

Jan. 6, 1948.

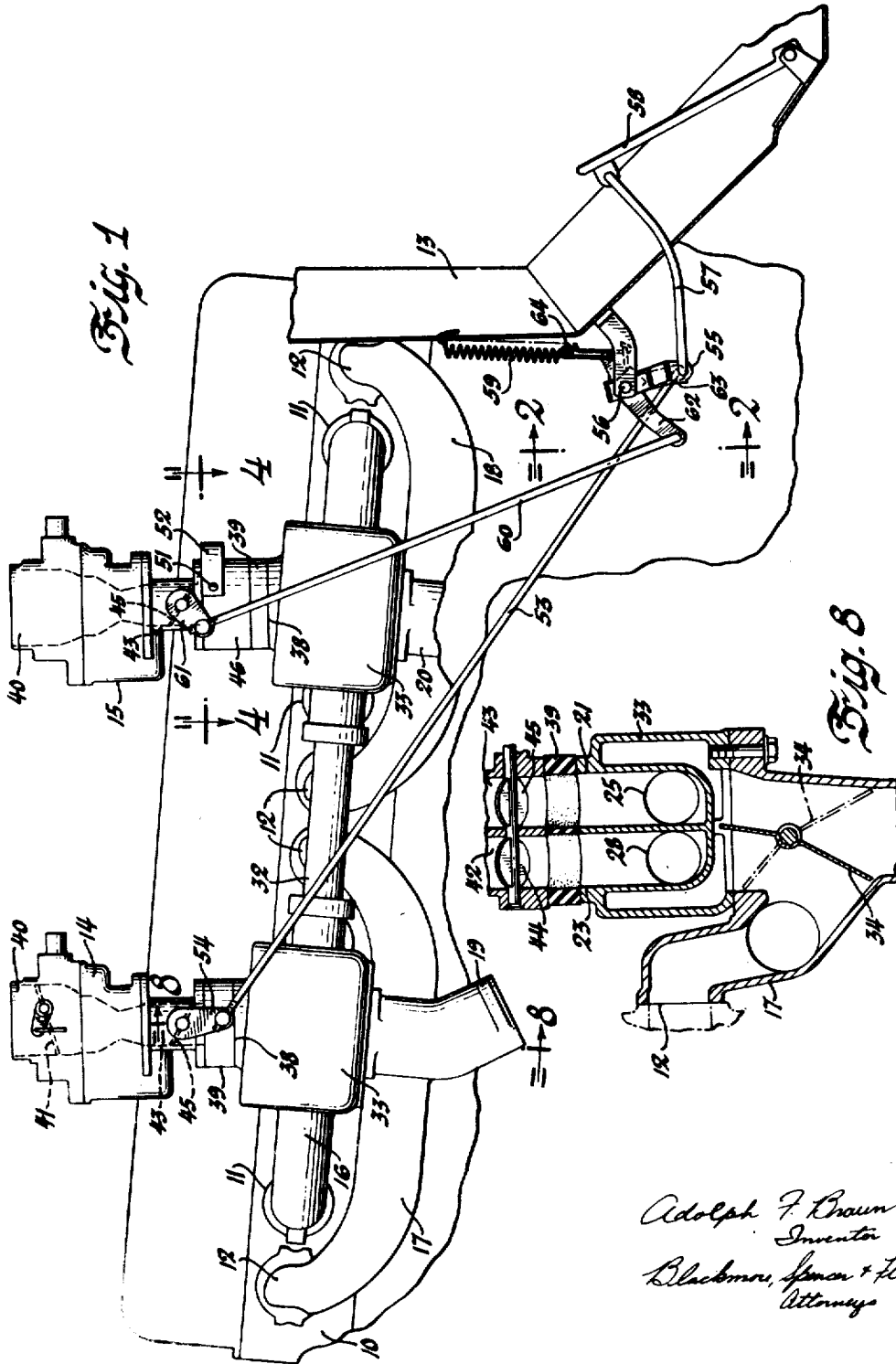
A. F. BRAUN

2,434,192

DUAL CARBURETOR FUEL SYSTEM

Original Filed June 7, 1940

3 Sheets-Sheet 1



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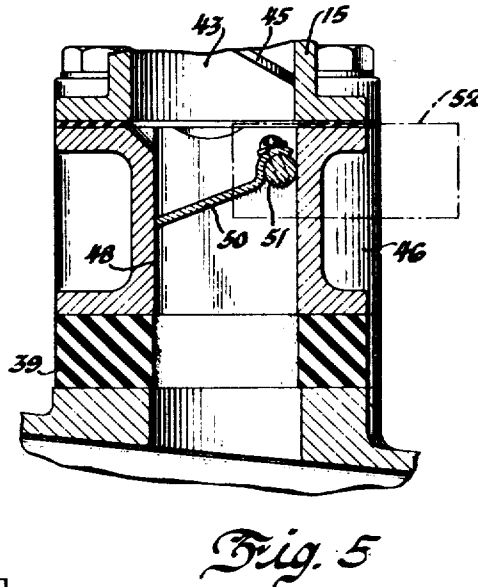
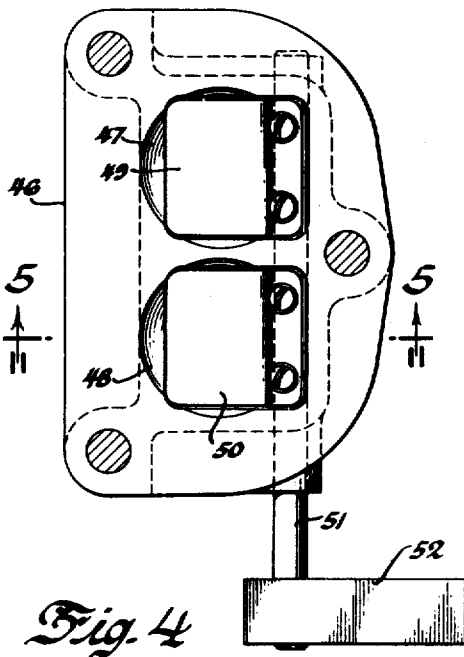
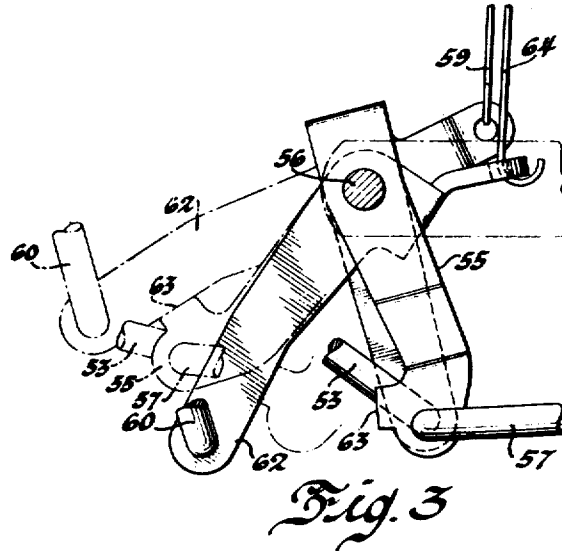
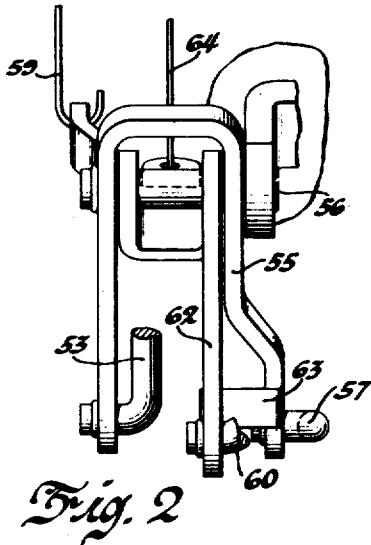
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DUAL CARBURETOR FUEL SYSTEM

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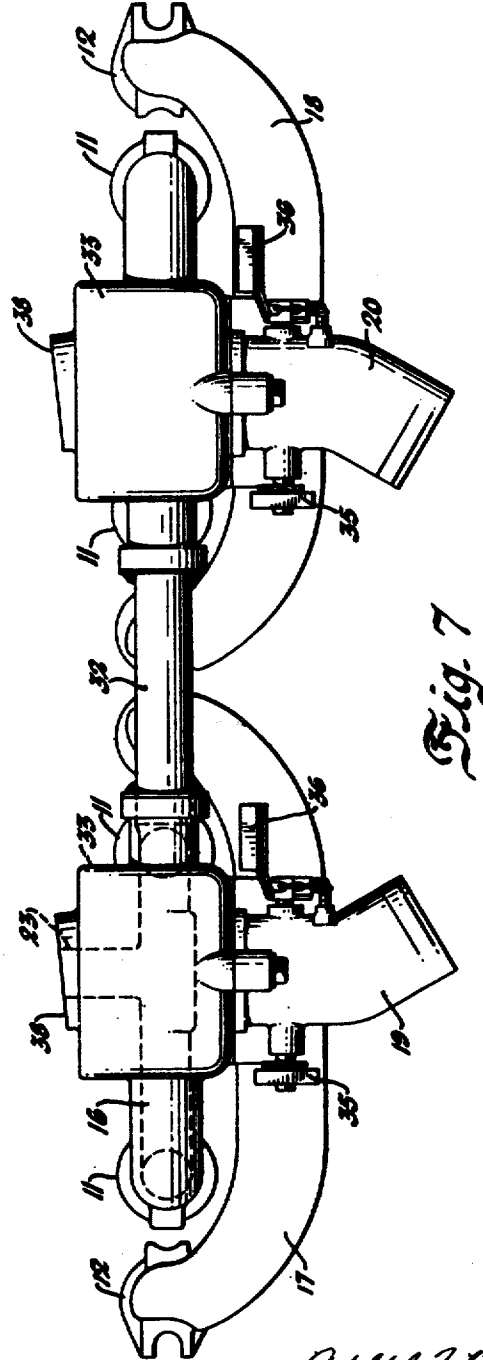
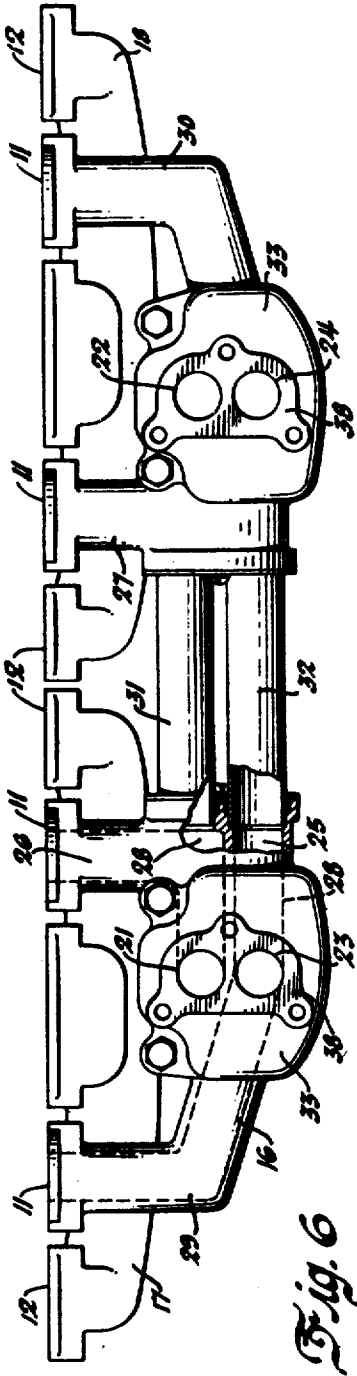
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DUAL CARBURETOR FUEL SYSTEM

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,434,192

DUAL CARBURETOR FUEL SYSTEM

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Continuation of application Serial No. 339,255, June 7, 1940. This application February 5, 1941, Serial No. 377,547

30 Claims. (Cl. 123-127)

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The invention relates to dual fuel supply systems for multi-cylinder internal combustion engines, particularly systems in which a combustible mixture of fuel and air is supplied by a plurality of carbureting means and distributed to a plurality of engine intake ports. In the embodiment herein described the engine is provided with an intake manifolding system to which two separate carburetors are connected, one carburetor supplying most of the fuel mixture for relatively low speed operation, and the other carburetor coming into full operation at relatively high engine speeds.

More specifically, the structure shown includes a multi-cylinder in-line engine having four intake ports, a dual manifold having two substantially independent passages each leading to two engine ports and two duplex or twin carburetors, one barrel of each carburetor arranged to supply mixture to one of the manifold passages and the other barrel of each carburetor supplying the other passage. By "twin" or "duplex" carburetors is meant, as understood in the art, two substantially independent carburetors united in a unitary assembly. The two individual carburetors, each comprising a venturi, fuel jets, and throttle valve, are usually supplied with fuel from a single float bowl and may for convenience be supplied with air through a single air inlet. control mechanism is provided whereby the throttle valves of one of the duplex carburetors are actuated in the normal manner and, after a certain extent of opening of said first valves, the throttle valves of the second carburetor are actuated. Additional means are provided related to the second carburetor to cause the supply of mixture therefrom to vary in response to varying engine speed.

The primary object is to provide for increased supply of fuel mixture for high speed operation of the engine without in any way interfering with the normal performance and the accuracy of fuel metering at lower speeds, thereby enabling the engine to be operated smoothly and efficiently over an extremely wide range of speeds and loads. Further objects, advantages and details of construction will appear from the following description taken in connection with the accompanying drawings in which:

Figure 1 is a side elevation of parts of an en-

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gine as mounted in an automobile chassis and showing one embodiment of the invention.

Figure 2 is a detail view of control features taken on line 2-2 of Figure 1.

5 Figure 3 is a side elevation of the parts shown in Figure 2.

Figure 4 is an approximately horizontal section on line 4-4 of Figure 1.

10 Figure 5 is an approximately vertical section in line 5-5 of Figure 4.

Figure 6 is a plan view showing the engine manifolds in assembled relation.

Figure 7 is a side elevation of the structure shown in Figure 6.

15 Figure 8 is a detail section on line 8-8 of Figure 1.

Referring to the drawings, 10 indicates an internal combustion engine block of conventional in-line type, that is, having its cylinders arranged in a series lengthwise of the engine. Usually, although not necessarily, the cylinders of such engines have their axes in a single plane. The engine as shown is provided with four intake ports as indicated at 11 and double the number 20 of exhaust ports as indicated at 12, which arrangement is especially suitable for engines having eight cylinders. Although the engine illustrated and to which the invention has been hitherto applied is of the eight-cylinder type, it 25 will be obvious that the invention is not limited, in its broader aspects, to use in such engines.

The engine is shown as positioned at an angle to the horizontal, that is, as sloping downwardly to the right in Figure 1, which position is the 30 usual one for engines mounted as in automobile practice.

The position of the dash of an automobile chassis is indicated at 13 and a throttle lever or pedal 58 is so located as to be actuated by the 35 foot of a driver. Two carburetors are shown at 14 and 15, respectively, which are preferably mounted with their axes vertical. Considering the carburetors as vertical, the inclination of the engine block will be evident from the relation 40 between the angular positions of the engine and carburetors in Figure 1. Having reference particularly to the use of engines in automobiles, the carburetor 14 will be termed the front carburetor and 15 the rear carburetor, and the engine will be referred to as sloping rearwardly. 45

Manifolds

The manifolds constituting a novel feature of the present invention include an intake manifold 16 and exhaust manifolds 17, 18. Since, in the engine illustrated, there are eight exhaust ports 12, it is convenient, especially with a long engine block, to provide a primary exhaust manifold for each four exhaust ports. Accordingly, the manifold 17 is applied to the front four ports and manifold 18 to the rear four ports. Outlets 19, 20 serve to connect the primary manifolds to any suitable exhaust pipe or pipes by which the exhaust gases are discharged at any usual or convenient point.

The intake manifolding comprises two substantially independent passages, one connecting the carburetor ports or risers 21, 22 to the two intermediate ports 11 of the engine, and the other connecting the carburetor ports or risers 23, 24 to the two end ports 11. The first-mentioned passage comprises a header indicated by 28, extending from riser 21 to riser 22, which header is joined to the intermediate engine ports by branches 26 and 27. The second passage comprises a header 25 extending from riser 23 to riser 24, continuing beyond these risers at each end and joined to the end ports of the engine by branches 29, 30. As shown, the intake manifold is formed of two castings connected by sections of tubing 31, 32, the section 31 constituting part of the header 28 and the section 32 similarly related to header 25. These structural details, however, are dependent merely upon convenience of manufacture and the parts may obviously be cast integrally or formed in parts as desired.

It is customary to provide heating means whereby the exhaust gases may be applied to the intake manifold to promote vaporization of the fuel. For this purpose I provide for each pair of risers 21, 23 and 22, 24, respectively, a heating structure as shown in Figure 8. This comprises a heat box or jacket 33 enclosing a portion of the risers and header and to which exhaust gases are conducted from the exhaust manifold 17. A valve or damper 34 located in the path of the exhaust gases flowing through the manifold 17 to its outlet 19 serves to control the delivery of the gases to the heating jacket. In the position shown in full lines the damper directs substantially all the exhaust through the heating jacket while in the position shown in dotted lines substantially all the exhaust flows directly to the outlet without passing through the jacket. The position of the damper is controlled in the usual manner by a coiled bimetal thermostat 35 acting as a spring and tending, when the thermostat is cold, to hold the damper in the full line position. As the thermostat becomes warmer, however, its spring effect becomes less and the damper is permitted to move to dotted line position by reason of the impact of the exhaust upon the lower and larger wing of the damper. Additional tendency to move the damper or to hold it in open position may be imparted by weight 36 mounted eccentrically upon the damper shaft.

The structure of the heating mechanism for the rear section including risers 22, 24 is substantially the same as that for the front section. The control devices, however, as the thermostat 35, should be adjusted or determined initially by inherent properties to permit the damper to open considerably earlier than the damper of the front heater. This is desirable both because the rear heater is more remote from the fan and cooling effects that

exist nearer the front of the engine and because the rear carburetor delivers much less fuel than the front carburetor under most conditions under which application of exhaust heating is necessary.

Carburetors and controls

The top of the intake manifold is provided with a seat or seats 38 to receive the carbureting means, here shown as two twin carburetors 14, 15. These seats are inclined relative to the manifold so as to provide an approximately horizontal upper surface. Thus the carburetors have a vertical position notwithstanding the rearward slope of the engine and manifolds. An annular pad 39 of heat-insulating material is positioned between each carburetor and its seat on the manifold in order to reduce conduction of heat to the carburetor.

The carburetor as illustrated at 14 is a duplex or twin carburetor of any standard construction suited to the demands of the particular engine. As usually constructed, these carburetors comprise an air horn 40 in which is located a choke valve 41, generally of the "automatic" type, that is, an unbalanced valve whose position is determined by air or engine temperature and engine demands. Various other adjuncts are usually or may be present, such as accelerator pumps and devices to facilitate starting and "warming up" operation. From the air horn the air flows past the usual fuel jet or jets through the two barrels or individual carburetors 42, 43, subject to the control of the twin throttles 44, 45, mounted upon a common shaft.

The rear carburetor 15 may be a duplicate of carburetor 14. Since, however, the rear carburetor supplies at low speeds only what may be considered as an idling mixture and need not be relied upon for the peculiar functions incident to starting or low speed or cold operation, I prefer to eliminate such parts as are unnecessary to the particular field in which this carburetor chiefly operates. For example, carburetor 15 may be without a choke valve and accelerating pump. Such details as "fast idle" and "economizer jet" present on some carburetors, may also be eliminated.

While, as illustrated, the carbureting means 14, 15 comprises two completely separated carburetors, it will be obvious that, for convenience in manufacture and mounting, they may be constructed in a unitary assembly.

Beneath the rear carburetor 15 is inserted a fitting 46 shown in detail in Figures 4 and 5. This fitting is provided with two vertical passages 47, 48, registering respectively with the risers 22, 24, and with the corresponding barrels of carburetor 15. The passages 47, 48 are of approximately rectangular cross-section for a portion of their lengths and within this portion are mounted the valves 49, 50. These valves are rigidly connected eccentrically to the shaft 51 to which is secured, outside of the fitting, the eccentric weight 52 or equivalent means tending to hold the valves in the closed position as shown. As the suction in the intake passages and the resulting flow of air increases, the unbalanced valves 49, 50 will tend to open, thus permitting an increased supply of fuel mixture from carburetor 15.

It will be noted from Figures 4 and 5 that the location of the weight 52 is such that it swings toward a vertical position as the valves 49, 50 open, thereby reducing the force opposing the

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further opening of the valves. Thus the valves have less tendency to close when in wide open position than when they are more nearly closed, and very little force is required to keep them open as they approach open position. The same result may be secured by well known means where equivalents, such as springs, are used in place of weights.

The throttle valves 44, 45 of carburetor 14 are actuated in any suitable manner as by a rod 53 connected to throttle lever 54. The rod is connected to a U-shaped lever 55 pivoted at 56 to a fixed bracket and also connected by a link 57 to the throttle pedal 58. (See Figures 2 and 3.) A spring 59 connected to the lever 55 serves to stress the linkage in the direction to bring the throttles to "closed" or idling position.

The throttle valves of carburetor 15 are actuated by rod 60 connected to throttle lever 61. This rod is connected to a lever 62, also pivoted at 56 and lying in the path of a lug 63 on lever 55. A spring 64 acts upon lever 62 stressing the parts in the direction to bring the throttles of carburetor 15 to idling position.

As the lever 55 is moved in a direction to open the throttles of carburetor 14, and preferably at the point where the said throttles are about half opened, the lug 63 comes into engagement with lever 62 thus imparting opening movement to the throttles of carburetor 15. Thus the levers and rods finally reach the positions shown in dotted lines in Figure 3. The lengths of the levers and dimensions of other parts are so calculated that the throttles of carburetor 15 will be fully open when those of carburetor 14 reach their fully open position.

It will be noted, however, that flow of fuel mixture from carburetor 15 is dependent, because of the auxiliary automatic throttle valves 49, 50, not upon throttle position but also upon the suction in the intake passages, i. e., upon the demands of the engine. Hence, when the engine is lagging slowly under heavy load with the manually actuated throttles relatively open, the fuel will still be supplied chiefly from carburetor 14 thus enabling that carburetor to deliver an accurately proportioned mixture.

It is well-known that it is very difficult to maintain an accurate metering of fuel in proportion to air over a wide range of speeds in a carburetor depending, as most modern carburetors do, upon air flow characteristics to determine the metering of liquid fuel. If the passages are sufficiently small to maintain accurate metering at the lowest speed required, then they become too restricted to supply the air necessary for high speeds. This is particularly evident in modern automobile practice where engine speeds are demanded varying from a few hundred R. P. M. up to four thousand or more R. P. M. In my invention I overcome this difficulty by providing one carburetor operating over the low speed range quite within its metering capabilities and supplementing its mixture supply by introducing mixture from an auxiliary carburetor.

It will be understood that in the so-called "closed" position of carburetor throttle valves it is customary to leave sufficient opening so that fuel mixture required for the lowest or "idling" speed of the engine may be supplied. The valves of carburetor 15 are preferably given this usual setting or at least are so adjusted as to permit a slight flow of mixture at their "closed" position. This relatively small flow of fuel serves to compensate for the greater distance of the rear

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ports from carburetor 14 and thus renders the distribution more uniform, particularly at very low speeds, and contributes to the smoothness of operation of the engine. On the other hand, after the speed and throttle positions become such that carburetor 15 begins to deliver more than its minimum supply, then the combined capacity of the two carburetors insures ample supply of fuel mixture for the highest speeds.

While I have shown herein, for purposes of illustration, specific details of structure, it will be understood that the structural embodiment may be varied widely without departing from the spirit and scope of the invention.

This application is filed as a continuation of Serial No. 339,255, filed June 7, 1940 and now abandoned.

I claim:

1. An internal combustion engine having a plurality of intake ports, intake manifold structure having one passage connecting certain of said ports and a second passage connecting other ports, two twin carburetors each positioned to supply fuel mixture to both said passages, and independent heating means separately controllable arranged to apply exhaust gas to heat the mixture delivered by each carburetor.

2. An internal combustion engine inclined downwardly toward one end, intake manifold structure the passages of which are similarly inclined, a carburetor positioned nearer the higher end of the engine and arranged to supply the major portion of the fuel mixture required for lower speed operation and a carburetor positioned nearer the lower end of the engine and arranged to supply additional fuel mixture for higher speed operation.

3. An internal combustion engine having a plurality of intake ports, manifolding having one passage connecting certain of said ports and another passage connecting other ports, two twin carburetors each positioned to supply fuel mixture to each of said passages, and means for controlling said carburetors comprising throttle valves for each carburetor and additional valves for one carburetor responsive to mixture flow.

4. The combination with an internal combustion engine of two carburetors for supplying fuel mixture thereto, means for controlling the supply from each carburetor, the means for one carburetor being actuated in accordance with the position of the means for the other in such manner as to increase the supply from the second carburetor after a predetermined actuation of the control of the first, and additional means for retarding delivery from the second carburetor at low engine speeds.

5. The combination with an internal combustion engine of two carburetors for supplying fuel mixture thereto, throttling means for each carburetor, means for actuating the throttling means of one carburetor, means for actuating the throttling means of the second carburetor arranged to initiate opening movement of said second throttling means after said first throttling means has reached a predetermined opening, and additional throttling means for said second carburetor operative to retard delivery of mixture therefrom even though the second throttling means be open.

6. The combination with an internal combustion engine of two carburetors, the first having a throttle valve and a choke valve, the second having throttle valve but no choke valve, means for actuating the first throttle valve over a pre-

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determined range beyond which actuation of the first throttle valve actuates the second throttle valve, and means permitting delivery of idling mixture from said second carburetor while said first carburetor is operating within said range.

7. The combination, with an internal combustion engine having a manifold, of primary and secondary carbureting devices each adapted and arranged to supply explosive mixture to said manifold, a throttle valve for each such device, means for manually controlling the opening of said throttle valves at such relative rates that the supply from the secondary device is permitted to increase faster than the supply from the primary device during the latter part of the opening movement of the primary throttle valve, and additional means to control supply of mixture from the secondary device in accordance with engine demands.

8. In an internal combustion engine, a duct which extends from the intake port of one cylinder to the intake port of another cylinder, means for delivering a combustible mixture of fuel and air into the duct at a plurality of points spaced from each other, means for regulating the delivery of combustible mixture into the duct at each of the points, means for operating the regulating means so that the proportionate rate of delivery of combustible mixture at one of the points lags behind that at the other of the points until the rate of delivery at the last mentioned point approaches its maximum value, and means for increasing the lag in the proportionate rate of delivery of combustible mixture at the first mentioned point when the speed of the engine decreases.

9. In an internal combustion engine, two means for furnishing a combustible mixture of fuel and air to the same cylinder of the engine, means for regulating the delivery of combustible mixture from one of the first specified means to the cylinder of the engine, and means affected by the speed of the engine and independently thereof by the position of the second specified means for regulating the delivery of combustible mixture from the other of the first specified means to the cylinder of the engine.

10. In an internal combustion engine, two means for furnishing a combustible mixture of fuel and air to the same cylinder of the engine, means for regulating the delivery of combustible mixture from one of the first specified means to the cylinder of the engine, means affected by the speed of the engine for regulating the delivery of combustible mixture from the other of the first specified means to the cylinder of the engine, and means interconnected with the second specified means for limiting the delivery of combustible mixture from the last mentioned of the first specified means to the cylinder of the engine.

11. In an internal combustion engine, two means for furnishing a combustible mixture of fuel and air to the same cylinder of the engine, means for regulating the delivery of combustible mixture from one of the first specified means to the cylinder of the engine, means interconnected with the second specified means for regulating the delivery of combustible mixture from the other of the first specified means to the cylinder of the engine, and means for regulating the delivery of combustible mixture from the last mentioned of the first specified means to the cylinder of the engine in accordance with the speed of the engine.

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12. In an internal combustion engine, two means for furnishing a combustible mixture of fuel and air to the same cylinder of the engine, means for regulating the delivery of combustible mixture from one of the first specified means to the cylinder of the engine, means interconnected with the second specified means for regulating the delivery of combustible mixture from the other of the first specified means to the cylinder of the engine, and means for regulating the delivery of combustible mixture from the last mentioned of the first specified means to the cylinder of the engine in accordance with the speed of the engine including a valve which is so unbalanced that flow of combustible mixture from the carburetor to the engine tends to open it and means which yieldingly opposes movement of the valve toward its open position with a force which decreases as the valve moves toward its open position.

13. In an internal combustion engine having an intake passage, means forming a plurality of mixing conduits for supplying fuel to said passage, said conduits being longitudinally spaced with respect to and communicating with said passage, independently of each other, a manually operated throttle valve for one of said conduits and a throttle valve solely responsive to automatic control subsequent to the opening movement of the manually operated throttle valve for the other of said conduits.

14. In an internal combustion engine having a plurality of cylinders, an intake manifold having a plurality of outlet ports for supplying fuel to certain of said cylinders, a pair of carburetors spaced from the center of and spaced apart lengthwise of said manifold, a manually operated throttle for one of said carburetors, a second throttle for the other carburetor, and means responsive to suction as determined by the attainment of a predetermined engine speed for operating said second throttle.

15. In an internal combustion engine, means forming an intake manifold, a main carburetor mounted near one end of said manifold, an auxiliary carburetor mounted between said main carburetor and the other end of said manifold at a point so spaced from the main carburetor as to result in the dampening of the pulsations of the flow during high speed operation, and means for keeping the auxiliary carburetor closed during low speed operation.

16. In combination with an intake manifold for an internal combustion engine, a carburetor having a plurality of passages communicating with said manifold, operator controlled valves in said passages, and an unbalanced valve movable in one of said passages between said throttle valve and said manifold, said unbalanced valve being biased toward closed position.

17. In combination with an intake manifold for an internal combustion engine, a carburetor having a plurality of passages communicating with said manifold, operator controlled valves in said passages, an auxiliary valve in one of said passages, said auxiliary valve having an unbalanced area tending to swing toward open position under the influence of a pressure differential thus imposed between said manifold and said carburetor, and means biasing said auxiliary valve toward closed position.

18. In combination with the intake manifold of an internal combustion engine, a carburetor defining a plurality of intake passages communicating with said manifold, operator controlled valves in said passages, one of said passages being

controlled solely by its operator controlled valve, and an auxiliary valve having an area unbalanced about its support positioned in the other of said passages.

19. In a charge forming device for internal combustion engines, a pair of induction passages, throttle valves controlling said passages, means for actuating the throttle valves progressively with one valve opened before the other valve, the latter being initially opened before the former has been fully opened, an auxiliary air flow valve in the later opened induction passage and adapted to be opened by engine suction, and yielding means adapted to close the air flow valve at times when the engine suction is below a predetermined value.

20. In a multiple-stage charge forming device for internal combustion engines, a plurality of independent induction passages, throttle valves for said passages, means for progressively opening the throttle valves so that the later opening valve begins to open before the earlier opening valve is fully open, a choke valve in a later opening passage, said choke valve being operable by engine suction, and yielding means adapted to close the choke valve.

21. In a charge forming device for an internal combustion engine, a plurality of induction passages, throttle valves for said passages, means for manually controlling said throttle valves in series whereby initial opening of a later opening valve occurs before the full opening of an earlier opening valve, said manual means being adapted to positively close said valves, and means for closing at least one of the induction passages when the engine suction drops below a predetermined value.

22. In a charge forming and distributing system for an internal combustion engine: an intake manifold; a primary induction passage, a choke valve for said primary passage; a second induction passage; throttle valves for said passages; and means for manually controlling said throttle valves whereby said valves are opened progressively so that the later opening valve begins to open before the earlier opening valve is fully open.

23. In an internal combustion engine, an intake manifold, primary carbureting means which communicates with the atmosphere for supplying a primary mixture to said manifold, secondary carbureting means which communicates with the atmosphere for supplying a supplementary mixture to the manifold, a pivoted throttle valve which controls the communication of each of said carbureting means with the atmosphere, the throttle valve for the secondary carbureting means opening after the throttle valve for the primary carbureting means but before the latter is fully open, the valve for said secondary carbureting means being unbalanced so that it is openable by manifold suction, and means adapted to cut out the secondary carbureting means upon a drop of manifold vacuum below a predetermined value.

24. In a fuel mixture supply system for an internal combustion engine having an intake manifold, a primary induction passage, a secondary induction passage, throttle valves for the respective passages, the valve for the secondary induction passage being openable by manifold vacuum, means for controlling the throttle valves whereby the primary passage supplies the engine with fuel mixture over its range of operation and the secondary passage furnishes a supplementary

mixture when the throttle valve of the primary passage has been opened a predetermined amount less than full opening, and means for cutting out the supplementary mixture when the manifold vacuum decreases below a predetermined value subsequent to the opening of the throttle valve of the primary passage said predetermined amount.

25. In a charge forming device for an internal combustion engine, a plurality of primary induction passages, a plurality of secondary induction passages, throttle valves in said passages, the valves in the secondary passages being offset, means for simultaneously controlling the primary throttle valves, means for simultaneously controlling the opening of the offset valves, and means for simultaneously closing the offset valves when the primary valves are substantially wide open and engine suction is low.

26. In a multiple stage charge forming device for internal combustion engines, a plurality of induction passages, throttle valves for said passages, means for progressively opening the throttle valves so that the later opening valve begins to open before the earlier opening valve is fully open, a choke valve for a later opening passage, said choke valve being operable by engine suction, and yielding means urging said choke valve toward its closed position.

27. In a fuel mixture supply and distributing system for internal combustion engines, an intake manifold, a plurality of carburetor induction passages which communicate with the atmosphere, a pivoted valve which controls the communication of each of said passages with the atmosphere, the valve for one of the passages opening after the valve for the other of the passages but before the latter is fully open, at least one of said valves being unbalanced so that it is openable by manifold vacuum, and means for closing said unbalanced valve when the engine is operating at low speed.

28. In a charge forming device for an internal combustion engine, a primary induction passage and a secondary induction passage, throttle valves for said passages, means for manually controlling said throttle valves whereby the secondary throttle valve is opened after the primary valve has been but partially opened, said manual means being adapted to positively close said valves, and means for rendering the secondary passage substantially inoperative at engine suction below a predetermined value.

29. In a fuel mixture supply system for an internal combustion engine having an intake manifold, a plurality of carburetors spaced apart longitudinally of and communicating with the manifold independently of each other, each of said carburetors having a mixture passage, control means for said mixture passages whereby said passages are adapted to be brought into operation in overlapping progression, said control means including an air flow valve in at least one mixture passage which is adapted to be opened by engine suction, and means for closing said air flow valve when the engine suction is below a predetermined value.

30. In a charge forming device for an internal combustion engine, a plurality of induction passages, throttle valves for said passages, means for controlling said valves in series with a later opening valve initially opened before an earlier opening valve is fully opened, and means controlled by suction posterior to the throttle valve of one of said induction passages adapted to close

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said passage when said suction drops below a predetermined value.

ADOLPH F. BRAUN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,213,499	Johnson	Jan. 23, 1917
2,160,922	Sullivan	June 6, 1939

Number

2,075,330
1,304,888
1,152,031
2,254,834
2,193,533
2,160,922
1,550,649
1,180,483
2,282,311
2,317,625

12

Name

Date

Angell	Mar. 30, 1937
Kenneweg	Mar. 27, 1919
Lobell	Aug. 31, 1915
Betry	Sept. 2, 1941
Kishline	Mar. 12, 1940
Sullivan	June 6, 1939
Remington	Aug. 18, 1925
Fogolin	Apr. 25, 1916
Ericson	May 12, 1942
Mallory	Apr. 27, 1943

Certificate of Correction

Patent No. 2,434,192.

January 6, 1948.

ADOLPH F. BRAUN

It is hereby certified that errors appear in the printed specification of the above numbered patent requiring correction as follows: Column 1, line 30, for "control" read *Control*; column 2, line 10, for "in line" read *on line*; column 4, line 74, for "valves 45" read *valves 49*; column 5, line 39, after "not" insert *only*; lines 42 and 43 for "lagging" read *lugging*; column 8, line 36, for the words "of said manifold" read *of and communicating with said manifold independently of each other*; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 6th day of April A. D. 1948.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.

11

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ADOLPH F. BRAUN.

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[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.