June 26, 1945. G. R. ERICSON 2,379,288

INTERNAL-COMBUSTION ENGINE

Filed July 31, 1942 2 Sheets-Sheet 1

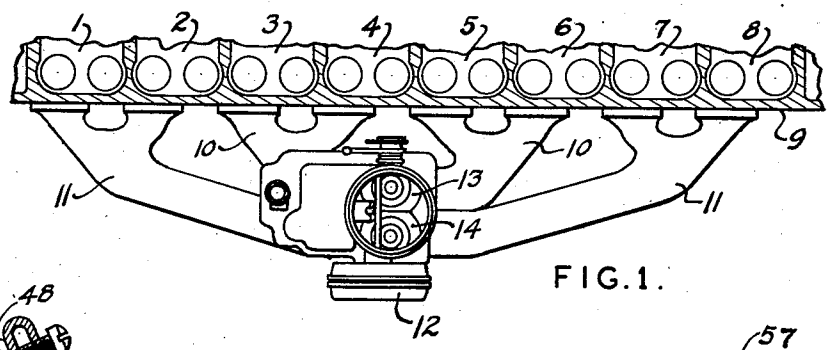

FIG. 1.

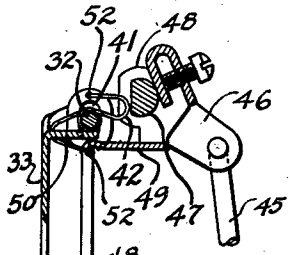

FIG. 5.

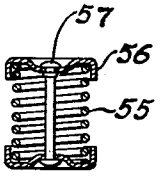

FIG. 6.

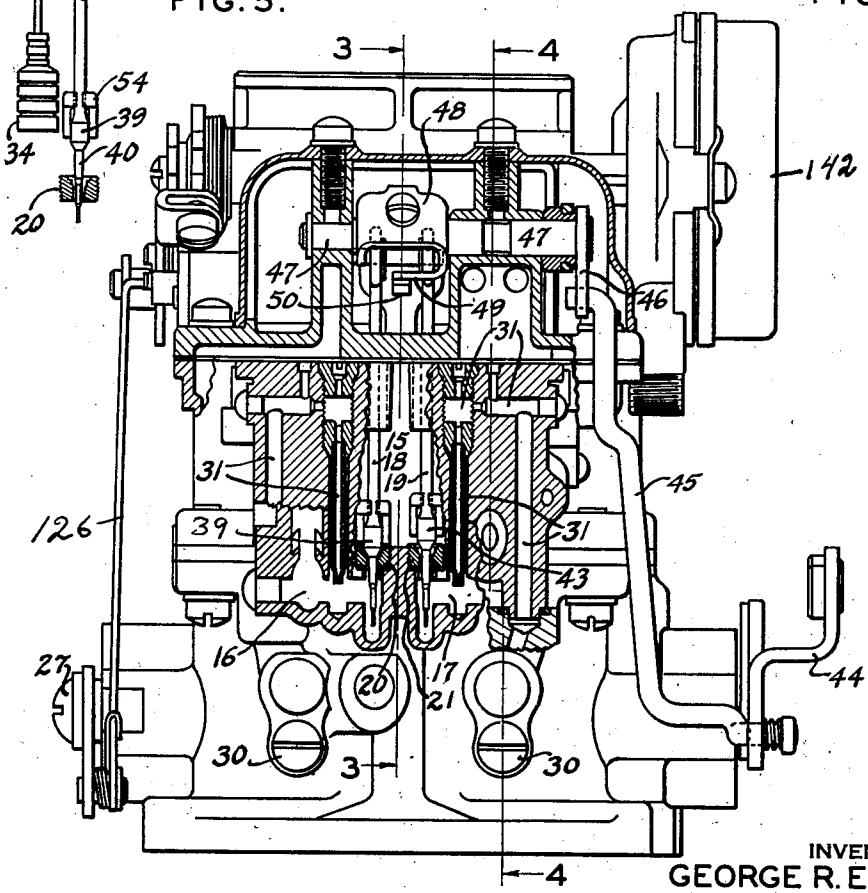

FIG. 2.

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June 26, 1945. G. R. ERICSON 2,379,288

INTERNAL-COMBUSTION ENGINE

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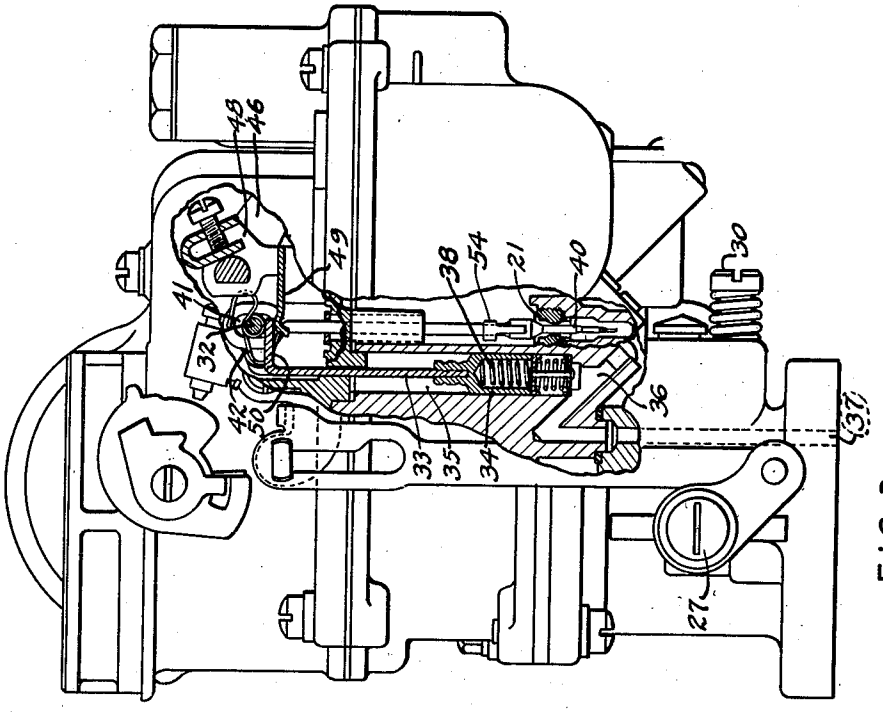

FIG. 3.

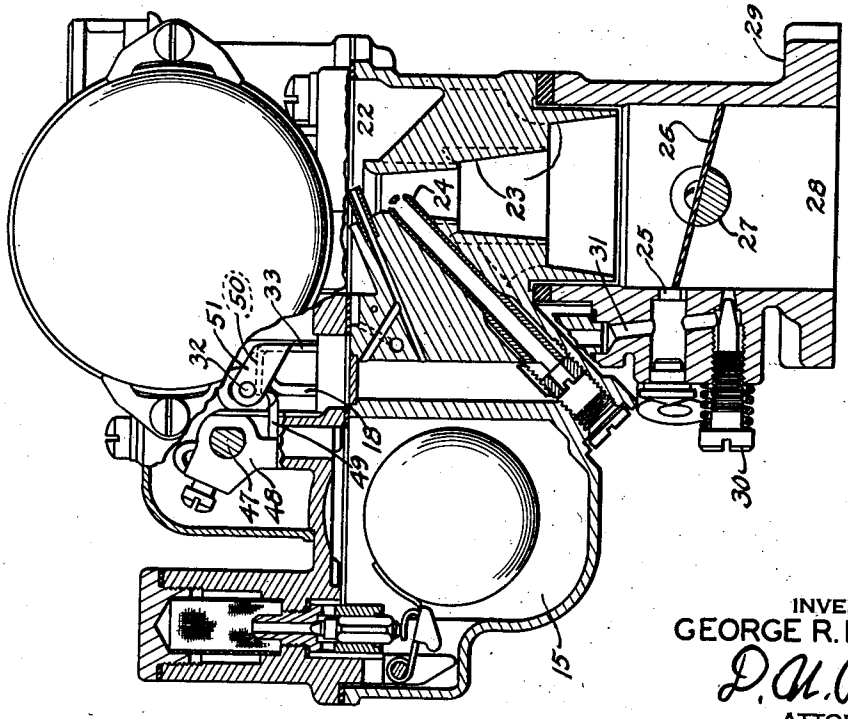

FIG. 4.

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2,379,288

INTERNAL-COMBUSTION ENGINE

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Application July 31, 1942, Serial No. 453,116

30 Claims. (Cl. 123—127)

This invention relates to internal combustion engines and more particularly to means and methods for operating such engines under conditions requiring the minimum of power without waste of fuel.

I have discovered that certain types of engines may be operated at idling speeds by the use of only part of the cylinders of the engine. Also, the engine may be more efficiently operated on part of its cylinders when only a small amount of power is required from the engine, as when driving along a level road at a limited speed.

There are other conditions under which it is not necessary to supply any fuel to the engine, as, for instance, when coasting, and my invention may be used to completely discontinue the supply of fuel under these conditions. In this respect, the invention is an improvement on my previous Patent No. 2,036,205, issued April 7, 1936. The invention will be better understood upon reference to the following specification, claims, and drawings, in which

Figure 1 is a diagrammatic view of a multi-cylinder internal combustion engine having my invention applied thereto.

Figure 2 is a sectional elevation showing a carburetor equipped for the performance of my invention.

Figure 3 is a diagrammatic sectional view taken along the line 3—3 of Figure 2.

Figure 4 is a diagrammatic sectional view taken substantially along the line 4—4 of Figure 2.

Figure 5 is a side elevation showing one of the metering rods or control valves.

Figure 6 shows an enlarged view of a modified form of precompressed coasting spring.

Figure 1 shows a multi-cylinder internal combustion engine having eight cylinders numbered 1 to 8. The engine block is indicated generally by the reference character 9, and this is connected to intake manifolds 10 and 11 which are served with fuel mixture by a carburetor 12 having two barrels 13 and 14. The inner manifold 10 supplying the inner four cylinders which operate only when full power is required may be termed the auxiliary manifold and the outer manifold 11 may be termed the main manifold, although the relationship may be reversed, if desired. Each barrel of the carburetor is supplied with fuel from the float chamber 15 by means of separate fuel passages 16 and 17, and the fuel supply to each passage is controlled by metering rods or valves 18 and 19, respectively.

Main jets 20 and 21 are provided with restricted orifices forming valve seats to receive the cooperating valve portions of the metering rods under certain conditions hereafter described.

It will be understood that the barrels of the carburetor may be substantially the same in construction, and each comprises an air inlet 22, one or more venturis 23, a main fuel nozzle 24, an idle fuel nozzle 25, and a throttle valve 26, which is mounted on shaft 27 controlling the fuel discharge outlet 28. The carburetor is bolted onto the intake manifolds by means of the flange 29. An idling adjustment screw 30 is provided for controlling the discharge outlet of one of the idling passages. The idle passages are supplied with fuel from the jets 20 and 21 through passages 31, which are connected to the passages 16 and 17, respectively, at a point between the main jet and the discharge outlet of the main jet. It will be understood that the idle fuel may be supplied independently from the main jets, if desired, as shown in my prior Patent No. 1,967,708, issued June 5, 1934.

The above construction is fairly well known, except as indicated and is frequently referred to as the plain tube type of carburetor. The construction is such that when the throttle valve is in nearly closed position, only fuel from the idle passages 25—31 is delivered to the engine and when the throttle is opened, the fuel discharge is transferred to the main nozzle 24, and the suction from the main nozzle prevents the discharge of fuel at the outlet 25, it being understood that the venturis 23 cause a higher suction to be established at the outlet of the main nozzle than that which exists at 25 during open throttle operation.

The metering rods 18 and 19 are connected to a pin 32 which is mounted on piston rod 33. This rod is connected to the piston 34 mounted in cylinder 35 for operation by suction through the passage 36. This suction passage is connected to the discharge outlet of the carburetor posterior to the throttle, as at 37. A spring 38 is mounted under the piston in a position to be compressed when the suction is high, so as to draw the members 18 and 19 down into the main jets. The metering rod 18 is provided with a valve portion 39, which seats in the main jet 20, to cut off all fuel supply to the carburetor barrel 13 and the inside manifold 10 when the suction is high. The point at which this main jet is cut off may be at a suction corresponding to 5" to 10" of mercury, depending on the particular installation, and at low suctions the fuel

is permitted to flow normally, subject to regulation by the graduated metering portion 40 carried at the lower end of the rod 18.

The rod 18 is connected with the pin 32 by means of a limited, lost motion, flexible connection 41 which may be provded with a light spring 42 to insure the firm seating of the valve 39 without preventing further downward movement of the rods 33 and 19. The rod 19 is provided with a valve portion 43 similar to the valve 39, which may be seated to shut off the fuel from the main jet 21 by further downward movement of the piston 34 after the valve 39 has seated. The spring 38 is calibrated to permit the seating of the valve 43 when the suction exceeds the normal idling suction, for instance, when coasting at speeds higher than the normal idling speed of the engine.

One of the important features of this device is the provision of means for preventing the valves 39 and 43 from occupying a position in which they substantially restrict but do not completely close the jet, and I have provided special means for this purpose, as follows:

A magnet 54 is mounted on the rod in such a position that its lower end approaches contact with the top of the jet just at the time when the valve reaches closing position. The jet is made of magnetic material, so that the magnet holds the jet firmly to the seat although with a very light pressure. The spring 42 is a very light spring, just sufficient to hold the weight of the rod and valve against the slight suction normally present which draws the metering rod portion 40 of the valve downwardly, but as soon as the magnet approaches the jet, the additional force of the magnet causes the valve to close with a snap action, which is only overcome when some piston force is applied by the spring 38 or by the manually operated member 49. However, as soon as the valve is broken away from its seat, the magnetic action is weakened, and the valve opens with a snap action. This arrangement prevents the valve occupying a position in which it would allow a highly restricted flow of fuel through the jet but still not sufficient to permit operation of the cylinders. If the valve remained in such nearly closed position, it would simply result in the wastage of fuel.

Another means for preventing the valve from occupying a nearly closed position is the action of the suction itself. During normal operation with the valve open, the normal suction of the carburetor can act on the metering rod portion 40 only, but the diameter and area of this portion are small compared to the diameter and area of the valve member 39. Thus, when the valve member begins to restrict the flow, the downward force exerted on it is increased in the measure of the difference in area between the rod portion 40 and the valve member 39, and this constitutes the snap action means for closing or opening the valve regardless of the magnet 54. In both cases, the spring 42 may be used to give a highly flexible action to the valve, although this action is limited by the length of the slot 41, so that the valve may be positively closed or opened.

In many installations, the action of the spring 38 may be used alone to oppose the suction action and position the metering rods and the valves 39 and 43. However, in some installations, the positive opening and closing of the valves will be improved by the use of the precompressed spring 55, which is held in a capsule composed of top and bottom washers 56 held together by the rivet 57 which limits the expansion of the precompressed spring 55 but does not prevent compression. The use of the spring 55 permits comparatively rapid downward movement of the metering rod after the establishment of a predetermined suction. Also, the action of this capsule is to present a fairly solid bottom for the piston 34 during the normal idling period.

The valve 39 is designed to shut off its jet at approximately 10 inches of mercury of vacuum alone, while the valve 43 is not intended to shut off its jet until a vacuum of at least 18 inches of mercury is developed. With this wide difference required in the action of the valves, it would be necessary to provide for substantial travel of the piston 34 and corresponding extra length of the metering rod portions 40, if the spring 38 alone were depended on to control the actuation of the valves. The provision of the spring capsule 56 permits the piston 34 to reach a definite limit of travel responsive to any vacuum between 10 inches and 18 inches of mercury. This position is retained until the 18 inches is exceeded, at which point the spring 55 yields and permits closing of the valve 43.

By this construction, the action of the parts may be more accurately controlled, and the size and length of the parts may be reduced. It will be understood that the figures of 10 inches and 18 inches of mercury are only illustrative and may be varied substantially according to the requirements of the particular engine and the use to which the device is applied. Without making any attempt to list the factors on which the closing pressures of the valves will depend, it may be noted that the compression ratio of the engine is an important factor in determining the normal idling manifold vacuum.

It will be understood that the usual accelerating pump is provided, and that the pump discharge to the inside (auxiliary) carburetor barrel 13 is made a little heavier than to the outside carburetor, because the manifold 10 will most frequently become dry and will require more fuel to wet it upon acceleration. The outside manifold is longer and has more surface to wet, but the wetting action is initiated sooner after coasting, and it is kept wet during normal idling.

It will also be understood that the fuel may be first shut off in the outside manifold 11 while permitting the engine to idle on the inside manifold 10, but, in most constructions, the shut off of the fuel to the inside manifold would be preferred on the ground that the manifold is shorter, has less well surface and capacity, and therefore, requires less time and fuel to set it in operation after idling.

The throttle shaft 27 is normally biased to close the throttle by the conventional spring which is not shown. The shaft 27 is connected by means of the lever 44, link 45, and lever 46 to the rock shaft 47. This rock shaft carries a lever 48 having a projecting arm 49 which is constructed and arranged to contact the underside of the horizontal projection 50 which is preferably integral with the upper end of the piston rod 33. The member 50 has upturned lugs 51 (Fig. 4) on which the pin 32 is mounted, so as to make a direct operating connection between the piston 34 and the metering rods 18 and 19. This connection, however, is flexible by reason of the fact that the spring 42 is bent at its ends to pass through the openings 52 which are controlled through the metering rod above and below the slot or lost motion connection 41. The connection between the throttle

valve and projecting arm 49 is such that the projection 50 and the metering rods are forced upwardly upon an opening movement of the throttle, and, in the preferred construction, the rod 19 is first lifted off its seat to initiate the supply of fuel to the outside manifold 11, and the rod 18 is forced off its seat later in the opening movement of the throttle.

It will be understood that the usual accelerating pump actuated by opening movement of the throttle is provided. An example of this pump may be found in my previous patent above mentioned, but it is not believed necessary to describe it in detail. A conventional automatic choke mechanism is also provided, but this is not essential to the present invention and need not be described.

While the automatic choke mechanism is not described in detail, reference may be had to Coffey Patent No. 2,085,351, issued June 29, 1937, or Blattner 2,166,899, issued July 18, 1939, which shows means for preventing the closing of the throttle to its full idle position by the throttle spring, which is provided to normally maintain it in that position. This means operates during the warming up period, so that the starting and warming up is accomplished by joint action of all the cylinders of the engine, and it should be noted that the adjustment of the arm 50 with respect to the member 49 is such as to prevent the closing of the valve 39 when the fast idle is in operation; that is to say, when the throttle is held in the fast idle position, as by means corresponding to the members 35—41—26 of the Coffey Patent No. 2,085,351, or 32, etc. of Blattner, the throttle is opened far enough to insure the lifting of the valve 39 off of its seat. It may also be noted that when the engine is equipped with an automatic starting device corresponding to that which is shown in Coffey Patent No. 2,174,313, issued September 26, 1939, the opening of the throttle by means of the accelerator pedal will be sufficient to lift the valve 39 off its seat before the starter switch is operated. It may also be noted generally that the link 126 shown in Figure 2 of this application corresponds generally to the link 26 of Coffey 2,085,351, and to link 32 of Blattner, and the housing 142 and thermostatic control mechanism may be said to correspond generally to the housing 42 and thermo-control mechanism of the Coffey patent.

From the foregoing it will be observed that the present invention may be adopted in carburetors of various types, particularly where the fuel distributing system includes a manifold so constructed and arranged as to feed the explosive mixture to separate banks of cylinders from a carburetor mechanism. In such assemblies it will be practical with the present invention to permit the idling of a motor only with an extremely small amount of power such as may be derived from an idling mixture supplied to only a part of the total number of cylinders of the engine. This development is elastic at least to the extent that one or more jets can be totally closed where only a limited amount of power may be necessary to drive along a substantially level road at a relatively limited speed. The closing of a jet or of more than one jet, is essentially synchronized with the mechanism controlling the normal operation of the engine and it is preferable that the closing of the jet or jets be brought about with a snap action such as will tend to eliminate undesirable and irregular explosions tending to bring about a possible surging condition in the motor. In other words, it is desirable that where a bank of cylinders is to be discontinued from use as a source of power in a motor, the shutting off of one of the fuel supplies to these cylinders should represent an operation clearly eliminating unsatisfactory conditions which might be caused should the opening and closing of the jet be slow or ragged in its function. As previously suggested, in instances where the engine is being driven by the motor the thought can be utilized for closing all jets.

In the present disclosure the metering rods controlling the jets are operated by vacuum and the valves carried by the metering rods for closing the jets are positioned axially of the metering rods so that their opening and closing operations will be timed in proper relation with the operation of the motor to secure the desired result. Means are included to bring about the snap action of the valves when opening and closing the jets and other means may be provided for accomplishing this same purpose. The idea may be adopted to carburetor structures not involving the suction operation of the metering rods.

The basic teaching resides in the fact that by selectively shutting off the idling mixture to predetermined cylinders, by automatic means or otherwise, substantial fuel can be saved during certain periods of engine operation without in any way affecting the motor. The successful accomplishment of the invention essentially comprehends a construction and arrangement such that interference during normal operation is nil.

It will be apparent from the foregoing that in adopting the invention it will be essential to take into consideration many features of the charge forming device and engine to which the device is to be applied and while some of these features are pointed out in the present specification other factors may appear which will tend to modify a proper installation.

I claim:

1. The method of operating an automobile having a multi-cylinder engine which comprises supplying fuel to all of the cylinders during normal operation of the automobile by the engine, cutting off the supply of fuel to one or more of the cylinders when the engine is idling, and cutting off the supply of fuel to all of the cylinders when the engine is being driven by the automobile.

2. The method of operating a motor vehicle of the type having a multi-cylinder internal combustion engine, an air inlet for the engine, and a control device for said air inlet, which comprises supplying fuel to all of said inlets during operation of the vehicle by the engine, supplying fuel to only part of said inlets, when less than a predetermined amount of power is required from said engine, and cutting off the supply of fuel to all of said inlets when the engine is being driven by the vehicle.

3. In an internal combustion engine having a plurality of cylinders and separate air conduits therefor, manual means for controlling the supply of fuel to said air conduits, and suction means for operating said control means to cut off the supply of fuel to at least one of said conduits when the suction has increased a predetermined degree after the operation of said control.

4. In an internal combustion engine having a plurality of cylinders, air supply conduits for said cylinders, pressure responsive valve means for stopping the supply of fuel to one of said conduits, and valve means responsive to a dif-

ferent pressure for stopping the supply of fuel to the other of said conduits.

5. In an internal combustion engine, a pair of mixture conduits each independently feeding a group of cylinders, a fuel metering orifice member for each of said conduits, a valve member for each of said orifice members, a throttle in each of said conduits, suction responsive means to close said valves successively against said orifice members as the suction in said conduit increases whereby the group of cylinders are successively cut out, and yielding means normally urging said valves away from said seat members.

6. In a fuel supply system for multiple cylinder engines, a carburetor, independent mixture conduits connecting certain of said cylinders and said carburetor, a fuel metering orifice for each of said conduits, a valve member for regulating the discharge through each of the orifices, a throttle in each of said conduits, means operable in response to suction for closing said valves in sequence as the suction in the conduit varies, and means normally urging said valves towards open position.

7. In a fuel supply system for multiple cylinder engines, a carburetor, independent mixture conduits connecting certain of said cylinders and said carburetor, a fuel metering orifice for each of said conduits, a valve member for regulating the discharge through each of the orifices, a throttle in each of said conduits, and means operable in response to movement of said throttle to substantially closed position for moving certain of said valve members to a fully closed position.

8. In a fuel supply system for multiple cylinder engines, a carburetor including a fuel bowl, independent mixture conduits connecting said carburetor with certain of said cylinders, a fuel metering orifice between said bowl and each of said conduits, a valve member for regulating the discharge through each of the orifices, a throttle in each of said conduits, means for moving the throttles in said conduits simultaneously towards open and closed positions, and means operable in response to movement of said throttles to substantially closed position for moving certain of said valve members to fully closed position, whereby the entire fuel supply to certain of said cylinders is discontinued.

9. In a fuel supply system for multiple cylinder engines, a carburetor including a fuel bowl, independent mixture conduits connecting said carburetor with certain of said cylinders, a fuel metering orifice between said bowl and each of said conduits, a valve member for regulating the discharge through each of the orifices, a throttle in each of said conduits, means for moving the throttles in said conduits simultaneously towards open and closed positions, means operable in response to movement of said throttles to substantially closed position for moving certain of said valve members to fully closed position, whereby the entire fuel supply to certain of said cylinders is discontinued upon the substantially closed position of said throttles, and means for moving certain other valve members to fully closed position by increase in suction beyond that created by the substantially closed position of said throttles.

10. In a fuel supply system for a multiple cylinder engine, a carburetor, independent mixture conduits connecting certain of said cylinders with said carburetor, a fuel metering orifice for each of said conduits, a movable metering pin for regulating the discharge through each of the orifices, a valve member carried by one of said metering pins, a throttle in each of said conduits, means for moving the throttles in said conduits simultaneously towards closed position, and means operable in response to movement of said throttles for moving the metering pin carrying said valve to a position whereby the orifice is completely closed by said valve.

11. In a fuel supply system for multiple cylinder engines, a carburetor, independent mixture conduits connecting certain of said cylinders with said carburetor, a fuel metering orifice for each of said conduits, a movable metering pin for regulating the discharge through each of the orifices, a valve member carried by one of said metering pins, a throttle in each of said conduits, means for moving the throttles in said conduits simultaneously towards closed position, means operable in response to movement of said throttles for moving the metering pin carrying said valve to a position whereby the orifice is completely closed by said valve, and resilient means normally urging said last-named metering pin towards closed position.

12. In a multiple cylinder internal combustion engine including a carburetor, conduits connecting said carburetor with groups of cylinders, means for supplying and controlling a fuel mixture of maximum power and economy for normal running through all of said conduits, means for supplying an idling mixture through each of said conduits from said carburetor when the normal fuel supply is discontinued, and means for sequentially discontinuing the idle mixture through said conduits controlled by variations of the vacuum in said conduits.

13. In a fuel supply system for multiple cylinder engines, a carburetor including a fuel bowl, independent mixture conduits connecting said carburetor with certain of said cylinders, a fuel metering orifice connecting said fuel bowl with each of said conduits, a metering pin for normally regulating the discharge through each of the orifices, valves carried by said metering pins, a throttle in each of said conduits, means for moving the throttles in said conduits towards open and closed position, and means operable in response to movement of the throttle in one of said conduits to substantially closed position for moving the metering pin to cause the valve carried thereby to positively close said orifice, whereby the entire fuel supply to the cylinders connected with said conduit are without source of fuel supply.

14. A method of operating a multiple cylinder internal combustion engine which includes supplying fuel and air for normal operation in a mixture suitable for maximum power and economy through a plurality of mixture conduits and from a suitable source, arranging the mixture conduits to supply the normal fuel mixture to independent groups of cylinders and controlling said conduits by jointly movable throttle valves, discontinuing the normal fuel supply and feeding idling mixture through said conduits when the throttle valves are in substantially closed position, and discontinuing the idle mixture through certain of said conduits by means operated in response to the movement of said throttle valves to their substantially closed position, whereby the engine may idle with certain groups of cylinders entirely disconnected from their fuel source.

15. In an internal combustion engine having

a plurality of cylinders and separate air conduits therefor, fuel supply means for said conduits, an individual metering orifice for each conduit, valves for controlling said orifices, suction operated means for actuating said valves, one of said valves being adapted to seat while the other remains movable, and means to insure quick seating of said last mentioned valve as it approaches the corresponding metering orifice to prevent the supply of fuel through said last orifice at a rate insufficient to support combustion in the corresponding cylinders.

16. In an internal combustion engine having a plurality of cylinders and separate air conduits therefor, fuel supply means including a metering orifice for each of said conduits, valves controlling said orifices, and a suction operated device for actuating said valves, one of said valves being connected to said device by means of a flexible element and being adapted to seat against the corresponding metering orifice while the other valve remains movable.

17. In a fuel supply system for a multiple cylinder engine, a carburetor, independent mixture conduits connecting the same to certain of said cylinders, a fuel metering orifice for each of said conduits, a movable metering pin for regulating the discharge through each of said orifices, a valve member carried by one of said metering pins, a throttle in one of said conduits, means for operating said throttle, and means operable in response to movement of said throttle for moving the metering pin carrying said valve to a position whereby its metering orifice is completely closed.

18. An internal combustion engine fuel supply system as described in claim 17 in which the mentioned throttle is located in one mixture conduit and the valved metering pin controls the metering orifice supplying the other mixture conduit.

19. In a fuel supply system for a multiple cylinder engine, a carburetor, independent mixture conduits connecting certain of said cylinders with said carburetor, a fuel metering orifice for each of said conduits, a valve for regulating the discharge through the metering orifice associated with one of said conduits, a throttle in the other conduit, means operable in response to throttle closing movement for moving said valve toward the corresponding metering orifice, and means producing rapid final closing movement of said valve whereby said valve cannot remain in such a restricting position as to allow the passage to its associated cylinders of insufficient fuel for operating the same.

20. In a fuel supply system for a multiple cylinder engine, a carburetor, independent mixture conduits connecting certain of said cylinders with said carburetor, a fuel metering orifice for each of said conduits, a movable metering pin for regulating the discharge through each of said orifices, a valve member carried by the metering pin associated with one of said conduits, a throttle in the other conduit, means for closing said throttle, means operable in response to opening of said throttle for moving said valve away from the corresponding metering orifice, and means producing rapid initial movement of said valve away from its orifice to prevent said valve from remaining in such a restricted position as to permit the passage of insufficient fuel thereby to operate the associated engine cylinders.

21. In an internal combustion engine fuel supply system as described in claim 20 in which said last mentioned means also functions to produce rapid final closing movement of said valve.

22. In a fuel supply system for a multiple cylinder engine, a carburetor, independent mixture conduits connecting certain of said cylinders with said carburetor, a fuel metering orifice for each of said conduits, a movable metering pin for regulating the discharge through each of said orifices, a valve member carried by one of said metering pins, a throttle in one of said conduits, means operable in response to movement of said throttle for actuating said valved metering pin to and from its closed position, and means applying additional force tending to hold said valve closed whereby closing of said valve is effected under different suction conditions than opening thereof.

23. In a fuel supply system for multiple cylinder engines, a carburetor, independent mixture conduits connecting certain of said cylinders with said carburetor, a fuel metering orifice for each of said conduits, a movable metering pin for regulating the discharge through each of said orifices, a valve carried by one of said metering pins, a throttle in one of said conduits, spring means for opening said valve, means responsive to suction in the throttled conduit for closing said valve, and means applying additional closing force to said valve as it approaches and engages its controlled orifice whereby closing of said valve occurs under different suction conditions than opening thereof.

24. In a fuel supply system for a multiple cylinder engine, a carburetor, independent mixture conduits connecting certain of said cylinders with said carburetor, a fuel metering orifice for each of said conduits, a movable valve controlling one of said orifices, a throttle in one of said conduits, means responsive to suction in the throttled conduit for opening and closing said valve, and means for supplying extra fuel to the valve controlled conduit approximately as said valve is opened for wetting the associated mixture conduit.

25. In a multiple cylinder internal combustion engine including a carburetor, conduits connecting said carburetor with groups of cylinders, means for supplying and controlling a fuel mixture of maximum power and economy for normal running through all of said conduits, means for supplying an idling mixture through at least one of said conduits from said carburetor when the normal fuel supply is discontinued, and means for sequentially discontinuing the idle mixture through said conduits controlled by variations of the vacuum in said conduits.

26. In a multiple cylinder internal combustion engine including a carburetor, conduits connecting said carburetor with groups of cylinders, means dependent upon throttle movement for supplying and controlling a fuel mixture for maximum power and economy from said carburetor to one group of cylinders, means for supplying fuel from said carburetor through another conduit to another group of cylinders when additional power is desired, and means for initially proportioning the supply of fuel to said conduits from said carburetor to maintain a continuous flow of power from said engine.

27. In a multiple cylinder internal combustion engine including a carburetor, conduits connecting said carburetor with groups of cylinders, means dependent upon throttle movement for supplying and controlling a fuel mixture for maximum power and economy from said carburetor

to one group of cylinders, means for supplying fuel from said carburetor through another conduit to another group of cylinders when additional power is desired, and means controlled by manifold suction for initially proportioning the supply of fuel to said conduits from said carburetor to maintain a continuous flow of power from said engine.

28. In a multiple cylinder internal combustion engine including a carburetor, conduits connecting said carburetor with groups of cylinders, means dependent upon throttle movement for supplying and controlling a fuel mixture for maximum power and economy from said carburetor to one group of cylinders, means for supplying fuel from said carburetor through another conduit to another group of cylinders when additional power is desired, and means for initially varying the supply of fuel to one of said conduits to maintain an uninterrupted flow of power.

29. In an internal combustion engine, a plurality of mixture conduits communicating with separate cylinders of said engine, a fuel supply passage for each of said conduits, a valve controlling each of said passages, a spring-resisted, suction-responsive device for applying closing force to said valves upon increases of engine suction, said valve being arranged to be serially closed during movement of said device and said device having a lost-motion connection to one of said valves, and spring means cooperable with said device in the last portion only of the closing movement of said last mentioned valve for additionally resisting closing thereof whereby said latter valve is fully closed only at a higher suction than the other valve.

30. The combination specified in claim 29 in which each of said mixture conduits feeds a separate group of engine cylinders, said suction-responsive device being constructed to cut off the supply of fuel to one of said groups during low speed operation and to both of said groups when the engine is being driven by an outside force.

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