

Nov. 17, 1964

J. S. REID

3,157,170

CARBURETORS

Filed April 13, 1962

7 Sheets-Sheet 1

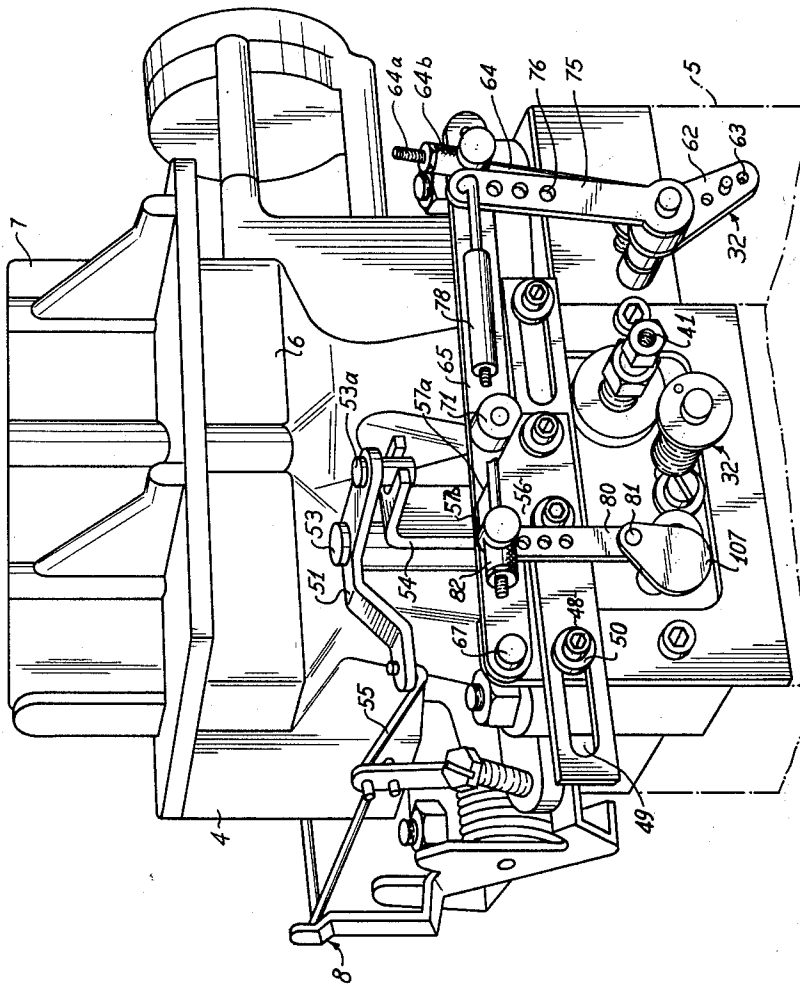


Fig. 1.

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7 Sheets-Sheet 2

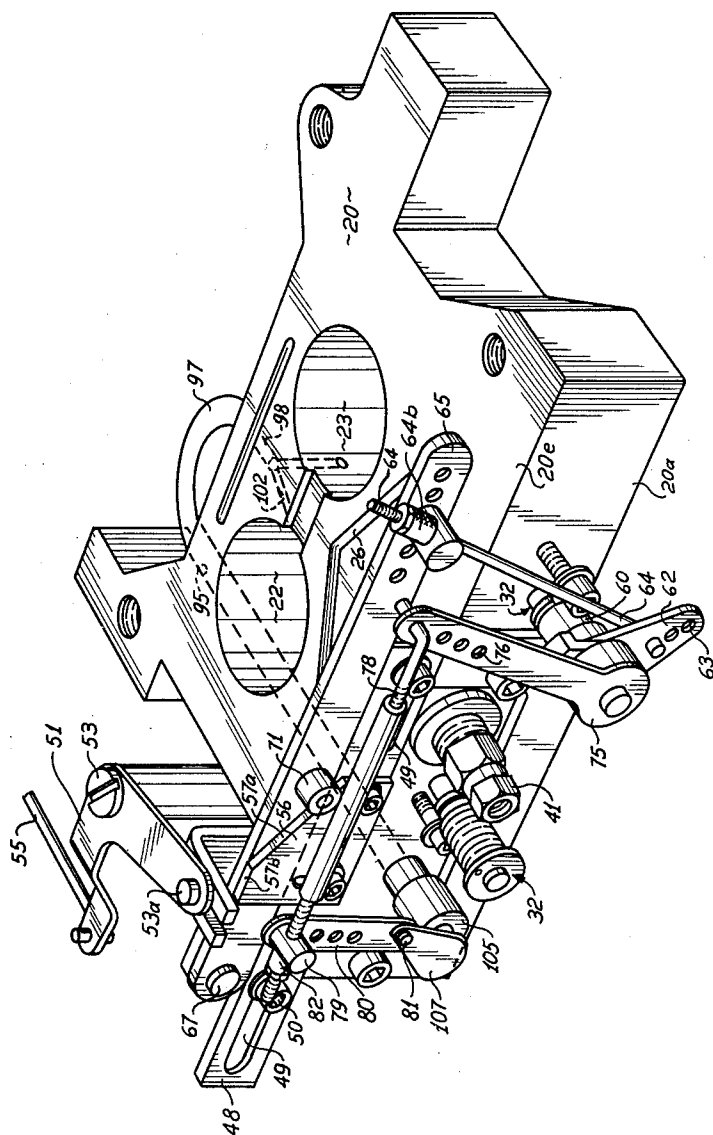


Fig. 2.

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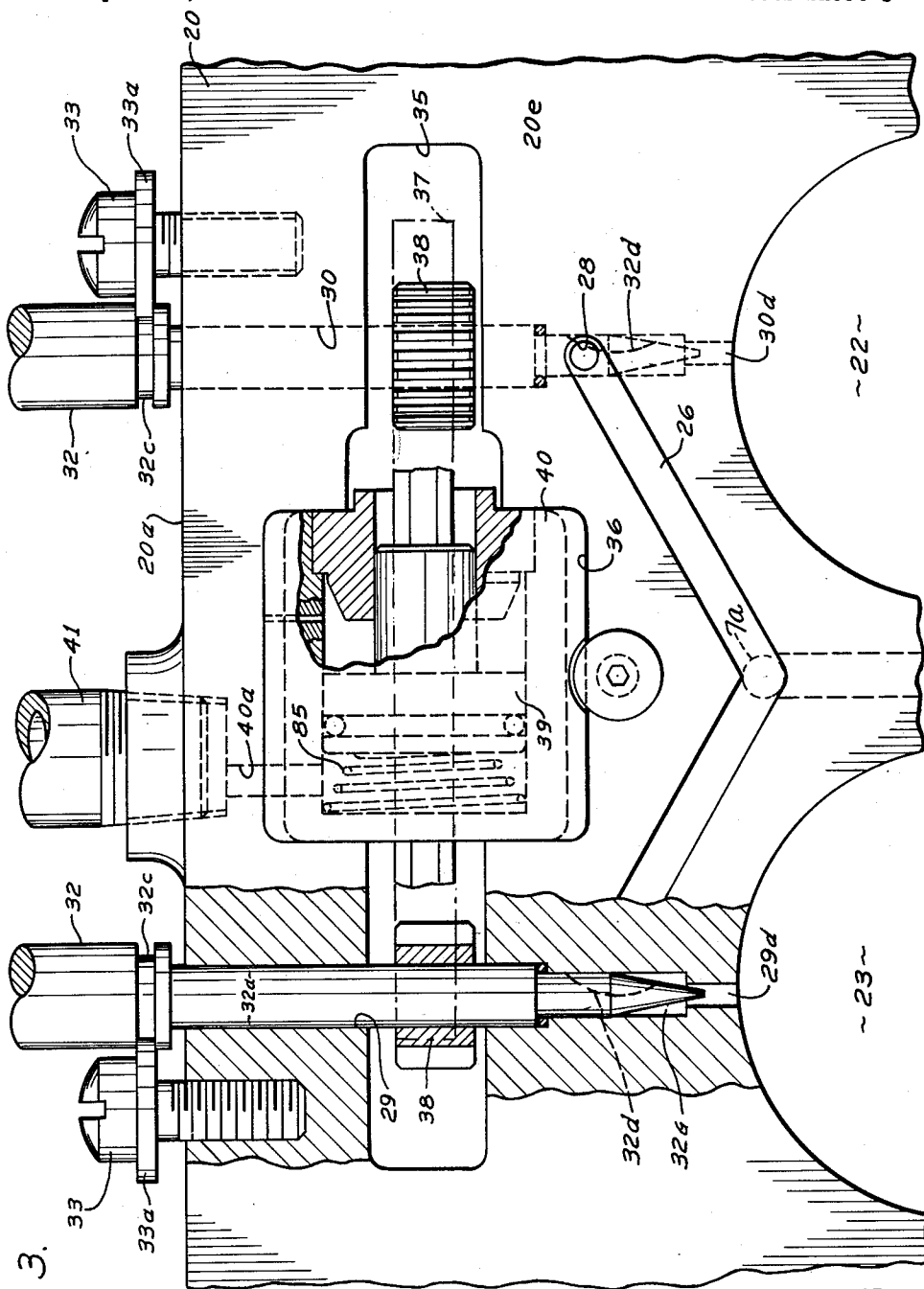


Fig. 3.

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Filed April 13, 1962

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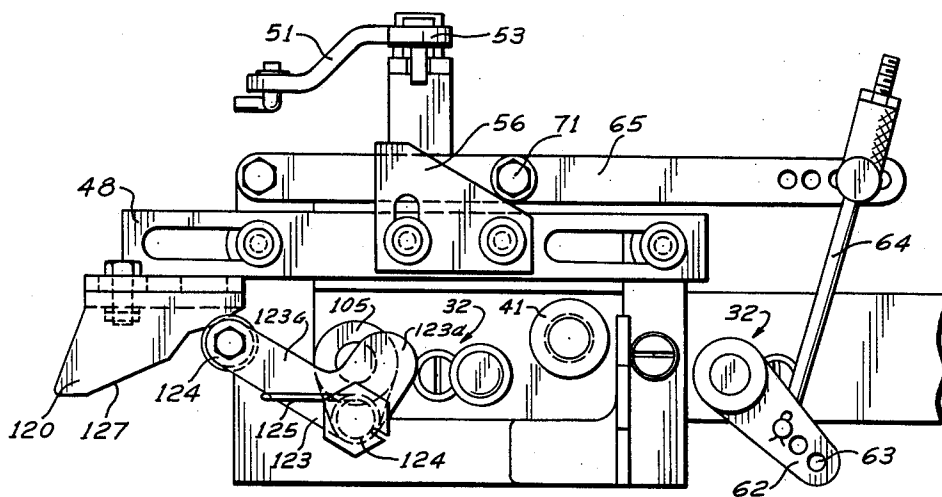


Fig. 5.

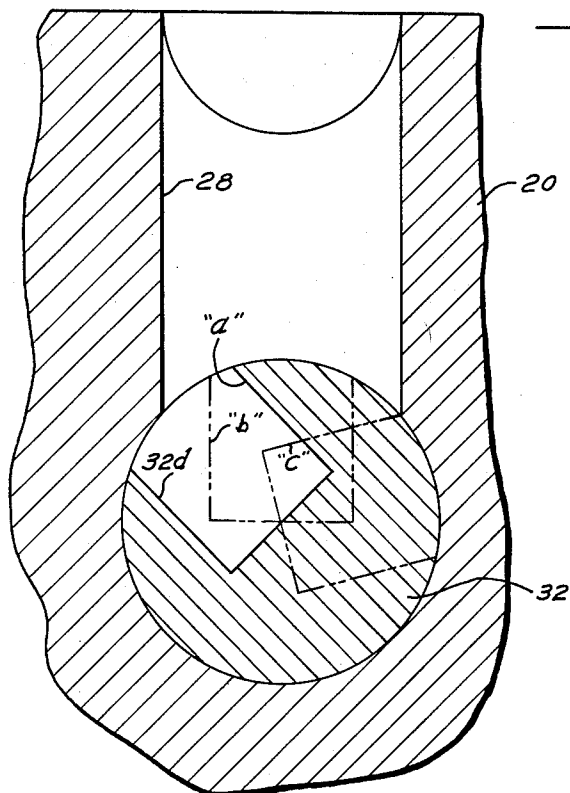


Fig. 4.

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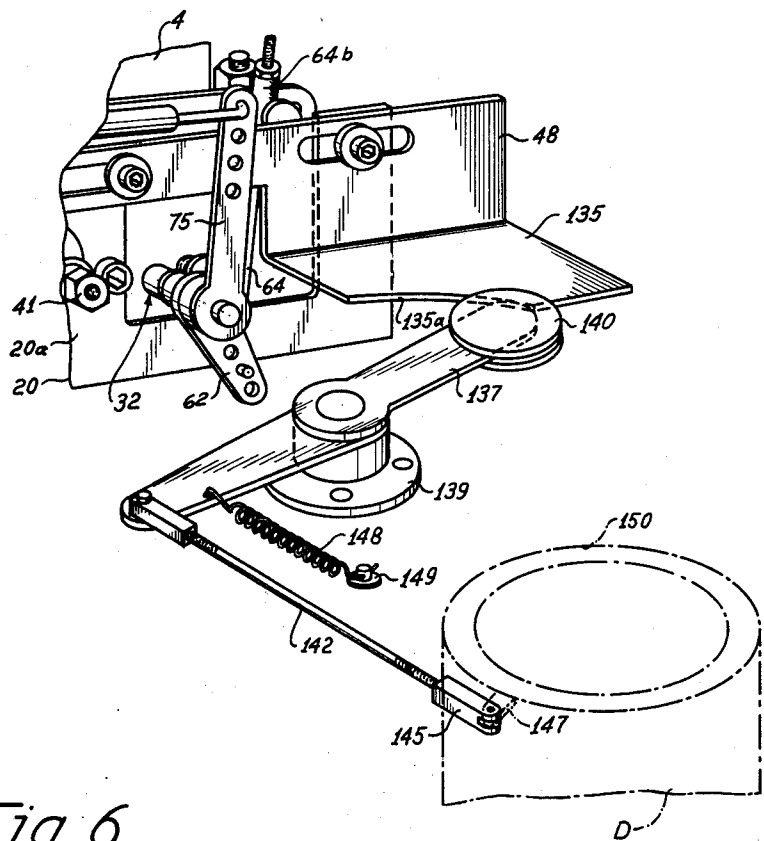
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Filed April 13, 1962

7 Sheets-Sheet 5



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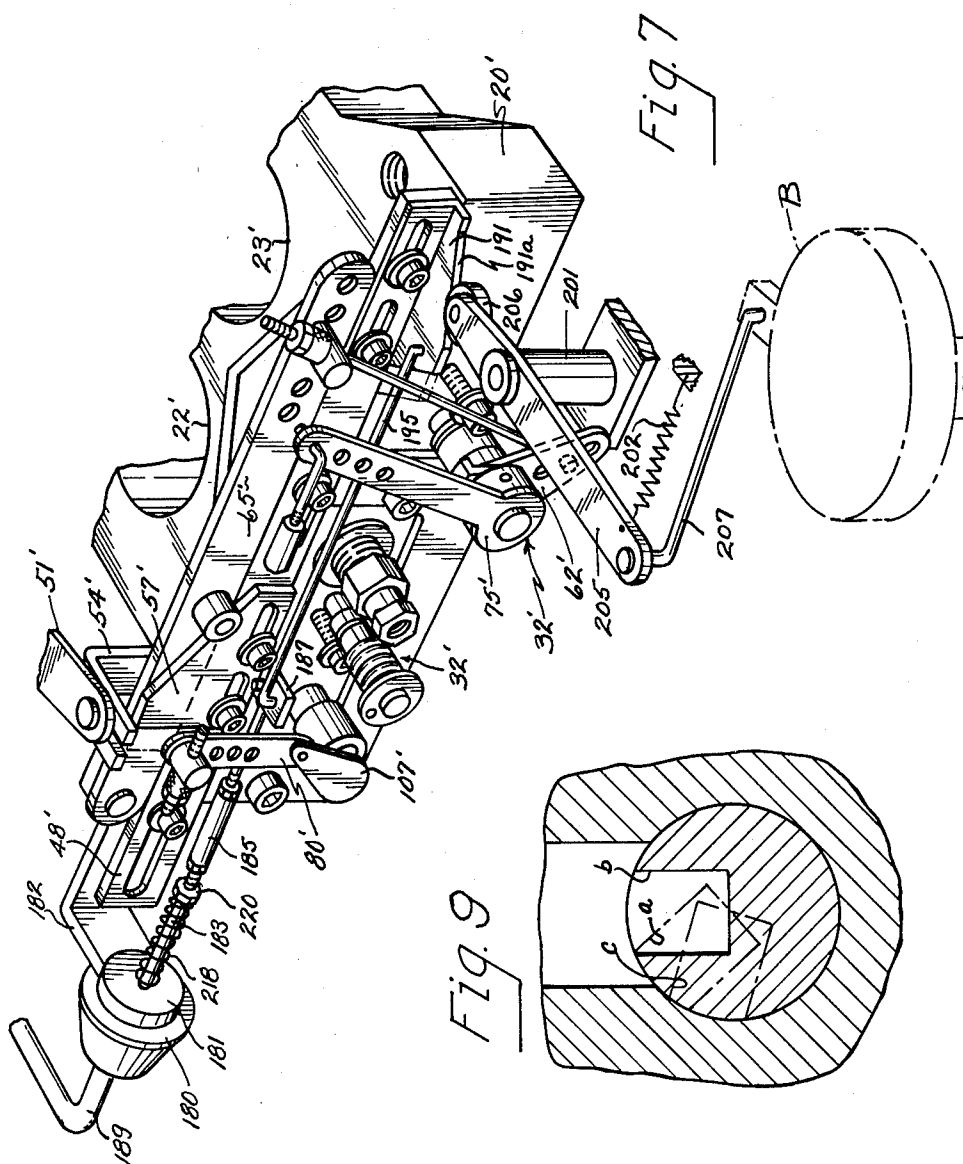
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Filed April 13, 1962

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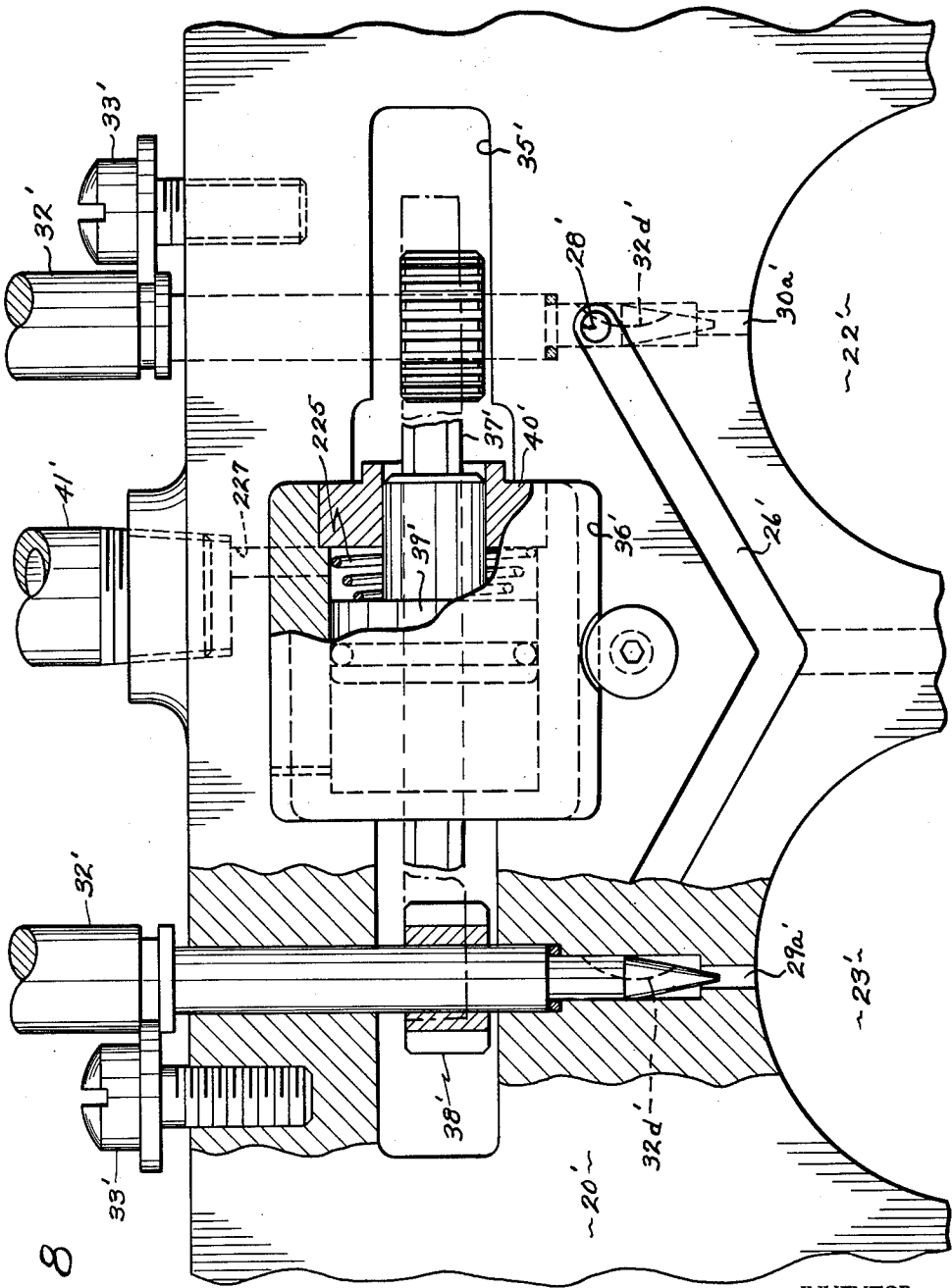


Fig. 8

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Filed Apr. 13, 1962, Ser. No. 187,234

16 Claims. (Cl. 123-119)

This invention relates generally to carburetors especially designed for use with internal combustion engines or the like and more particularly to carburetor structures, with which an overall high engine efficiency may be obtained for all conditions of engine operation.

Before a combustible fuel such as gasoline commonly in use today is supplied to an internal combustion engine for ignition therein, it is required to be carbureted with a predetermined amount of air, which mixture of fuel and air is generally referred to as "carbureted fuel." This carbureted fuel provides an explosive mixture which, when fed into the engine is ignited so as to provide sufficient energy to run the same.

As is known in the art, the amount of energy per volume of "carbureted fuel" is directly related to the ratio of fuel to air in said mixture.

For example, it has been determined that in a carbureted fuel mixture containing approximately 15 parts of air to 1 part gasoline fuel of present day standards proportioned by weight, a combustible mixture will be obtained which, when applied to and ignited in an internal combustion engine maximum efficiency of operation of the engine will be obtained.

As will be further recognized, an internal combustion engine that is used in an automotive vehicle is required to operate under various load conditions, and consequently a carburetor designed for use with said engine must be operable to supply the proper mixture of fuel and air as above defined for all conditions of operation thereof and also during the transitional periods during which the engine is changing from one operational condition to another.

For example, if the engine is running at "idle speed" and it is then actuated to accelerate the vehicle, the carburetor is required to change from an idle condition of operation to an accelerated condition and consequently during this transitional period the carburetor is required to provide a progressively increasing quantity of carbureted fuel to said engine if the latter is to operate efficiently during said period and likewise a sustained larger quantity at said elevated speed, which carbureted fuel during said cycle should have approximately the above noted optimum ratio of gasoline fuel to air, or otherwise the by-products of combustion of said engine will contain a greater proportion of hydrocarbons, unburned fuel and/or other volatile products than would otherwise be present if proper carburetion was obtained.

In like manner, assuming that the vehicle is running at a higher speed than the "idle speed" which may be hereinafter defined as a "cruising speed," and it is then desirable to decelerate said vehicle, the engine controls are actuated to return the carburetor to its idle condition preparatory to decreasing said vehicle velocity.

However, as is well known, in the intake manifold of an internal combustion engine, gasoline fuel in the carbureted mixture has a tendency to condense onto the walls of said manifold thus forming what is known in the art as a "dense fuel." When the conventional carburetor is returned to its idle condition, it supplies the engine with an idle quantity of carbureted fuel while the engine is decelerating which, when combined with the dense fuel results in an overly rich mixture and consequent inefficient combustion during said cycle and consequently undesir-

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able by-products of combustion exhaust to atmosphere from said engine.

Conventional carburetors in use today are provided with control elements that function at various engine speeds in an attempt to thus effect an efficient carburetion of the fuel and air throughout substantially all conditions of engine operation which may be encountered.

However, a distinct disadvantage of said control systems has been their inability to control the carburetor so as to provide a proper carbureted fuel mixture during the transitional periods when the engine is changing from one operating condition to another, and particularly during the acceleration and deceleration transitional periods as above described.

It is therefore a primary object of the present invention to provide a new and improved carburetor structure especially designed for use with an internal combustion engine and the like, and which structure is particularly applicable to provide a predetermined optimum mixture of carbureted fuel to its associated engine during the transitional acceleration and deceleration periods of the latter.

Another object of the present invention is the provision of a new and improved carburetor structure especially designed for use with an internal combustion engine or the like and which structure is operable to provide an optimum carbureted fuel mixture to the engine during the transitional operational periods during which the engine is changing from one operational condition to another.

Another object of the present invention is the provision of a new and improved carburetor structure especially designed for use with an internal combustion engine and the like and which structure is especially applicable to provide an optimum mixture of carbureted fuel to the engine during the transitional period when the engine is accelerating from an idle speed to a relatively higher or cruising speed, and which carburetor structure is variably responsive to the engine throttle controls during said transitional period.

Yet another object of the present invention is the provision of a carburetor structure which is especially designed for use with an internal combustion engine which exhibits a transitional change in internal vacuum conditions while the same is decelerating from a relatively high or cruise speed to a low or idle speed, and which carburetor structure is responsive to said internal vacuum conditions effective to provide an optimum mixture of fuel and air to said engine.

Another object of the present invention is to provide a carburetor structure as defined in the last preceding paragraph and which is also responsive to the throttle controls of the engine during the deceleration period of said engine.

Another object of the present invention is to provide a carburetor structure as is defined hereinabove, and which is operable to provide an optimum carbureted fuel mixture to an internal combustion engine for all conditions of operation of said engine.

Additional objects and advantages of the carburetor structure of the present invention will be apparent to one skilled in the art to which it pertains and upon reference to the following disclosure of several preferred embodiments thereof and which are illustrated in the drawings accompanying this specification, forming a part hereof and in which:

FIG. 1 is a side elevation of a carburetor assembly embodying the present invention;

FIG. 2 is a perspective view of the carburetor structure of the present invention removed from its assembled position with the conventional carburetor of FIG. 1 to show the otherwise hidden construction thereof;

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FIG. 3 is a fragmentary plan view of the housing of the carburetor structure being shown partly in section to illustrate the idle fuel valve assembly therefor;

FIG. 4 is a fragmentary vertical sectional view of one of the idle fuel valves shown in several of its actuated positions;

FIG. 5 is a side elevation of a second embodiment of carburetor structure embodying the present invention;

FIG. 6 is a third embodiment of carburetor structure which incorporates a distributor advance and retard control that is operable in conjunction with the carburetor controls;

FIG. 7 is a side perspective view of a fourth embodiment of carburetor structure;

FIG. 8 is a fragmentary plan view of the idle fuel valve assembly of the FIG. 7 carburetor embodiment; and,

FIG. 9 is a fragmentary vertical sectional view of one of the idle fuel valves of FIG. 8 in several of its actuated positions.

Briefly, the carburetor structure of the present invention is herein incorporated into a conventional down-draft type of carburetor assembly and is intended to be substituted for the structure and controls of said conventional assembly which function to provide idle fuel and air to the same.

The carburetor structure as substituted into the conventional carburetor assembly is intended to provide a progressively increasing quantity of carbureted fuel to the engine during the transitional acceleration period during which interval the engine is accelerating from idle speed to a cruise speed, being likewise operable to provide fuel to said engine at said cruise speed and subsequently upon deceleration of said engine, to effectively discontinue the intake of fuel to said engine during which interval the carburetor structure supplies sufficient air to said engine for carburetion with the dense fuel previously disposed in the intake manifold to thus enable efficient operation thereof and then as the engine reaches its idle speed the instant carburetor structure is operable to again supply sufficient fuel and air to said engine to sustain the operation thereof at said idle speed.

Referring now particularly to the drawings and with particular reference to FIG. 1, a conventional down-draft carburetor assembly is herein shown and includes a body 4 which is intended to be disposed in an upright position and connected to the intake manifold 5 of an internal combustion engine in the usual manner.

The carburetor assembly is of the type commonly referred to as a two barreled carburetor inasmuch as it has two separate barrels in which fuel and air are mixed preparatory to submission of the carbureted fuel to the intake manifold 5. As will later be apparent, the inventive concepts as are disclosed herein may be readily adapted to any carburetor structure having only one or more than several carburetor barrels.

In adapting the down-draft type of carburetor for use with an internal combustion engine for an automotive vehicle the carburetor is connected to a fuel supply usually through a reservoir or float chamber such as is illustrated at 6 and through suitable internal porting formed in the body 4 to a position adjacent the main venturi area of said body.

With fuel provided to the carburetor, air is drawn into its upper end through its air horn and filter unit as indicated at 7 by the vacuum of the intake manifold whereby as said air passes downwardly through the carburetor barrels it draws the fuel into the air stream to form a carbureted fuel mixture which is then directed to the intake of the engine.

As will be understood, a throttle or butterfly valve is disposed in each of the barrels and is usually carried on a single throttle shaft which is suitably rotatably mounted in the carburetor body so as to have its end thereof extending outwardly from the same and attached by suit-

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able linkage 8 to a manual throttle or accelerator control disposed in the operator's position of the vehicle.

To adapt the carburetor structure of the present invention to the particular carburetor assembly herein disclosed, the aforementioned idle controls and idle valve or valves heretofore used in said conventional assembly are rendered inoperable so as not to effect any regulation of operation of the combined structure.

As best seen in FIG. 2, the preferred embodiment of carburetor structure is herein seen to comprise a housing 20 which is somewhat rectangular in its configuration thus defining opposed longitudinal side walls 20a and 20b and opposed end walls 20c and 20d.

The housing 20 is mounted on the intake manifold 5 of the engine being thus disposed between the latter and the base of the carburetor body 4 of the conventional assembly disposed thereabove, said housing in addition having mounting holes 21 accommodating suitable bolts or like fasteners to secure the combined assembly onto said manifold.

A pair of circular chambers 22 and 23 are formed in said housing, being spaced apart so as to define longitudinal extensions of the barrels in the carburetor body 4 located thereabove.

A secondary fuel supply is provided for connection to the housing 20, and for this purpose a V-shaped fuel groove 26 is formed in the top surface 20e of said housing which groove, at its vertex, communicates with a fuel passage 7a formed in the body 4 of the conventional carburetor assembly connecting at its upper end with the main fuel supply to the conventional assembly.

The remote ends of the fuel groove 26 each communicates with a fuel transfer port 28, the opposite end of each of the latter communicating, in turn, with one of a pair of valve bores 29 and 30 formed in the housing 20 and extending inwardly from the side wall 20a thereof and communicating respectively with the aforementioned housing chambers 22 and 23.

An idle needle valve 32 is disposed in each valve bore 29 and 30, said valve as best seen in FIG. 3, having a cylindrical barrel 32a formed with a pointed nose 32b on its forward end which is adapted to be located in predetermined spaced relation with port 29a, 30a respectively in each of said bores to thus define a fuel inlet orifice communicating with the housing chambers 22 and 23.

The barrel 32a of each needle valve 32 extends outwardly from the housing side wall 20a and is provided with a circumferential groove 32c which is intended to slidably accommodate the flange 33a of an adjusting screw 33 threadedly mounted in the housing adjacent each of said valve bores 29, 30 whereby upon adjusting said screw its associated needle valve 32 will be moved longitudinally through its bore to thus regulate the size of fuel inlet orifice.

As seen in FIGS. 3 and 4, each of the idle needle valves 32 is provided with a valve groove 32d which is substantially of semi-circular configuration being formed in the barrel and adjoining nose portions thereof and projecting likewise radially into said valve and positioned thereon so as to be carried into selective communication with the fuel transfer port 28 associated therewith.

Each of the idle needle valves 32 is manually adjustable to an "idle" position by means of the aforementioned adjusting screw 33 and additional drive means therefor now to be described so that a predetermined portion of its fuel groove 32d is moved into registry with the aforesaid inlet port 8 being thus operable to permit an idle quantity of fuel to enter into each of the housing chambers 22 and 23.

From this position, each needle valve is intended to be rotatable within its bore in response to the engine controls being moved to an accelerated position to carry said valve groove across said inlet port and hence into

a plurality of degrees of registry therewith being thus operable to vary the fuel flow therethrough.

For this purpose, the housing 20 as best seen in FIG. 3, is formed with an elongated channel 35 disposed approximately centrally between the housing side wall 20a and the housing chambers 22 and 23, the idle needle valves 32 extending transversely thereacross in longitudinal spaced relation to each other.

Said channel is enlarged at its medial portion to define a piston chamber 36.

A rack 37 is disposed in channel 35 and is adapted to mesh with a pinion 38 mounted on the barrel 32a of each of idle needle valves 32, being thus operable by reciprocation to rotatably actuate each of said valves.

Said rack mounts a piston 39 thereon, the latter being disposed within cylinder 40 carried within the aforementioned chamber 36, said cylinder communicating through port 40a and conduit 41 to the intake manifold of the engine being thus operable to indicate the engine vacuum conditions in the interior of said cylinder.

The fuel idle needle valves 32 are each rotatably actuatable by the vehicle operator actuating the throttle controls, and to accomplish this, a slide bar 48 as seen in FIGS. 1 and 2 is mounted on the housing 20, said bar having longitudinally spaced slots 49 thereon which accommodate suitable fasteners 50 to thus enable the same to be slidable longitudinally along wall 20a of said housing.

A bell crank lever 51 is pivotally anchored at 53 to the housing 20 and one end thereof, as indicated at 53a is swivelly connectable to an upstanding bracket 54 mounted on the aforementioned slide bar 48. The opposite end of said bell crank lever 51 is connectable by linkage 55 to the manually operated throttle controls disposed at the operator's position.

With this assembly, the operator by depressing the accelerator pedal will effect a counterclockwise rotation of the bell crank lever 51 and slide the bar 48 to the right as viewed in FIG. 2.

Cam 56 is mounted on the slide bar 48 so as to extend upwardly therefrom, said cam having a cam surface of linear profile which includes a first cam surface 57a extending upwardly from one end of said cam at approximately 40 degrees and a second cam surface 57b connecting at one end with said first cam surface and extending substantially parallel to the direction of movement of the slide bar 48.

As will hereinafter be more readily apparent, the contour of the cam profile including surfaces 57a and 57b may be selectively varied to accommodate the operational characteristics of any one particular carburetor structure, for example, instead of a linear profile it may be determined that a curved surface of constant or variable radius may provide optimum operating characteristics for the carburetor structure herein.

As best seen in FIG. 2, one of the idle fuel needle valves 32 mounts a yoke 60 on the end thereof projecting outwardly of the housing side wall 20a, said yoke being freely rotatable on said valve and mounting a link 62. The free end of link 62 is provided with a plurality of spaced holes 63 in one of which is selectively disposed one end of a connecting rod 64, the opposite end of the latter being adjustably anchored to a cam arm 65. The end of the connecting rod 64 is preferably threaded as is indicated at 64a and threadably accommodates an adjusting nut 64b whereby the length of rod between the link 62 and cam arm 65 may be selectively varied.

The opposite end of the cam arm 65 is swivelly connected at 67 to the housing 20.

A cam roller 71 is mounted on the cam arm 65 preferably intermediate its ends, said roller being adapted to rollably move over the cam surfaces 57a and 57b.

A second link 75 is seen to have its one end mounted on the needle valve adjacent the aforesaid yoke 60, being rotatable with said valve the opposite end of said link

being formed with a plurality of spaced holes 76, one of which is intended to accommodate one end of a connecting rod 78, the opposite end of the latter extending through a bushing 79 swivelly mounted on one end of link 80, the opposite end of the latter being pivotally anchored at 81 to the housing. The end of the connecting rod 78 projecting outwardly from the bushing 79 is preferably threaded so as to accommodate an adjusting nut 82 thereon, said nut being threadably adjustable to vary the length of said connecting rod extending between said bushing 79 and link 75 to thereby rotate the yoke 60 and needle valve 32 connected therewith in a corresponding clockwise or counterclockwise direction as viewed in FIG. 2, said adjustment being made, as will be hereinafter described, to define an "idle" position for said needle valves.

Link 75 is formed with lug 75a which projects outwardly therefrom so as to be disposed in the path of travel taken by link 62.

With reference now directed particularly to FIGS. 1 and 2, the cam operating assembly just described is herein shown in its "idle" position in which position the cam roller 71 is disposed on the cam surface 57a closely adjacent the right end thereof so as to locate the cam arm 65 generally parallel to the top surface 20e of the housing 20.

With the assembly thus disposed, the engine of the vehicle is started and the manual throttle controls are moved to their respective idle positions.

The adjusting nut 82 may then be adjusted to vary the length of lever 78 thereby rotating the idle fuel needle valves 32 through the aforementioned rack and pinion assembly so as to locate the valve grooves 32d thereon in the "idle position" for the particular engine such as the position illustrated at "a" in FIG. 4 whereby a predetermined portion of each valve groove is in registry with the inlet port 28 associated therewith so as to permit a predetermined idle quantity of fuel to enter into each of the housing chambers 22 and 23.

As will be apparent, the adjusting nut 64b on link 64 is also required to be adjustable to permit the yoke 60 to move to its idle position.

Thereafter, when the operator actuates the throttle controls to accelerate the engine, the slide bar 48 as is aforementioned, is slidably moved to the right as viewed in FIG. 2 likewise moving its cam surface 57a to the right effective to swing the cam arm 65 in a counterclockwise direction about its pivot 67 upwardly of the housing 20 whereby the link 62 engages the lug 75a which is effective to rotate the idle fuel needle valve 32 connected thereto and the remaining valve through rack 37 and pinions 38 in a clockwise direction as viewed in FIG. 4 whereupon the grooves 32d progressively move to a "full on" position as is identified at "b" thereby providing an increasing quantity of fuel to the housing chambers 22 and 23 to be combined with the fuel mixture passing downwardly from the conventional carburetor located thereabove so as to result in an optimum fuel mixture being delivered to the intake manifold.

At the "full on" position, a maximum quantity of fuel passes through said valve grooves and into the connected housing chambers 22 and 23 downstream of the now open throttle valve so as to provide an optimum carbureted fuel mixture for sustaining the engine at said elevated speed.

With the present configuration of cam 56, when the valve grooves 32d reach their "full on" position the cam roller 71 has reached the cam surface 57b whereupon as the acceleration of the vehicle is continued, no further rotation of the idle valves 32 is realized inasmuch as the cam surface 57b is substantially parallel to the direction of movement of the slide bar 48. Consequently, the idle fuel valves 32 remain in their "full on" position at engine speeds above idle speed.

As is well known, in conventional carburetors, when

the throttle controls are actuated to accelerate the engine, the inrush of air through the carburetor barrels, as a result of the butterfly valve being opened, is oftentimes uncontrollably more than is actually required to provide a fuel mixture of the above noted optimum proportions of fuel and air. Consequently, at the beginning of the acceleration cycle, a lean carbureted fuel mixture is delivered to the intake manifold and the ignition thereof is usually faulty thus developing unwanted volatile by-products of combustion in the exhaust.

With the valve assembly as described herein functioning during the acceleration of the engine to provide a progressively increasing quantity of fuel to the engine, the carbureted fuel mixture delivered to the intake manifold contains an optimum ratio of air to fuel at approximately a ratio of 15 to 1 during said acceleration cycle and likewise during the interval the engine is sustained at said elevated speed.

It has also been found with the aforesaid idle valve assembly functioning as previously described, that is to say operating during the acceleration cycle to provide a progressively increasing quantity of fuel to the engine, that the choke mechanism usually provided with the conventional carburetor assembly may be discarded since adequate fuel and air is immediately directed to the housing chambers 22 and 23 upon the initiation of said cycle.

When the operator releases the accelerator pedal to initiate a deceleration of the vehicle, the butterfly valves in the conventional carburetor body 4 and the cam arm 63 move to their idle position and the vacuum in the intake manifold increases to approximately a magnitude of 25 inches of mercury.

This vacuum increase is communicated to the cylinder 40 and is effective to cause the piston 39 and attached rack 37 to move to the left as viewed in FIG. 3 against the pressure of spring 85 located in said cylinder so as to rotate the needle valve 32 and carry the fuel grooves 32d thereon to an "off" position such as is shown at "c" in FIG. 4.

As a result the source of idle fuel is cutoff during the deceleration cycle and remains off during the interval of high vacuum.

With the main fuel supply and idle or secondary fuel supply thus cutoff from the carburetor during the deceleration of the engine, the "dense fuel" in the intake manifold mixes with an idle source of air, yet to be described, so as to provide an adequate carburetion thereof before it is ignited, whereby resulting in an efficient engine deceleration cycle without exhausting said dense fuel to atmosphere in the form of unburned fuel, hydrocarbons and other volatile products prevalent in present day internal combustion engines.

As the dense fuel is consumed and the engine speed reduces, the intake manifold vacuum decreases and when it reaches the idle magnitude or approximately a value of 17 inches of mercury at which value the engine has reached its idle speed, the spring 85 returns the piston and attached rack to the idle position therefor being thus effective to return the idle needle valves 32 to their "idle" position.

The carburetor structure of the present invention is also provided with an idle or secondary air supply which is operable to provide idle air to the carburetor chambers when the carburetor is in idle position.

For this purpose, the housing 20 is formed with a bore 95 that extends transversely thereacross one end of which is connected to one end of conduit 97, the other end of said conduit communicating with port 98 formed in the opposite side of said housing and connecting, in turn with the vertex of a V-shaped transfer port 102, the free ends of the latter communicating with the housing chambers 22 and 23. The opposite end of the bore 95 mounts a flanged nozzle 105.

Air passing through the open end of nozzle 105 is directed through conduit 97 and communicating ports 98

and 102 into the housing chambers 22 and 23 to mix with the idle fuel entering into said chambers through idle ports 28.

A flapper valve 107 is pivotally attached to the flange of said nozzle so as to extend over its open end being thus operable to regulate the amount of air passing therethrough.

Flapper valve 107 is connected through link 80 to the connecting rod 78 whereby as the latter is slidably actuated said valve is passed over the open end of the nozzle to control the air passing therethrough.

With the slide bar disposed in its idle position the flapper valve 107 is adjusted so as to crack the open end of the nozzle and permit a predetermined idle air flow to pass through said nozzle and into the housing chambers.

And, as the carburetor controls are actuated to accelerate the engine, the slide bar 48 movement is effective to pivot the flapper valve 107 completely over the nozzle 105 so as to cut off the idle air flow therethrough.

Conversely, when deceleration of the engine is initiated and the slide bar 48 is returned to its idle position, the flapper valve is likewise swung to its idle position to provide an idle air flow to the housing chambers during said cycle which air flow as aforementioned mixes with the dense fuel for carburetion of the same during the deceleration cycle and thereafter with the idle fuel flow when the idle needle valves 32 have returned to their respective idle position.

In FIG. 5 a second embodiment of carburetor structure is herein disclosed and differs from the previous embodiment by providing an idle air supply that is variably regulated during the acceleration cycle of the engine.

For this purpose, a second cam 120 is mounted on the underside of the slide bar 48 so as to be movable with the same.

An L-shaped flapper valve 123 is swingably mounted at 124 to the housing 20 preferably below the opening in the nozzle 105 so as to bring its leg 123a into selective sealing relation with said opening.

The other leg 123b of said valve mounts a cam roller 124 which is adapted to be urged by spring 125 into engagement with cam surface 127 of cam 120.

The cam surface 127 is seen to be of irregular contour being thus effective as the cam 120 is moved with the slide bar 48 to the right during the acceleration of the engine to cause a variable rotation of the valve 123 to thereby provide a predetermined pattern of air to the housing chambers 22 and 23 during said acceleration interval.

In FIG. 6 is herein shown a third embodiment of carburetor structure embodying the concepts of the present invention and which includes control means for variably regulating the ignition distributor during the acceleration and deceleration engine cycles so as to advance and/or retard the spark delivered to each of the spark plugs for igniting the carbureted fuel charge to each piston.

As is well known, when the engine speed is increased, the ignition spark must be introduced into each respective engine cylinder earlier in the ignition cycle, in order that the carbureted fuel charge can be ignited and will have time to burn and deliver its power to the piston.

In like manner, when the engine speed is decreased, the ignition spark must also be progressively returned or retarded to its idle position in order to prevent igniting the charge too early in the firing cycle.

In order to accomplish this result, a cam 135 is adjustably secured to the right end of the slide bar 48, said cam projecting outwardly from the side of said bar and having a cam surface 135a formed thereon of predetermined contour. As will be apparent the contour of said cam surface may be varied to correspond to the operational characteristics of any particular engine.

A cam follower arm 137 is pivotally mounted at its center on pedestal 139 carried on the engine housing

convenient to the carburetor, said arm rollably carrying a cam roller 140 on its one end which is adapted to ride upon the aforesaid cam surface 135a.

The opposite end of said arm swivelly mounts one end of adjusting lever 142, the opposite end of the latter being similarly attached at 145 to arm 147, the latter being integral with the housing of the conventional distributor D.

The follower arm 137 and cam roller 140 are shown in the respective idle position therefor such that the latter is in engagement with the right end of cam surface 135a.

A spring 148 connecting at one end to the follower arm 137 between the pedestal 139 and the end of said arm remote from the roller 140, and at its opposite end to anchor 149 mounted on the engine block urges the roller into positive engagement with said cam surface.

With this assembly, as the slide bar 48 is slidably actuated to the right while the acceleration of the engine is undertaken, the cam roller 140 follows the contour of cam surface 135a and is effective to permit follower arm 137 to swing about pedestal 139 in a counterclockwise direction effective to force the lever 142 to the right with the consequent rotation of the distributor housing in a counterclockwise direction so as to advance the ignition spark.

Conversely, as the slide bar 48 is slidably moved to the left to its idle position at the initiation of the deceleration of the engine, the follower arm 137 is swung in a clockwise direction back to its idle position which is effective to return the distributor to its respective idle position during the transitional deceleration period.

In this manner therefore, the ignition spark is progressively advanced during the time the engine is accelerated and returned to idle spark position when the deceleration engine cycle is initiated.

In FIGS. 7, 8 and 9 a fourth embodiment of carburetor structure is herein disclosed, and differs basically from the previous carburetor embodiment as shown in FIG. 1 by having means responsive to a change in the vacuum in the intake manifold to actuate the cam means for controlling the idle fuel valves so as to enable said valves to be rapidly moved back through their respective "idle" positions to a closed or vacuum lock position at the initiation of the deceleration cycle and also to allow the distributor control means to retard the distributor past its normal "idle position" to a "vacuum retard position" during said deceleration cycle.

With reference directed particularly to FIG. 7, those components that are equivalent to the components of the aforesaid previous carburetor structure are herein identified by the same reference numerals being primed to distinguish the same therefrom.

As seen in FIG. 7, the cam 57' is attached to the slide bar 48' so as to be relatively slidable therealong.

A vacuum motor 180 has its cylinder 181 mounted on bracket 182, the latter being attached to the left end of the slide bar 48'. The piston rod 183 of said vacuum motor is connected by adjustable link 185 to lug 187 formed on said cam 57'.

Conduit 189 connects the vacuum motor to the intake manifold whereby the vacuum conditions of the latter are transmitted to said motor.

A spring 218 is mounted on the piston rod 183 and has its ends interposed between a ring 219 carried in the latter and the motor cylinder 181 being thus effective to urge said piston rod to the right as viewed in FIG. 7.

The pressure exerted by spring 218 may be varied by nut 220, and in its present environment said spring pressure is adjusted so as to resist any movement of the piston rod 183 to the left by a vacuum below approximately 20 inches of mercury.

Under normal conditions of operation therefor during the acceleration cycle wherein the vacuum reaches a magnitude of approximately 17 inches of mercury, the vacuum motor 180 is inoperative.

A second cam 191 is also attached to the right end of the slide bar 48' so as to be relatively slidable therealong and has a cam surface 191a thereon of preselected contour.

Link 195 interconnects cam 57' and cam 191 whereby a slidable actuation of the former will cause a like movement to the latter.

Pedestal 201 mounted on the engine housing rotatably carries lever 205, the latter rollably mounting roller 206 on its one end which is adapted to engage the surface 191a of cam 191, being urged against the same by spring 202.

The opposite end of lever 205 is swivelly attached to link 207, the remote end of the latter being similarly connected to the distributor body B.

The slide bar 48', cam 57', cam arm 65' and distributor cam 191 are adjustable as in the previous carburetor structure to an "idle" position such as is shown in FIG. 7.

Upon accelerating the engine by actuating the controls therefor connected to said slide bar 48', the latter is slidably actuated along the housing 20' in the same manner as slide bar 48 to move cam 57' therewith and cause the cam arm 65' to swing in a counterclockwise direction of rotation effective to progressively rotate the idle fuel needle valves 32' from their respective "idle" position to an "accelerated" position such as the position identified at b in FIG. 9 whereby an increased quantity of fuel is directed into the housing chambers 22' and 23'.

As the slide bar 48' is slidably moved to an accelerated position or to the right as viewed in FIG. 7, distributor cam 191 likewise moves to the right and swings the lever 205 in a clockwise direction which movement is transmitted to the distributor body B to cause its counterclockwise rotation which, in turn, progressively advances the spark during the acceleration cycle.

Thereafter, upon initiating a deceleration of the engine, it will be recalled that the vacuum in the intake manifold increases to a magnitude of approximately 25 inches of mercury.

This increase in vacuum is transmitted to vacuum motor 180 and is effective to retract or pull its piston rod 183 to the left as viewed in FIG. 7 against the pressure of spring 218 and slides cams 57' and distributor cam 191 to the left past their respective "idle" positions to a "vacuum lock" position such as is shown in dotted lines in said figure.

As a result, spring 202 swings the lever 205 in a counterclockwise direction past the "idle position" therefor whereby the distributor body B is likewise rotated in the same direction so as to retard the spark past its respective idle position to the vacuum retard position to thereby result in further lowering the power output of the engine and hence a reduction in the speed of the same during said deceleration cycle whereby the engine is operable to assist in braking the vehicle.

With the cam 57' removed to a "vacuum lock" position which, as aforementioned is beyond the respective "idle position" therefor as shown in dotted lines in FIG. 7, the increase in vacuum is utilized to rotatably actuate the idle fuel needle valves 32' back to and past their respective "idle" positions to a "closed" position such as is shown at c in FIG. 9.

To accomplish this, the piston 39' carried on the rack 37' in the present structure is reversed in its assembly, and a conical spring 225 is disposed between the right end of the latter as viewed in FIG. 8 and the adjacent wall of the cylinder 40'.

The conduit 41' communicating with the intake manifold connects through port 227 with the right end of the cylinder 40' in juxtaposition to said adjacent cylinder wall.

With this assembly, as the deceleration cycle is initiated and the vacuum increases to approximately 25 inches of mercury, this increase is transmitted to the cylinder 40' and is effective to pull the piston 39' to the right as viewed in FIG. 8 against the resistance of conical spring 225 so as

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to rotate each valve 32' in a counterclockwise direction as viewed in FIG. 9 back past their respective "idle" position "a" and to a fully "closed" or vacuum lock position as shown at c.

In this manner, each idle fuel needle valve 32' is retained in its closed position during the interval of high vacuum in the deceleration cycle.

As the engine speed is reduced, and the manifold vacuum likewise diminishes, conical spring 225 forces rack 37' to return to its "idle" position which is effective to rotate said valves 32' clockwise and to return the same to their respective idle position "a" as viewed in FIG. 9.

During this same interval, spring 218 overcomes the vacuum motor 180 and slides cam 57' and distributor cam 191 to the right as viewed in FIG. 7 to thus return the same to their respective "idle" positions, the movement of cam 191 thereby causing the distributor body B to rotate to its normal idle position, and the re-positioning of cam 57' likewise locating the cam arm 65' and slide bar 48' at their idle positions. The flapper valve 107' likewise returns to its idle position so as to provide an idle air flow to the housing chambers.

Having thus described the carburetor structure of the present invention in several of its preferred embodiments it will be realized that it is susceptible to various modifications, arrangements and combinations without departing from the inventive concepts as are defined in the appended claims.

What is claimed is:

1. In a carburetor assembly having a body provided with a carbureting barrel for connection to the intake of an internal combustion engine and to which are directed primary valve means in said barrel actuatable between idle and accelerating positions for regulating the flow of carbureted fuel to said engine intake, means defining a carbureting chamber between said primary valve means and said engine intake, means for supplying a secondary source of fuel and air to said chamber, sensing means connected between said secondary valve means and said engine intake being responsive to a change in the vacuum conditions in the latter upon initiating the deceleration of said engine by returning said primary valve means to idle position effective to actuate said secondary valve means to an off position so as to disconnect said secondary fuel source from said chamber.

2. In a carburetor assembly having a body provided with a carbureting barrel for connection to the intake of an internal combustion engine and to which are directed primary sources of fuel and air for carburetion therein, and primary valve means in said barrel actuatable between idle and accelerating positions for regulating the flow of carbureted fuel to said engine intake, means defining a carbureting chamber between said primary valve means and said engine intake, means for supplying a secondary source of fuel and air to said chamber, sensing means connected between said secondary valve means and said engine intake being responsive to a change in the vacuum conditions in the latter upon initiating the deceleration of said engine by returning said primary valve means to idle position effective to actuate said secondary valve means to an off position so as to disconnect said secondary fuel source from said chamber and said sensing means being thereafter responsive to the vacuum conditions in the intake of said engine returning to an idle condition effective to actuate said secondary valve means to idle position to re-direct an idle fuel flow from said secondary source to said chamber.

3. In a carburetor assembly having a body provided with a carbureting barrel for connection to the intake of an internal combustion engine and to which are directed primary sources of fuel and air for carburetion therein, and primary valve means in said barrel actuatable between idle and accelerating positions for regulating the flow of carbureted fuel to said engine intake, a housing having a carbureting chamber therein for placement in

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communication with said barrel between said primary valve means and said engine intake, means for supplying a secondary source of fuel and air to said chamber, secondary valve means including a needle valve adjustably mounted in said housing between said secondary fuel source and said chamber, and means operatively connecting said needle valve to said primary valve means responsive to the actuation of the latter to an accelerating position to actuate said needle valve and direct a progressively increasing quantity of fuel from said secondary source to said chamber.

4. In a carburetor assembly as is defined in claim 3 and wherein the means connecting the needle valve to the primary valve means includes cam means slidably actuatable by said primary valve means effective to actuate said needle valve.

5. In a carburetor assembly as is defined in claim 3 and wherein the needle valve is rotatably adjustable in said housing to direct a progressively increasing quantity of fuel to said chamber.

6. In a carburetor assembly as is defined in claim 3 and wherein the secondary valve means includes a valve between the secondary air source and said chamber and means connecting said valve to said primary valve means and which is responsive to the actuation of the latter to an accelerating position to cause said valve to cut off said secondary air source to said chamber.

7. In a carburetor assembly as is defined in claim 6 and wherein the secondary air valve is actuatable in response to the primary valve means being moved to an idle position to direct an idle quantity of secondary air to said chamber.

8. In a carburetor assembly having a body provided with a carbureting barrel for connection to the intake of an internal combustion engine and to which are directed primary sources of fuel and air for carburetion therein, and primary valve means in said barrel actuatable between idle and accelerating positions for regulating the flow of carbureted fuel to said engine intake, a housing having a carbureting chamber therein for placement in communication with said barrel between said primary valve means and said engine intake, means for supplying a secondary source of fuel and air to said chamber, secondary valve means including a needle valve rotatably adjustable in said housing between said secondary fuel source and said chamber, an idle air valve disposed between said secondary air source and said chamber, cam means operatively connected between said needle valve and said primary valve means, lever means operatively connected between said idle air valve and said primary valve means, said cam means and lever means being operable respectively in response to the actuation of said primary valve means to an accelerating position to rotate said needle valve and direct a progressively increasing quantity of secondary fuel to said chamber and to move said idle air valve to a closed position effective to disconnect said secondary air supply from said chamber.

9. In a carburetor assembly as defined in claim 8 and wherein sensing means are connected between said needle valve and the engine intake being responsive to an increase in the vacuum conditions in the latter at the initiation of a deceleration of the engine to effect a rotation of the needle valve and cutoff the secondary source of fuel to said chamber.

10. In a carburetor assembly as defined in claim 9 and wherein the sensing means are responsive during said deceleration to the vacuum conditions in the intake thereof returning to an idle condition to actuate said needle valve and re-direct an idle fuel flow from said secondary source to said chamber.

11. In a carburetor assembly having a body provided with a carbureting barrel for connection to the intake of an internal combustion engine and to which are directed primary sources of fuel and air for carburetion therein, and primary valve means in said barrel actuatable be-

tween idle and accelerating positions for regulating the flow of carbureted fuel to said engine intake, means defining a carbureting chamber between said primary valve means and said engine intake, means for supplying a secondary source of fuel and air to said chamber, secondary valve means connected between said secondary air source and said chamber, and cam means operatively connecting said secondary valve means to said primary valve means and responsive to the actuation of the latter toward an accelerating position to variably progressively diminish the flow of air from said secondary source to said chamber.

12. In a carburetor assembly having a body provided with a carbureting barrel for connection to the intake of an internal combustion engine and to which are directed primary sources of fuel and air for carburetion therein, and primary valve means in said barrel actuatable between idle and accelerating positions for regulating the flow of carbureted fuel to said engine intake, means defining a carbureting chamber between said primary valve means and said engine intake, means for supplying a secondary source of fuel and air to said chamber, secondary valve means connected between said secondary fuel source and said chamber, cam means operatively connected between said primary and secondary valve means being responsive to the actuation of said primary valve means toward an accelerating position to actuate said secondary valve means to an "on" position effective to direct a progressively increasing quantity of fuel from said secondary fuel source to said chamber and means interconnecting said primary valve means and the spark advancing means of the engine distributor responsive to actuating the primary valve means to an accelerating position to progressively actuate the spark advancing means of said distributor.

13. In a carburetor assembly having a body provided with a carbureting barrel for connection to the intake of an internal combustion engine and to which are directed primary sources of fuel and air for carburetion therein, and primary valve means in said barrel actuatable between idle and accelerating positions for regulating the flow of carbureted fuel to said engine intake, a housing having a carbureting chamber therein for placement in communication with said barrel between said primary valve means and said engine intake, means for supplying a secondary source of fuel and air to said chamber, secondary valve means including a needle valve rotatably adjustable in said housing between said secondary fuel source and said chamber, an idle air valve disposed between said secondary air source and said chamber, cam means operatively connected between said needle valve and said primary valve means, lever means operatively connected between said idle air valve and said primary valve means, said cam means and lever means being operable respectively in response to the actuation of said primary valve means to an accelerating position to rotate said needle valve and direct a progressively increasing quantity of secondary fuel to said chamber and to move said idle air valve to a closed position effective to disconnect said secondary air supply from said chamber and means interconnecting said primary valve means and the spark advancing means of the engine distributor responsive to actuating the primary valve means to an accelerating position to progressively actuate the spark advancing means of said distributor.

14. In a carburetor assembly as is defined in claim 13 and wherein the means interconnecting the primary valve means and the spark advancing means includes second cam means actuatable with said first mentioned cam means.

15. In a carburetor assembly having a body provided with a carbureting barrel for connection to the intake of an internal combustion engine and to which are directed primary sources of fuel and air for carburetion therein, and primary valve means in said barrel actuatable between idle and accelerating positions for regulating the flow of carbureted fuel to said engine intake, a housing having a carbureting chamber therein for placement in communication with said barrel between said primary valve means and said engine intake, means for supplying a secondary source of fuel and air to said chamber, secondary valve means including a needle valve rotatably adjustable in said housing between said secondary fuel source and said chamber, said needle valve being adjustable to an idle position to direct an idle quantity of secondary fuel to said chamber, cam means operatively connected between said needle valve and said primary valve means being operable in response to the actuation of said primary valve means to an accelerating position to rotate said needle valve and direct a progressively increasing quantity of secondary fuel to said chamber and means operatively connected to said needle valve being responsive to an increase in the vacuum conditions in the engine intake at the initiation of a deceleration of the engine to reversibly rotate the needle valve past its idle position to a closed vacuum lock position effective to cutoff the secondary source of fuel to said chamber during the interval of high vacuum in said deceleration cycle.

16. In a carburetor assembly having a body provided with a carbureting barrel for connection to the intake of an internal combustion engine and to which are directed primary sources of fuel and air for carburetion therein, and primary valve means in said barrel actuatable between idle and accelerating positions for regulating the flow of carbureted fuel to said engine intake, a housing having a carbureting chamber therein for placement in communication with said barrel between said primary valve means and said engine intake, means for supplying a secondary source of fuel and air to said chamber, secondary valve means including a needle valve rotatably adjustable in said housing between said secondary fuel source and said chamber, said needle valve being adjustable to an idle position to direct an idle quantity of secondary fuel to said chamber, first cam means operatively connected between said needle valve and said primary valve means being operable in response to the actuation of said primary valve means to an accelerating position to rotate said needle valve and direct a progressively increasing quantity of secondary fuel to said chamber, second cam means operatively connected to the body of the engine distributor responsive to actuating the primary valve means to an accelerating position to progressively rotate said distributor body and effect an advancement of the ignition spark from its idle position, and means operatively connected to said needle valve and said distributor body being responsive to an increase in the vacuum conditions in the engine intake at the initiation of a deceleration of the engine to reversibly rotate said needle valve past its idle position to a closed vacuum lock position effective to cutoff the secondary fuel to said chamber and to reversibly rotate said distributor body past its idle position to a vacuum retarded position during the interval of high vacuum during said deceleration cycle.

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