June 21, 1960

A. F. BRAUN

2,941,788

FOUR BARREL CARBURETOR

Original Filed Nov. 21, 1951

4 Sheets-Sheet 1

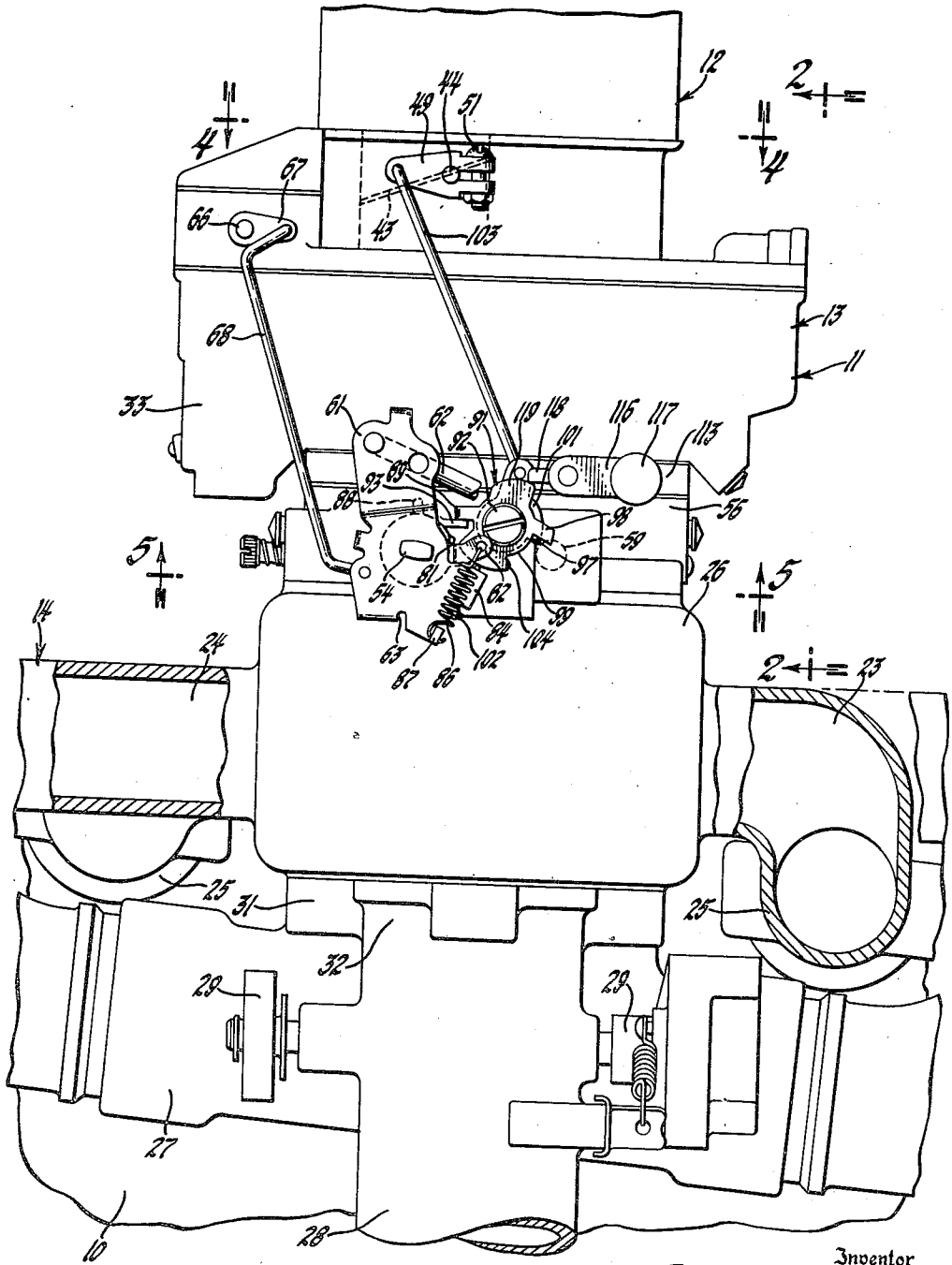


Fig. 1

Inventor

Adolph F. Braun

By

Willitt, Helwig & Baillio

Attorneys

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4 Sheets-Sheet 2

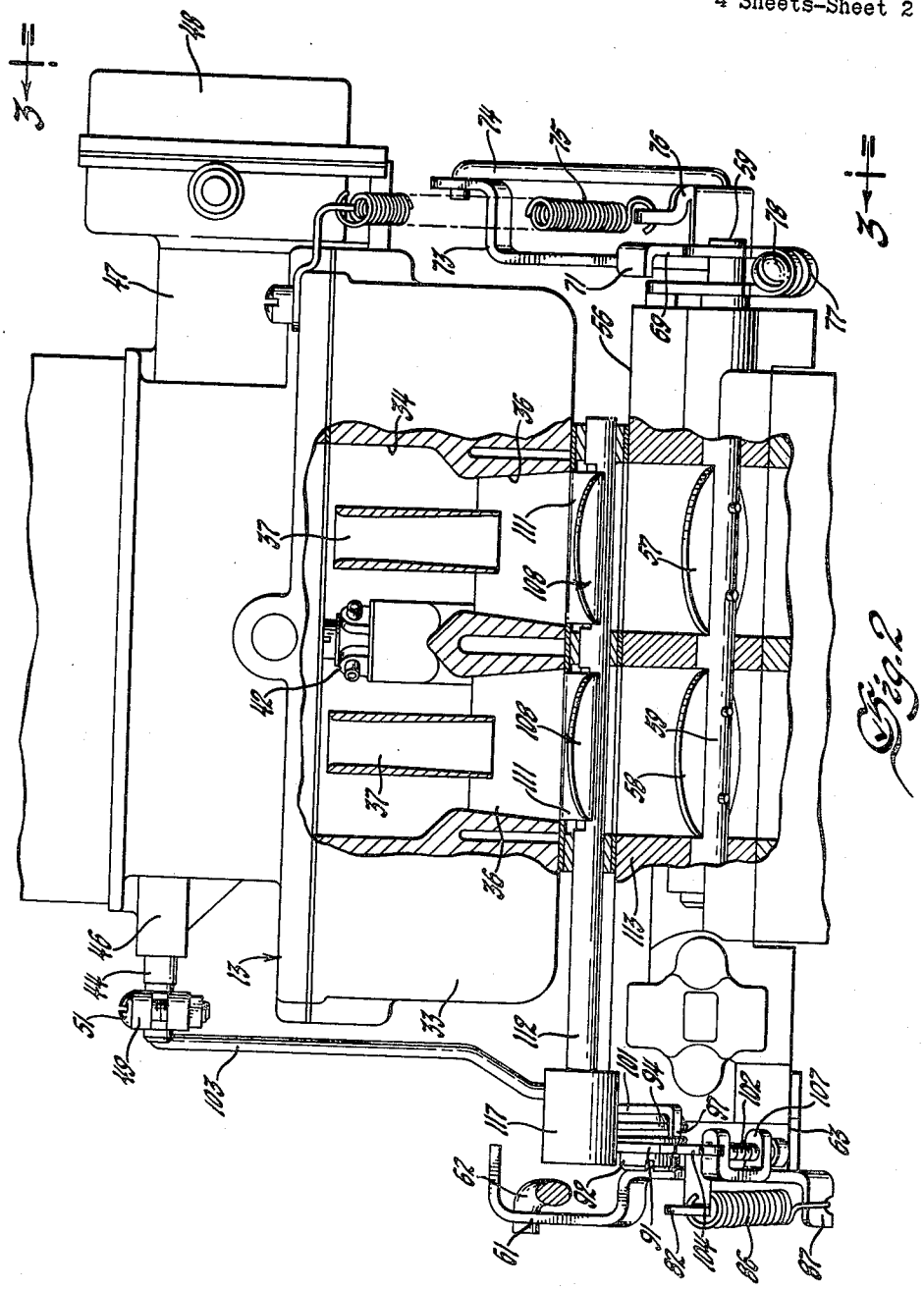


Fig. 2

Inventor
Adolph F. Braun

By
Willitt, Helwig & Baillio
Attorneys

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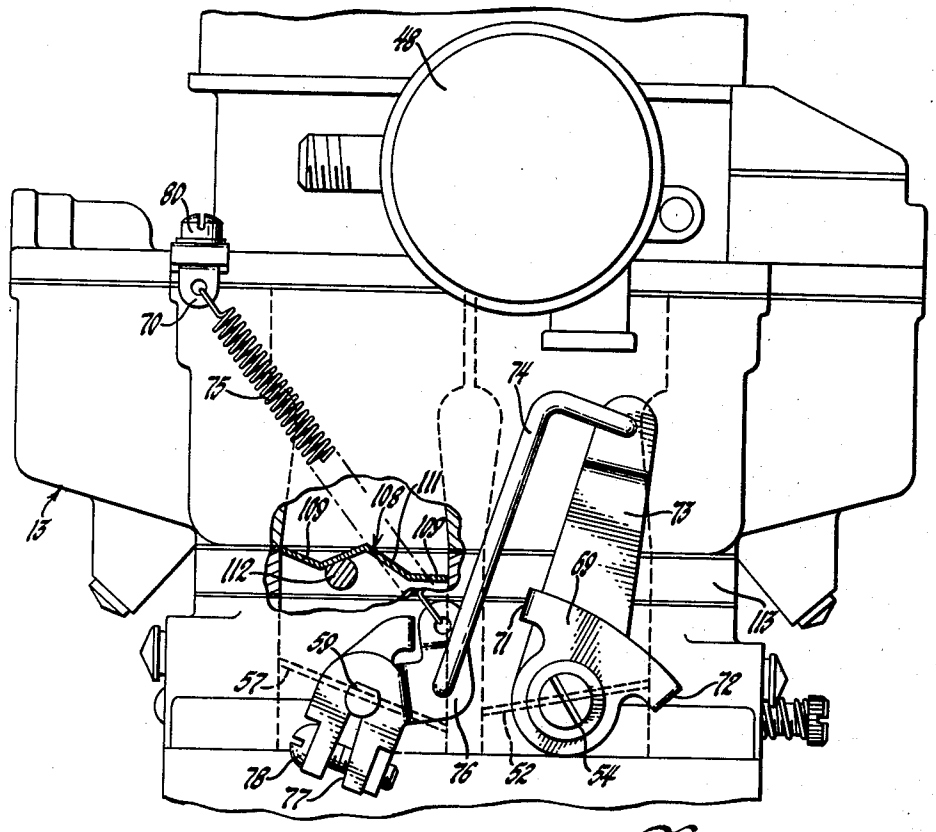


Fig. 3

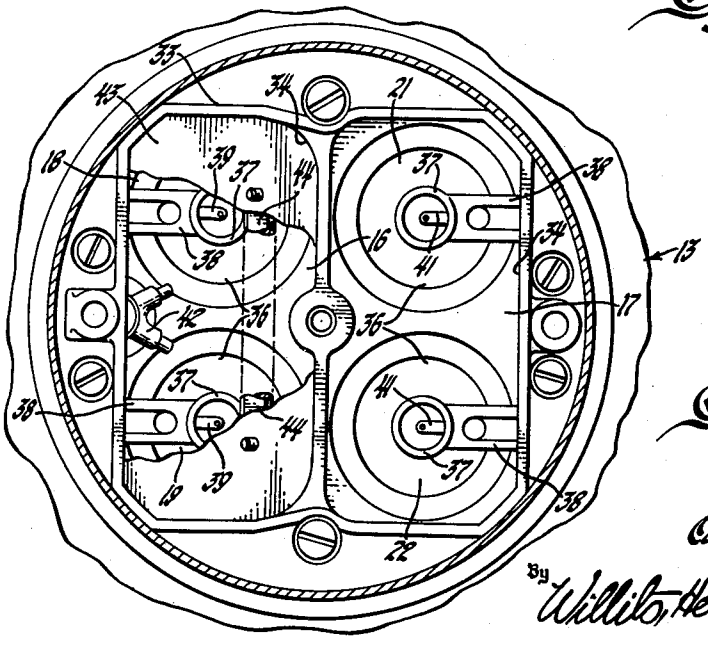


Fig. 4

Inventor
Adolph F. Braun
By Willitt, Helwig & Baillio
Attorneys

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4 Sheets-Sheet 4

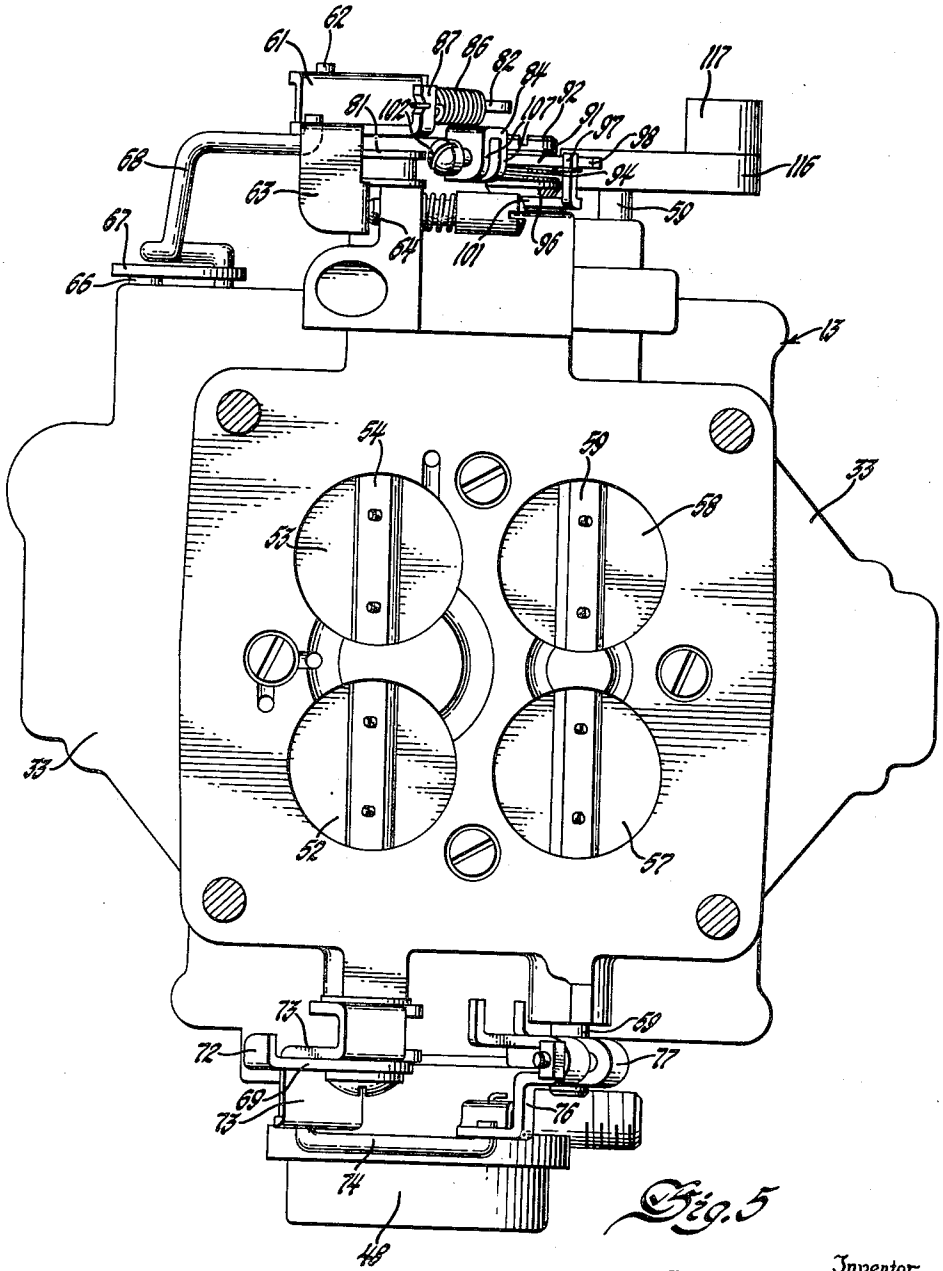


Fig. 5

Inventor
Adolph F. Braun

By Willits, Helwig & Baillio
Attorneys

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2,941,788

FOUR BARREL CARBURETOR

Adolph F. Braun, Pittsford, N.Y., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Continuation of application Ser. No. 257,578, Nov. 21, 1951. This application Nov. 18, 1957, Ser. No. 697,119

4 Claims. (Cl. 261—23)

This invention relates to charge forming devices for engines and has particular relation to controlling the flow of combustible mixture to one or more groups of cylinders of an engine through primary and secondary passages employed in the charge forming device, and is a continuation of Serial No. 257,578, filed November 21, 1951, now abandoned.

It is proposed to construct a charge forming device employing a compound carburetor in which the various elements of the structure will constitute a single mechanical unit for supplying the cylinders of the engine. This unit has control mechanism constructed as part of the unit and may be assembled at the factory in such way that when the unit is installed on an engine the charge forming device will be independently operable to meet the requirements of the engine. The device comprises a single inlet passage which branches in the carburetor to provide primary and secondary mixture forming passages. One of the primary passages and one of the secondary passages is connected to each of a plurality of main distribution passages formed in the inlet manifold of the engine. Each main distribution passage may supply a different group of cylinders of the engine. The primary pasages originate in a single primary chamber containing a choke valve beyond which the fuel is supplied to the primary passages through jets which spray into venturi passages formed in the inlet ends of the primary passages. The secondary passages also have similar venturi passages into which fuel is supplied by jets. No choke valve is required in the chamber leading to the secondary passages. The chamber leading to the primary passage also may be provided with separate jets through which fuel is supplied for accelerating the speed of the engine. The primary and secondary passages are provided with manually operated throttle valves which are mounted on different shafts. The throttle valves for the primary and secondary passages are connected by a mechanical linkage which opens the throttle valves at different rates and does not open the secondary throttle valves until the primary throttle valves are open to a predetermined extent. The rate of opening these valves is such that both the primary and secondary throttle valves will be completely open at the same time. The secondary passages are provided with additional means in the form of unbalanced flow actuated valves for controlling the flow of fluid to the engine. These valves are mounted upon a shaft the rotation of which is opposed by a force which tends to decrease as the valves are opened. These auxiliary throttles are located in the secondary passage between the secondary throttles and the secondary chamber forming the inlet thereto, so that the valves will not be affected by the wide variation in inlet manifold vacuum that occurs in the inlet manifold beyond the secondary throttles. The auxiliary valves are unbalanced valves which tend to open in response to the flow of fluid in the secondary passages anterior to the secondary throttles. There will be no force tending to open the valves until the secondary throttles are open

and then the auxiliary valves will be opened only in the event there is a sufficient difference in pressure in opposite sides of the valves and resulting from the flow of fluid in the secondary passages anterior to the secondary throttles. Connecting means is provided between the choke valve affecting the primary passages and the secondary and auxiliary throttles in the secondary passages to control the opening of the secondary and auxiliary throttles during the opening movement of the choke valve and under different conditions of engine operation.

In the drawings:

Figure 1 is a fragmentary side elevational view of an engine provided with a charge forming device embracing the principles of the invention.

Figure 2 is a fragmentary side elevational view of the charge forming device illustrated by Figure 1 with parts thereof broken away to illustrate in section the secondary passages employed in the compound carburetor employed in the structure illustrated. Figure 2 is taken substantially in the plane of line 2—2 on Figure 1 looking in the direction of the arrows thereon.

Figure 3 is another elevational view of the charge forming device showing a part of the carburetor broken away to better illustrate the auxiliary throttles employed in the secondary passages of the carburetor. Figure 3 is taken substantially in the plane of line 3—3 on Figure 2 looking in the direction of the arrows thereon.

Figure 4 is a cross sectional view through the carburetor inlet part of the charge forming device illustrated by the preceding figures. Figure 4 is taken in the plane of line 4—4 on Figure 1 looking in the direction of the arrows thereon.

Figure 5 is a bottom view of the carburetor structure illustrated in the preceding figure. Figure 5 is taken in the plane of line 5—5 on Figure 1 looking in the direction of the arrows thereon.

The engine 10 illustrated by Figure 1 has reciprocating pistons operating in cylinders which are supplied with combustible charges by a charge forming device indicated generally at 11. The charge forming device 11 generally comprises an inlet conduit 12, a carburetor 13, and an inlet manifold 14. The inlet conduit 12 is adapted to supply air to the carburetor 13 which is employed in forming a combustible mixture that is supplied to the cylinders of the engine through an induction passage means extending through all of these elements. As is customary in the art, the part of the induction passage embraced in the inlet 12 may include air cleaning and silencing devices sometimes employed with engines of this kind. At the inlet 12 the induction passage may constitute a single passage which may extend to the atmosphere through any cleaner and silencer devices that may be employed. Beyond the inlet 12 the induction passage branches in such a way as to provide primary and secondary chambers 16 and 17 respectively where the air supplied by the inlet 12 may be divided within the carburetor 13 and there employed in forming primary and secondary charges for use in operating the engine 10. The chambers 16 and 17 each communicate with one or more primary and secondary passages a plurality of which is indicated at 18 and 19 and 21 and 22 respectively and by which the charge formed by the carburetor 13 is delivered to the inlet manifold 14. At the lower ends thereto, the primary passage 18 and the secondary passage 21 communicate with one main distribution passage 23 of the inlet manifold 14 while the primary passage 19 and the secondary passage 22 likewise communicate at the lower ends thereof with another main distribution passage 24 of the inlet manifold 14. The main distribution passages 23 and 24 are shown as being in parallel relation to one another with the passage 24 being in front

of the passage 23 as the two passages are illustrated in Figure 1. The main distribution passage 23 is shorter than the main distribution passage 24 of the inlet manifold 14 and has outlets 25 at the opposite ends thereof which supply explosive mixture delivered by one or both of the primary and secondary passages 18 and 21 respectively, to the middle cylinders of the engine 10. The passage 24 has outlet ports at the opposite ends thereof which supply combustible mixture from one or both of the primary and secondary passages 19 and 22 respectively, to the end cylinders of the engine. The primary passages 18 and 19 supply combustible mixture to the passages 23 and 24 respectively, a short distance to one side of the middle of the passages 24 and 23 while the secondary passages 21 and 22 respectively supply combustible mixture to the passages 23 and 24 an equal distance on the other side of the middle of the passages.

The region where the primary and secondary passages 18 and 22 communicate with the main distribution passages 23 and 24 is surrounded by a heating chamber 26 which may be supplied with exhaust gas from the engine for the purpose of heating the mixture supplied to all of the cylinders of the engine. The cylinders of the engine have exhaust ports which communicate with the exhaust manifold 27, the central part of which has an outlet 28 controlled by an exhaust gas valve mechanism indicated at 29. The heating chamber 26 has inlet and outlet passages 31 and 32 respectively which communicate with the exhaust manifold 27 and the outlet 28 and the flow of exhaust gas through which is controlled by the valve mechanism indicated at 29. When the engine is cold, the valve mechanism will deflect the exhaust gas through the heating chamber 26. When the engine becomes warm and when pressure conditions in the exhaust manifold exceed a predetermined value the valve mechanism 29 will discharge the exhaust gas from the manifold 27 directly through the outlet 28 without passing through the heating chamber 26.

The carburetor 13 comprises an outer casing 33 having inner walls 34 projecting therethrough and in which the primary and secondary chambers 16 and 17 and the primary and secondary passages 18 and 19 and 21 and 22 are formed. The space between the inner walls 34 and the outer casing 33 provides primary and secondary float chambers which are separated from one another by a partition wall extending across the space in the region thereof between the primary and secondary passages. Each of the float chambers contains a float valve mechanism which controls the supply of fuel to the float chambers, one of the float chambers being adapted to supply fuels to the primary passages, the other to the secondary passages of the carburetor 13. Each of the float mechanisms comprises a parallel pair of floats which are connected together across the ends of the float chambers by a transversely disposed lever mechanism, the middle portion of which operates the valves by which fluid is admitted to the float chambers. The floats in each float chamber have the movable ends thereof projecting toward one another and occupy parts of the float chambers located at opposite ends of the primary and secondary passages within the carburetor 13.

The inner walls of the carburetor 13 are formed in such a way as to provide outer venturis 36 at the outer ends of the primary and secondary passages 18 to 22 which communicate with the primary and secondary chambers 16 and 17. One or more inner venturis 37 may be provided for each of the primary and secondary passages 18 to 22, these being disposed anterior to the venturis 36 and in such a way that the outlet ends of the inner venturis 37 discharge adjacent the throats of the venturis 36. The inner venturis 37 may be supported from the inner walls 34 of the carburetor 13 by webs 38 which project inwardly to the venturis 37 from oppositely disposed walls of the primary and secondary chambers 16 and 17 respectively. Jets 39 are provided for supplying fuel to the venturis of the primary passages 18 and 19 and jets 41 supply fuel to the venturis of the secondary passages 21 and 22. The primary chamber 16 is provided with accelerating jets 42 which are located in the middle of the outer wall thereof and which project in opposite directions toward the inlets to the primary passages 18 and 19.

The inlet to the primary chamber 16 of the carburetor 13 is controlled by a choke valve 43 which is mounted in unbalanced relation to the primary chamber 16 upon a shaft 44 the opposite ends of which project through the outer casing 33 of the carburetor 13 and are mounted in bearings 46 and 47 formed therein. Beyond the bearing 47 the carburetor 13 is provided with a temperature responsive actuating mechanism or thermostat indicated at 48. The thermostat 48 actuates the shaft 44 for the purpose of opening the choke valve 43 as the engine warms up. Beyond the bearing 46 the shaft 44 has an arm 49 secured thereto by a screw indicated at 51. The arm 49 responds to the movement of the valve 43 in response to the operation of the thermostat 48.

The flow of fluid through the primary passages 18 and 19 of the carburetor 13 is controlled by throttles indicated at 52 and 53 respectively and secured rigidly to a single shaft 54 which is supported at opposite ends in bearings formed in a throttle body 56 secured to the lower part of the carburetor casing 33. The secondary passages 21 and 22 also are controlled by throttles indicated respectively at 57 and 58 and which likewise are supported by a single shaft 59 projecting across the passages and supported at opposite ends thereof in bearings formed in the throttle body 56. The position of the primary throttles in the passages 18 and 19 is determined by a lever 61 which is rigidly secured to one of the outer ends of the shaft 54 and which may be operated manually by a rod 62. The rod 62 may be operated by the accelerator pedal in the vehicle in which the engine 10 is employed. The end of the lever 61 opposite the rod 62 is formed in such manner as to provide an inwardly bent arm 63 which is adapted in closed or idling position of the throttle to engage the end of a throttle stop screw indicated at 64. A spring is normally employed in the mechanism for operating the rod 62 for resiliently retaining the arm 63 in engagement with the stop 64.

The carburetor 13 also is provided within the casing 33 with an accelerating pump for supplying liquid fuel to the accelerating jets 42. The accelerating pump is actuated by a shaft 66 having an arm 67 connected by a rod 68 to a part of the primary throttle operating lever indicated at 61. A quick opening movement of the lever 61 will actuate the accelerating pump through the rod 68 and in such a way as to supply additional fuel from the jets 42 to the primary passages 18 and 19 for accelerating the engine 10.

The opposite end of the shaft 54 is rigidly secured to a relatively short lever 69 having spaced stops 71 and 72 turned inwardly at opposite edges thereof. Disposed between the stops 71 and 72 and rotatably mounted on the shaft 54 within the lever 69 is a relatively long arm indicated at 73. The distance between the stops 71 and 72 is such that the arm 73 will not be moved until the throttles 52 and 53 have been opened to a predetermined extent. It has been found desirable to have the throttles 52 and 53 in approximately half open position before the stop 72 engages the arm 73. Thereafter during the opening movement of the throttles 52 and 53 the arm 69 will move the arm 73 with the stop 72. The outer end of the arm 73 is connected by a rod 74 to one end of a relatively short arm 76 which is slotted at 77 and connected to the adjacent end of a shaft 59 by a screw indicated at 78. A spring 75 secured to the arm 76 and to a clip 70 attached by a screw 80 to the carburetor casing 33, tends to retain the throttles 57 and 58 in closed positions. The relation between the lengths of the arms 73 and 76 and the position of the throttle valves upon the

shafts 54 and 59 is such that the throttles 57 and 58 on the shaft 59 will be closed when the throttles 52 and 53 on the shaft 54 are closed. In such closed positions of the throttle the stop 71 will engage the arm 73. When the throttles 52 and 53 on the shaft 54 have been opened until the stop 72 engages the arm 73 the throttles 57 and 58 on the shaft 59 will commence to open and will be fully opened within the secondary passages at the same time the throttles 52 and 53 will be fully opened in the primary passages of the carburetor.

Located within the throttle lever 61 and rotatably mounted upon the end of the shaft 54 is a lever 81 having an outwardly bent end 82 which projects in front of an abutment 84 formed on the lever 61. Lever 81 is normally held in resilient engagement with the abutment 84 by a spring 86 connected between the end 82 of the lever 81 and an outwardly projecting lug 87 formed on the lever 61 below the abutment 84. The lever 81 therefore will tend to rotate with the lever 61 during the opening movement of the primary throttles of the carburetor 13. However, the lever 81 is also provided with an outwardly projecting lug indicated at 88 which may be rotated by opening movement of the lever 61 into engagement with a stop 89 projecting outwardly and laterally from a rotatable member indicated generally at 91. The member 91 is mounted upon the outer end of a stud 92 which projects outwardly from one side of the throttle body 56. The throttle body 56 also has an abutment 93 projecting outwardly therefrom on which the stop 89 may rest when the member 91 is rotated in one direction. When the stop 89 does rest upon the abutment 93 and the lever 61 is rotated to open the primary throttles, the lug 88 will engage the stop 89 to prevent further opening movement of the primary throttles without expanding the spring 86. The primary throttles can be further opened by applying a considerable pressure to the lever 61 but the operator of the vehicle will not normally apply this pressure except in emergencies. The spring 86 therefore will tend to prevent opening movement of the primary throttles beyond the position in which the lug 88 engages the stop 89. After the member 91 is rotated in such a way as to move the stop 89 a short distance away from the abutment 93 the throttle lever 61 can be rotated freely without the lug 88 engaging the stop 89. It has been found desirable to have the lug 88 and the stop 89 so related that when the stop 89 is on the abutment 93 and the lug 88 engages the stop 89 the primary throttles will be in about half open position. The angular position of the member 91 is determined by a spring 94 having one end thereof secured to a hub 96 which is rigidly secured to the member 91 and about which a large part of the spring 94 is spirally wound. The free end of the spring 94 is bent outwardly in such manner as to be engaged by a projection 97 which extends outwardly in front of a finger 98 formed integrally with the member 91 and projecting outwardly therefrom. An arcuate slot 99 is formed on the member 91 in front of the finger 98 to permit limited movement of the projection 97 about the axis of the stud 92. When the projection 97 rotates away from the finger 98 and within the slot 99, the projection 97 will tend to tighten the convolutions of the spring 94 in such manner as to tend to rotate the member 91 to move the stop 98 off the abutment 93. The projection 97 is formed integrally with a lever 101 which is also rotatably mounted upon the stud 92. The end of the lever 101 is secured by a rod 103 to the arm 49 which moves in response to the movement of the choke valve 43 when the choke valve is opened by operation of the thermostat 48. It will be apparent from Figure 1 that when the choke valve 43 is closed within the primary chamber 16 the spring 94 will tend to retain the projection 97 against the finger 98 and the stop 89 will be positioned upon the abutment 93. Under such circumstances the primary throttles cannot be opened beyond the position in which the lug 88 engages the stop 89 without expanding the spring 86. Projecting outwardly from the member 91 beyond the notch 99 is a fast idle stop indicated at 104. The edge of this stop is positioned in such a way that it may be engaged by the end of an adjustable screw 102 that is threaded through openings formed in lugs 107 that project inwardly from the outer end of the abutment 84 formed on the throttle lever 61. When the stop 89 is positioned on the abutment 93 the end of the screw 102 will engage a relatively high point on the cam like edge of the throttle stop 104, thereby holding the primary throttles in fast idling positions. When the member 91 is moved in such a way as to move the stop 89 away from the abutment 93, the decreasing radius of the edge of the fast idle stop 104 will tend to permit the primary throttles to progressively close to normal idling positions.

The secondary passages 21 and 22 of the carburetor 13 are also controlled by unbalanced flow actuated throttle valves indicated at 108. The unbalanced throttle valves 108 may be constructed in any suitable manner, but in order to provide valves that will operate well in passages of circular cross section such as the secondary passages 21 and 22 happen to be, it has been considered desirable to form the valves 108 with the edges thereof remote from the axes of rotation thereof bent laterally as is indicated at 109 from the angularly formed middle portions of the valves which are indicated at 111. The edges 109 of the valves 108 extend in planes which approximately intersect the axis of rotation of the valves 108 while the middle portions thereof are distorted laterally toward the inlet to the carburetor 13 and in such manner as to provide depressions for receiving shaft 112 on which the valves 108 are rigidly secured in unbalanced relation. For convenience in manufacture, the shaft 112 is mounted at opposite ends in bearings formed in a valve body 113 through which the primary and secondary passages of the carburetor 13 extend and which is located between the throttle body 56 and the carburetor casing 13. One end of the shaft 112 projects beyond the valve body 113 and has rigidly secured thereto the middle portion of a weighted lever indicated at 116. The weight 117 formed on the lever 116 is positioned in such manner as to lie substantially in a horizontal plane containing the axis of rotation of the shaft 112 when the valves 108 are positioned to close the secondary passages 21 and 22 of the carburetor 13. The end of the lever 116 opposite the weight 117 is formed to provide a projection 118 which will engage the end of the cam 119 formed on the member 91 when the member 91 is in a position in which the stop 89 rests upon the abutment 93. The stop 89 may be in this position when the choke valve 43 is closed but it is possible for the choke valve to open and for the projection 97 to move within the notch 99 to compress the spring 94 without rotating the member 119. The projection 118 therefore may engage the cam 119 in such a way as to prevent opening of the secondary flow actuated throttles 108 even though the choke valve 43 may be partially or fully opened. The cam 119 has an edge of decreasing radius toward the stop 89 so that as the stop rotates away from the abutment 93 and the radius of the cam 119 decreases, it is possible for the flow actuated throttles 108 to open to a progressively increasing extent. The extent of this edge is such that it is possible for the projection 118 to completely miss the cam 119 when the choke valve 43 is fully opened.

In operating the engine from a cold start it will be apparent that cranking the engine with the choke 43 in closed position will tend to increase the suction on the jets 39 that supply fuel to the primary passages 18 and 19 of the carburetor 13. This will supply a relatively rich mixture for starting the engine 10. Assuming that the accelerator pedal of the engine has not been depressed, the lever 61 will remain in the position indicated in Figure 1 with the fast idle cam 104 engaging the screw

102 in such manner as to slightly open the primary throttles 57 and 58 and into fast idling position. With the primary throttles open only to the fast idling position thereof, it will be apparent that the secondary throttles 57 and 58 will be held in closed position by operation of the spring 75 and that the flow actuated throttles 108 also will be held in closed position by engagement of the projection 118 with the cam 119. Under such circumstances, the only charge that can be supplied for starting the engine will be the mixture supplied by the primary passages 18 and 19 through the slightly opened throttles 52 and 53. The primary passage 19 will supply mixture to the middle portion of the passage 24 of the manifold 14 for starting the cylinders adjacent each end of the engine 10 while the primary passage 18 will supply mixture to the middle of the passage 23 of the manifold 14 for starting the group of cylinders at the middle of the engine 10. If, during the starting of the engine and before the choke valve 43 has opened to any appreciable extent, the accelerator pedal of the engine is depressed, it will be possible to easily open the primary throttles 52 until a position is reached where the lug 88 engages the stop 89. During this opening movement of the primary throttles 52 the lever 69 will be rotated into a position in which the stop 72 closely approaches the lever 73 but the stop 72 will not rotate the lever 73 and the secondary throttles 57 therefore will not be opened to any extent. While the lug 88 is in engagement with the stop 89, the secondary throttles 57 can be opened only by expanding the spring 86 which will not occur under normal operating conditions. The engine therefore may be started and the primary throttles 57 may be opened until the lug 88 engages the stop 89 without opening the secondary throttles 57. The flow actuated throttles 108 also cannot be opened to any extent under these conditions because the projection 118 will not engage any part of the cam 119 that will permit the secondary throttles 57 to open until after the stop 89 has moved to some extent away from the abutment 93.

However, as soon as the engine starts to warm up the foregoing operating conditions will be somewhat modified. For example, as soon as the choke 43 opens a few degrees, it will be apparent that the rod 103 will rotate the lever 101 and the projection 97 to an extent great enough to move the stop 89 out of the path of rotation of the lug 88. The lever 101 will so move the member 91 that the stop 89 will be rotated out of the path of the lug 88 if the accelerator pedal of the engine happens to be depressed to an extent where the pressure exerted by the screw 102 on the cam 104 is removed. If this force is removed, then the member 91 will rotate with the lever 101 and the projection 97 in response to the force of the spring 94 and will move the stop 89 out of the path of movement of the lug 88. If the throttle is so depressed at this time and the stop 89 does move out of the path of movement of the lug 88 then it will be possible to open the primary throttles 52 to any desired extent without expanding the spring 86. If the primary throttles are opened to the full extent, then it will be possible to open the secondary throttles to the full extent because the secondary throttles will commence to open after the primary throttles have been opened to the predetermined extent which has been assumed to be halfway open. However, it may not be possible under these circumstances to open the flow actuated throttles 108 to any extent. It will be noted that while a few degrees of rotation of the choke valve 43 will move the stop 89 out of the path of the lug 81, such few degrees of rotation will not move the cam 119 far enough to miss the projection 118 on the lever 116 or even far enough to permit an appreciable movement of the projection 118 upon the cam 119. Therefore notwithstanding the fact that the primary throttles 52 can be fully opened upon a slight opening movement of the choke valve 43 and notwithstanding the fact that the secondary throttles 57 can be fully opened under these circumstances, there can be no flow within the secondary passages 21 and 22 until the flow actuated throttles 108 can open. It is therefore possible to fully open the primary throttles 52 after the choke valve 43 has been opened a few degrees but without opening the secondary passages 21 and 22 to an extent where any appreciable amount of charge will be supplied through the secondary passages 21 and 22. However, as the choke valve 43 continues to open it will be possible to open the secondary passages to a progressively greater extent until the choke valve 43 is completely open when it will be possible to open the secondary passages to the fullest extent. This progressive opening of the secondary passages is made possible by the decreasing radii of curvature of the cam 119 which extends over a considerable arcuate surface of the cam 119. As the choke valve 43 continues to open, the projection 118 will engage portions of the surface of the cam 119 of progressively decreasing radii of curvature which will permit the flow actuated valves 108 to open to a greater extent as the member 96 is rotated in response to the opening movement of the choke valve 43. If the secondary throttles 57 and 58 have been previously opened to a greater or lesser extent and the conditions of operation of the engine 10 are sufficient to overcome the weight 117 which opposes the opening of the flow actuated throttles 108, then the flow actuated throttles will progressively open as the member 91 is opened by the opening movement of the choke valve 43. The flow actuated throttles 108 may be fully opened under certain operating conditions of the engine in the event the secondary throttles 57 and 58 are sufficiently open when the choke valve 43 is approximately fully open. In such position of the choke valve 43 it is possible for the member 119 to have rotated to such an extent that the projection 118 will completely miss the cam 119 during the movement of the flow actuated throttles 108 from fully closed to fully opened positions. Assuming the choke valve 43 to have been fully opened and the primary and secondary throttles also to have been fully opened, then it is possible for any desired amount of fluid charge to flow through the secondary passages depending upon conditions of operation of the engine 10. If the operation of the engine 10 demands a large flow of fluid through the secondary passages 21 and 22 of the engine, then the effect of the weight 117 will be fully overcome by the difference in pressure on opposite surfaces of the flow actuated throttles 108 and the flow actuated throttles thereupon will be opened to the fullest extent to supply the greatest possible amount of charge through the secondary passages 21 and 22. If the demands made by the engine on the charge forming device 11 is not so great, then the effect of the weight 117 will be progressively greater and the flow of fluid through the secondary passages 21 and 22 will be progressively restricted by the flow actuated valves 108. Whatever fluid does flow through the secondary passages 21 and 22 will be a suitable combustible charge depending upon the adjustment of the jets 41 which supply fuel to the secondary passages as the operation of the engine may require. The combustible mixture which is supplied by the secondary passages 21 and 22 will be supplied separately to the main distribution passages 23 and 24 of the inlet manifold 14 and from which main distribution passages the combustible mixture will be supplied to the different groups of cylinders of the engine 10, as has been described in respect to the operation of the charge supplied by the primary passages 18 and 19. It will be apparent therefore that each group of cylinders of the engine may be supplied with combustible mixture from the primary passages alone of the carburetor 13 or from the primary and secondary passages of the carburetor 13, depending upon the positions of the primary throttles 52 and 53, on the position of the choke valve 43 on the operation of the accelerator pedal of the engine 10, or upon operating conditions affecting the engine 10.

I claim:

1. A charge forming device for engines comprising an inlet manifold having main distribution passages for supplying combustible mixture to different groups of cylinders of an engine, a primary and a secondary passage formed in said charge forming device for supplying combustible mixtures to each of said main distribution passages of said inlet manifold, throttle valves in said primary and said secondary passages for controlling the supply of combustible mixtures to said main distribution passages, choke valve means for said main distribution passages, connections between said primary and said secondary throttles for opening said secondary throttles after said primary throttles have been opened to a predetermined extent, means responsive to the position of said choke valve for opposing the opening movement of said secondary throttles after said primary throttles have been opened to said predetermined extent; and means responsive to the position of said choke valve for preventing the flow of combustible mixture through said secondary passages after said secondary throttles have been opened.

2. A charge forming device for engines comprising a body having primary and secondary passages formed therein for supplying combustible mixtures to the cylinders of an engine, primary throttles in said primary passages, secondary throttles in said secondary passages, means for opening said primary throttles, means for holding said secondary throttles closed during the first part of the opening movement of said primary throttles and for opening said secondary throttles in response to the final opening movement of said primary throttles, means responsive to the suction in said secondary passage anterior to said secondary throttles for controlling the flow of mixture in said secondary passages, a choke valve for said primary passages and means responsive to the closing of said choke valve for closing said suction actuated means.

3. A charge forming device for engines comprising a body having a primary and a secondary pasage formed therein for supplying combustible mixtures to the cylinders of an engine, primary throttle means in said primary passage, secondary throttle means in said secondary passage, suction actuated throttle means in said secondary passage anterior to said secondary throttle means, a choke valve for said primary passage, means for opening said primary throttle means to a partly open position, resilient means for opposing the opening of said primary throttle means to said partly open position when said choke valve is in closed position, means responsive to the opening movement of said primary throttle means past said partly open position for opening said secondary throttle means, means preventing the full opening movement of said suction actuated throttle until said choke valve is in substantially fully opened position, and means progressively releasing said suction actuated throttle means for partial opening movement in response to the suction in said secondary passage anterior to said secondary throttle means as said choke valve is progressively opened.

4. A charge forming device for engines comprising a body having primary and secondary passages formed therein for supplying combustible mixtures to the cylinders of an engine, means adapted to form combustible mixtures in said passages, a primary throttle in said primary passage, a secondary throttle in said secondary passage, an unbalanced valve in said secondary passage between said secondary throttle and said mixture forming means, a cam rotatably mounted on said body, an arm adjacent said cam and having a weight formed therein to oppose the opening movement of said unbalanced valve in response to the flow of said mixture in said secondary passage, a choke valve in said primary passage, and means responsive to the closing movement of said choke valve for positioning said cam with respect to said arm to oppose the movement of said weight in response to the flow of said mixture in said secondary passage.

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