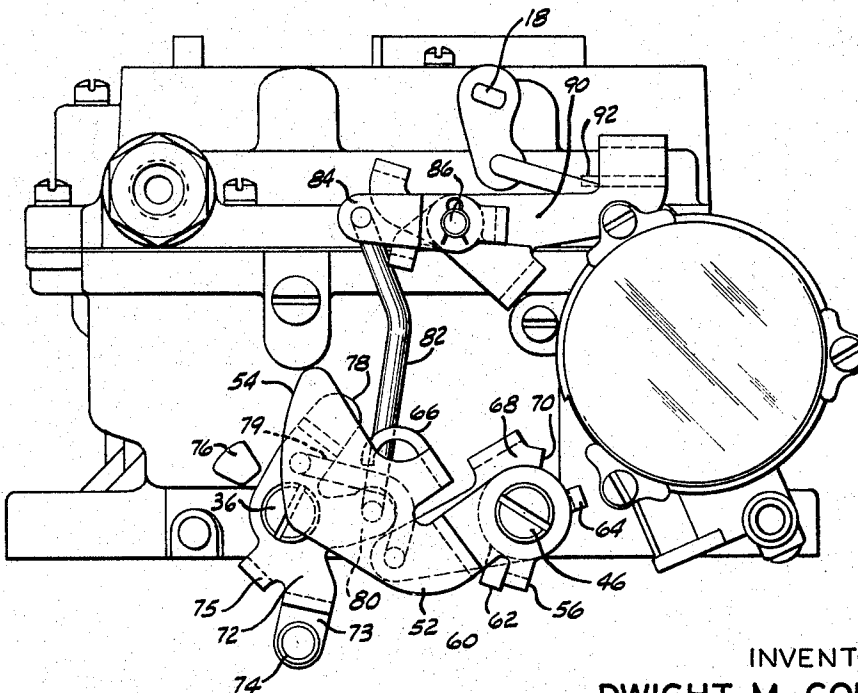


FIG. 3.

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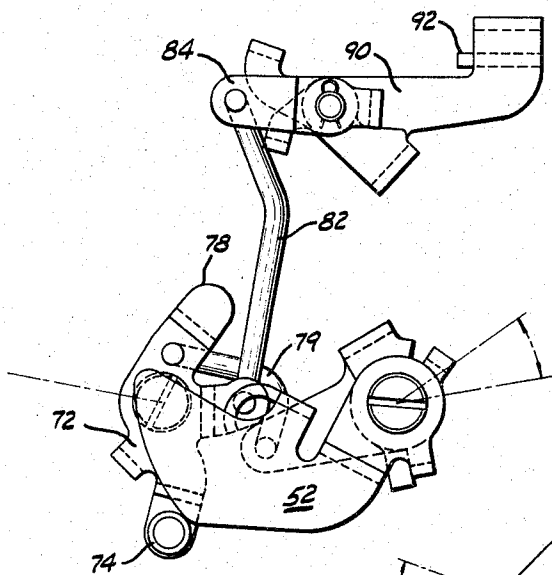


FIG. 4.

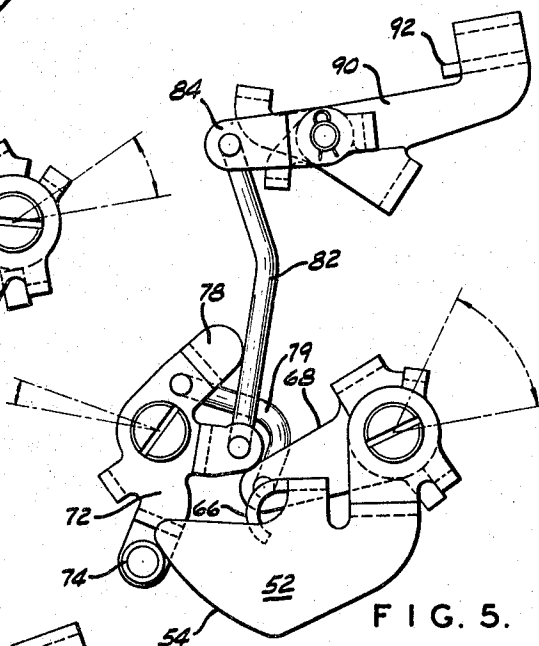


FIG. 5.

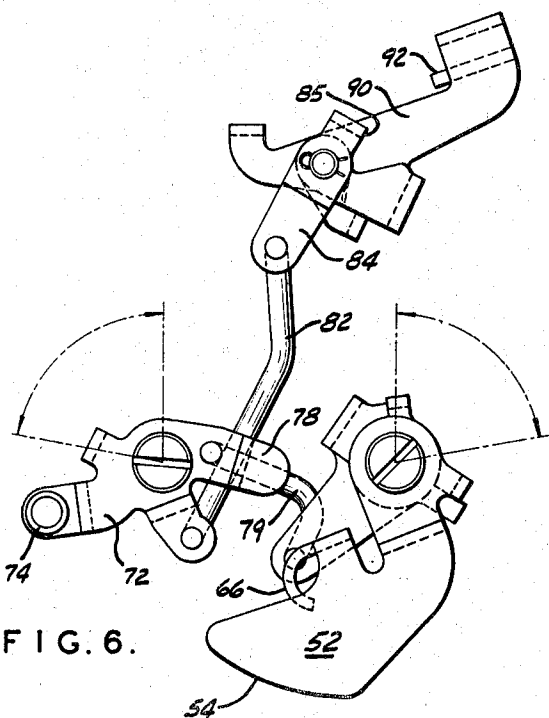


FIG. 6.

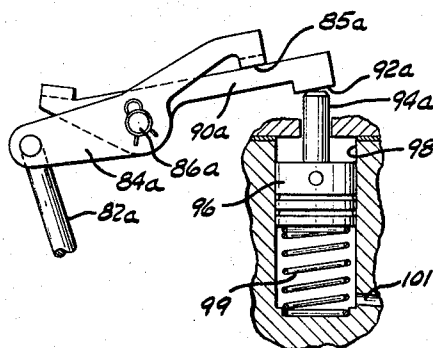


FIG. 7.

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9 Claims. (Cl. 261—23)

This invention relates to carburetors for internal combustion engines, and in particular to multistage, multi-barrel carburetors having provision for the admission of excess air to the intake manifold of the internal combustion engine during intervals of deceleration.

As is well-known, it is the function of the carburetor of the automotive internal combustion engine to supply the proper fuel-air mixture to the intake manifold of the engine according to operating conditions at any given time. To this end the carburetor will usually supply a fairly rich mixture for curb idle conditions, and a leaner mixture at part-throttle steady state cruising conditions. The fuel-air ratio may vary from approximately 12 to 1 at curb idle to the considerably leaner 15 to 1 ratio for steady state cruising.

It is also well-known that in the intake manifold of an internal combustion engine, gasoline has a tendency to collect or condense on the walls of the intake manifold and particularly on the lower surfaces thereof where it forms a layer or pool of fuel. This condensed fuel is of only minor importance during normal operation, since it is constantly being withdrawn and replenished in a more or less stable fashion. However, upon deceleration when the throttle valve of the carburetor is closed, the manifold vacuum changes from the normal 12 to 15 inches of mercury vacuum to as much as 23 inches mercury vacuum. This higher vacuum causes the thus collected fuel to flash rapidly into vapors and because of the greatly reduced quantity of air entering by way of the carburetor, a very rich mixture can be furnished to the individual cylinders for a short interval of time. This very rich mixture frequently is incompletely burned in the individual cylinders with the result that unburned hydrocarbons are exhausted by way of the exhaust ports and exhaust manifold. These unburned hydrocarbons, of course, are an important constituent of smog. Under certain conditions the unburned hydrocarbons will ignite in the exhaust manifold resulting in backfire. I have found that with certain modifications to the carburetor structure it is possible to admit additional air to the intake manifold during deceleration conditions, whereby a more nearly correct air-fuel mixture can be supplied to the engine, thus reducing the quantity of unburned hydrocarbons issuing from the engine and substantially eliminating the tendency of the engine to backfire. Accordingly, it is a primary object of the invention to provide a new and improved carburetor structure which will provide a predetermined optimum mixture of fuel and air to the engine during the period of deceleration.

It is another object of the invention to provide suitable linkages between the primary throttle shaft and the secondary throttle shaft whereby the secondary throttle will be opened slightly during a portion of the opening movement of the primary throttle.

It is yet another object of the invention to provide a slow closing mechanism for retarding the closing of the secondary throttle.

These and other objects of the invention will be readily apparent from a perusal of the drawing, the specification and the attached claims.

According to the invention, the primary and secondary throttle shafts are connected together in such a fashion that the primary shaft will open a predetermined num-

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ber of degrees, such as 25 to 30 degrees, without disturbing the position of the secondary throttle. At that time the further movement of the primary throttle shaft through an additional range up to approximately 60 degrees opening of the primary throttle, will progressively open the secondary throttles by a small amount such as from 5 to 15 degrees from the closed position. Thereafter the normal linkages will take over so that as the primary throttle shaft is moved to its full open position the secondary throttle will also move to its full open position so that the two throttles reach the maximum opening at the same time.

There is also provided a slow closing mechanism for the secondary throttles, so that during deceleration when the primary throttles are abruptly closed, the secondary throttle will remain open for a short interval against the bias of the slow closing mechanism. In the invention as illustrated, the slow closing mechanism takes the form of a dashpot operating with liquid in the dashpot, the liquid being the fuel of the carburetor. The delay in closing may range from one to as much as six or seven seconds, depending on circumstances. In an actual carburetor the delay in closing is of the order of five seconds.

In the drawing,

FIGURE 1 is a top plan view of a carburetor according to the invention.

FIGURE 2 is an end view of the carburetor.

FIGURE 3 is an opposite end view of the carburetor, showing the linkages connecting the primary and secondary throttle shafts.

FIGURE 4 shows the operating mechanism of the throttle shafts in an intermediate position.

FIGURE 5 shows the operating mechanism of the throttle shafts in still another intermediate position.

FIGURE 6 shows the operating mechanism when the throttles are in full open position, and

FIGURE 7 is a simplified schematic of the dashpot actuating mechanism.

Referring to FIGURE 1, there is shown generally at 10 a carburetor of the invention. The carburetor 10 is attached by way of bolts 2 to the intake manifold 3 of an internal combustion automotive engine. The carburetor is provided with a pair of primary mixture conduits 12 and a pair of secondary mixture conduits 14. Mixture conduits such as shown here are frequently called barrels. Each primary mixture conduit or barrel is provided with a main fuel nozzle cluster 13 for supplying the primary fuel to the mixture conduit. Also provided but not shown is the idle mixture passage for supplying fuel at curb idle and low part-throttle operation.

The secondary mixture conduits are provided with main fuel nozzle clusters 15, although in some carburetors of this general type the venturi is omitted and only a straight fuel nozzle is used.

As is customary, the primary side of the carburetor is provided with a choke plate 16, rotatably mounted on a shaft 18, which by way of suitable linkages is controlled by a thermostat indicated generally at 20.

Referring to FIGURE 2, it is seen that one end of choke shaft 18 is provided with a lever arm 22, which is connected by way of link 23 with a fast idle cam 24. The fast idle cam is mounted freely on a pivot 25 and is also provided with a stepped portion 26 for adjustment of the idle speed of the engine by way of idle speed adjusting screw 28. Also mounted on pivot 25 is a secondary throttle lockout 29, which lockout rotates freely on the pivot. A tab 30 on the fast idle cam moves downwardly under influence of the thermostatic coil relaxing when the engine warms up and engages a surface 32 on the secondary lockout to move it out of the locking position.

The secondary throttles are mounted for rotational movement on a throttle shaft 36, which shaft has mounted

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on it at one end a short lever arm 38, having a tab 39. The tab 39 is positioned slightly above a surface 34 of the secondary lockout. The purpose of the secondary lockout is to prevent opening of the secondary throttles prior to the time that the engine is fully warmed up. As shown in FIGURE 2, it is clear that as the choke opens to its full open position, link 23 moves fast idle cam 24 in a clockwise direction, thus rotating tab 30 to engage surface 32, moving the secondary lockout 29 out of the way so that tab 39 of the secondary throttle can clear the surface 34 of the lockout 29 and permit the secondary throttles to be rotated to any position after the engine has fully warmed up.

As shown in FIGURE 2, there is a clearance between the tab 39 and the surface 34 at the time both primary and secondary throttles are closed. The clearance is equal to approximately 5 to 15 degrees of secondary throttle rotation and is necessary in the practice of the invention as it will be hereinafter explained.

Also shown in FIGURE 2 is an end of the primary throttle shaft 46, on which is mounted an actuating lever arm 48 for connection to an accelerator pedal not shown. Also mounted on the end of throttle shaft 46 is a lever arm 49, upon which is mounted the idle speed adjusting screw 28 and to which is connected a link 47 for actuating the accelerator pump of the carburetor.

Referring to FIGURE 3, it is seen that the secondary throttle shaft 36 and the primary throttle shaft 46 now occupy the reverse position to that shown in FIGURE 2. Mounted on and fixed to shaft 46 is a lever arm 52, which is provided with a cam surface 54. Arm 52 also has a tab 56 which is bent backwardly in the view of FIGURE 3. A coil spring 57 (see FIGURE 1) has one end hooked over tab 56. Spring 57 encircles the end of shaft 46 outside the body of the carburetor. A loose lever 60 is provided with tabs 62 and 64. The other end of coil spring 57 engages the lower surface of tab 64. Lever 52 is also provided with a turned over portion 66, with a curved end which serves as a positive secondary throttle closing device.

Also mounted on shaft 46 is another loose lever 68, having a surface 70 for engagement by tab 64.

Mounted on secondary throttle shaft 36 and fixed thereto is a lever arm 72. Arm 72 is provided with an extension 73 upon which is mounted a roller 74 for engagement with cam surface 54, as will be hereinafter explained. Arm 72 is also provided with a backwardly extending tab 75 which when the arm is rotated in the clockwise position comes to rest against a boss 76, thus limiting the amount the secondary throttles can be opened. Still another extension of arm 72 is shown at 78, which extension coacts with the curved surface 66 to serve as a positive closer for the secondary throttle. A link 79 connects arm 72 with arm 68. Still another extension of arm 72, shown at 80, provides means for receiving an end of link 82. The other end of link 82 connects to a loose lever 84 mounted on a pivot 86.

Also mounted on pivot 86 is an arm 90, having a folded over extension 92. The extension 92 is adapted to engage the top of a stem 94 of the dashpot assembly.

The dashpot driving mechanism, as shown in FIGURES 1 and 3, is illustrated as it would be built for some particular carburetor. A simplified schematic of the dashpot and driving mechanism is shown in FIGURE 7, where corresponding numerals with the subscript A are used to denote the parts of the mechanism. Thus a link 82A is connected to the lever arm 84A which pivots on a pin 86A. Assuming the arm 84A to be rotating in a clockwise direction, a surface 85A presses against an upper surface of a lever arm 90A, also pivoted on pin 86A, and this in turn causes an extension 92A to press upon the stem 94A of the dashpot. Attached to the end of the stem 94A is a piston 96, which is received within the walls of a cylinder 98. A biasing spring 99 is placed

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beneath the piston to urge the piston in an upward direction. The space beneath the piston communicates by way of a restrictive passageway 101 with the fuel bowl of the carburetor, so that fuel is drawn into the space under the piston or expelled therefrom, depending upon the direction of movement of the piston. The restriction 101 controls the rate at which the piston moves.

The operation of the linkages between the two throttle shafts and also to the dashpot will now be explained with particular reference to FIGURES 3 through 6. In FIGURE 3 the throttle shafts, lever arms and linkages are shown in the throttle closed position. As the primary throttle is rotated (counterclockwise) lever arm 52 moves downwardly until at the angle shown in FIGURE 4 cam surface 54 just touches roller 74. At this point the secondary throttle is still closed. Also, there has been no movement of the dashpot operating mechanism. Additional rotation of the primary throttle through the angle shown results in cam surface 54 moving lever arm 72 in a clockwise direction by a few degrees as indicated in FIGURE 5. At this time the primary throttle is open approximately 60 degrees and the secondary throttle approximately 8 or 9 degrees. However, it should be borne in mind that the linkages and levers can be modified to give a greater or lesser opening of the primary throttle as well as a greater or lesser opening of the secondary throttle. Also shown in FIGURE 5 is the downward movement of link 82, which pulls lever 84 in a counterclockwise direction, thus allowing lever 90 to rise and the dashpot piston 96, under the influence of biasing spring 99, moves upwardly to make contact between the stem 94 and the extension 92 of lever 90.

Finally, in FIGURE 6 both secondary and primary throttles have reached the fully open position and cam surface 54 has moved completely away from roller 74. Upon closing of the primary throttle, as would happen under deceleration conditions, the lever arm 52 rotates clockwise and the extension 66 will rise until it contacts the extension 78 of arm 72, thus forcing the secondary throttle to begin a closing movement. When the throttles have assumed the approximate position of FIGURE 5, the dashpot will begin resisting the closing movement of the secondary throttles, even though the primary throttle is brought to the fully closed position. Under these circumstances, minimum fuel will flow from the idle fuel system of the primary barrel and air will be admitted by way of the partially open secondary throttle to lean out the mixture in the intake manifold of the engine so that more complete combustion of the mixture will take place in the cylinders of the engine and backfiring will be prevented. After a short interval of time e.g. 1 to 5 seconds, the dashpot will have allowed the secondary throttle to come to the fully closed position and after that time engine operation will be normal.

In a multistage carburetor of the type herein described, the secondary barrel is intended to supply additional air and fuel for heavy engine demands. However, in the practice of the invention it is necessary that when the secondary throttles are urged open by the cam surface 54, little or no fuel be supplied by the secondary side. This is easily taken care of by the calibration of the fuel system in the primary barrel to supply the addition fuel required when the secondary throttle is cracked open. The fuel system of the secondary side will be adjusted so that fuel will not flow in the secondary main fuel nozzle until the secondary throttle is opened to some position beyond the opening provided by the cam surface 54. In this fashion air only will be supplied by the secondary side of the carburetor during deceleration conditions and the leaning out of the air-fuel mixture will be accomplished in accordance with the object of the invention.

While a liquid dashpot utilizing the fuel of the carburetor has been illustrated, it will be readily apparent that an air type dashpot, either of the piston type or the diaphragm type, could be utilized in the practice of the inven-

tion. These and other modifications will become apparent to one skilled in the art, and it not intended that the invention be limited beyond that which is set forth in the appended claims.

I claim:

1. Apparatus for reducing the tendency of an internal combustion engine to backfire due to unavoidable enrichment of fuel/air mixture during deceleration conditions, comprising a two stage carburetor adapted to be mounted on an intake manifold, a primary mixture conduit in said carburetor for supplying the said combustible mixture at low to moderate loads, a secondary mixture conduit for supplying additional fuel during periods of heavy load, and an anti-backfire device comprising means for opening the said secondary throttle approximately 5 to 15 degrees during mid-range opening of the said primary throttle to admit additional air to the intake manifold without admission of additional fuel and means including a dashpot mechanism operatively coupled to said secondary throttle to delay closing thereof after said primary throttle has been closed for deceleration.

2. The invention of claim 1 in which the said means for opening comprises a cam on said primary throttle and a cam follower on said secondary throttle, the said cam being contoured to move the said follower and the said secondary throttle to open the said secondary throttle by from 5 to 15° while the said primary throttle is moved through the range of approximately 25 degrees from closed position to approximately 65 degrees from closed position.

3. The invention of claim 2 in which the said dashpot comprises a piston in a cylinder.

4. In an internal combustion engine carburetor having at least one primary barrel equipped with a pedal actuated throttle valve and an idle fuel circuit and a main fuel circuit and a secondary barrel provided with a throttle valve and a main fuel circuit, the improvement comprising means connecting the secondary throttle shaft to the primary throttle shaft so as to permit an initial movement of said primary shaft without movement of said secondary shaft, means to open said secondary throttle up to about 15° upon continued movement of said primary shaft, means to open said secondary throttle to its full open position upon continued opening of said primary throttle to its full open position and means to retard the closing of the said secondary throttle during the final closing thereof.

5. The carburetor of claim 4 in which the means to retard closing is a dashpot operatively connected to the said secondary throttle shaft.

6. The carburetor of claim 5 in which the said means

to open the said secondary throttle up to about 15° comprises a cam mounted on said primary throttle shaft and a cam follower mounted on said secondary throttle shaft.

7. The carburetor of claim 6 in which the said cam is so contoured that it will not engage the said follower until a predetermined opening of the said primary throttle has been effected.

8. Apparatus for reducing the tendency of an internal combustion engine to backfire due to unavoidable enrichment of the fuel air mixture during deceleration conditions comprising a two stage carburetor having primary and secondary mixture conduits, a fuel bowl, an idle fuel circuit and a main fuel circuit for said primary conduit and a main fuel circuit for said secondary conduit, a pedal actuated throttle in said primary conduit, a secondary throttle in said secondary conduit, means including a connecting link connecting said secondary throttle to said primary throttle in such a manner as to allow said primary throttle to open to about 50° to 75° of its travel before said link picks up the said secondary throttle to move the same in such a fashion that the said secondary and said primary throttles reach the full open position at the same time, a cam surface mounted on said primary shaft, a cam follower mounted on said secondary shaft, means positioning and arranging said cam surface and said follower such that the said primary throttle will rotate approximately 20 to 35 degrees before contacting the said follower, and means including a dashpot operatively linked to said secondary throttle in such fashion as to retard the closing thereof during approximately the final 5 to 15 degrees of closing of the said secondary throttle.

9. The apparatus of claim 8 in which the said dashpot comprises a piston in a cylinder and in which the said cylinder communicates by way of a restriction with the fuel bowl of the said carburetor.

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