

G. R. ERICSON ET AL
INTERNAL COMBUSTION ENGINE

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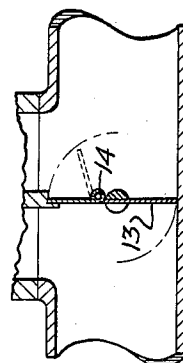


FIG. 2.

FIG. 1.

Gerald U Rich

ATTORNEY

UNITED STATES PATENT OFFICE

2,269,930

INTERNAL COMBUSTION ENGINE

George R. Ericson, Kirkwood, and Irven E. Coffey,
Normandy, Mo.

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18 Claims. (Cl. 123—122)

This invention relates to internal combustion engines and particularly to engines in which a number of cylinders are supplied from a single intake manifold system.

Difficulty has been experienced in designing a carburetion system for internal combustion engines operating over a wide range of speeds and loads due to the limitations of throttle range and volume range in modern carburetors. Carburetors of the plain tube type designed with Venturi tubes to give maximum efficiency throughout a low speed range, fails to have the capacity for engine operation at high speed with wide open throttle.

It is an object of this invention to produce a new and improved carburetion and manifolding system for internal combustion engines in which the advantages of the plain tube carburetor may be retained, without the disadvantages of having to make the choice between an extremely large venturi for maximum speed operation and a smaller venturi for flexible lower speed operation.

It is a further object of this invention to produce a carburetion and manifolding system in which the pulsation set-up in the intake manifold during high speed operation will be damped and greater freedom of flow of mixture to the engine with more uniformity of quality and less restriction than has been previously possible.

Another object of this invention is to provide a new and improved heating device for the fuel mixture.

Another object of this invention is to provide a new and improved means for controlling an auxiliary carburetor for high speed engine operation.

Other objects and advantages will appear from the following description and accompanying drawing, referring to which:

Fig. 1 is a schematic representation of a main carburetor and an auxiliary carburetor mounted on associated intake and exhaust manifold of the engine.

Fig. 2 is a longitudinal vertical section through exhaust manifold below the auxiliary carburetor.

Reference numeral 1 indicates an intake conduit having a main inlet 2 and an auxiliary inlet 3 and having outlets 4 and 5, each leading to one or more cylinders of an internal combustion engine. Other cylinders may also be connected to the same conduit at different points along the length thereof. The construction and operation of these cylinders is well known and is not shown but it will be understood by those skilled in the art that the manifold is connected to the valve controlled inlet ports of a four cycle engine and this invention is especially adapted to engines in which the intake valve lags some forty degrees or more beyond the bottom dead center

of the piston; that is to say, the intake valve is held open a substantial length of time after the piston has begun its compression stroke. While this lag is highly desirable for certain speed and operating conditions, it creates such disturbances as pulsation in the manifold at certain operating speeds and as stated above, one of the objects of the invention is to dampen these pulsations.

The reference numeral 6 indicates the main hot spot which is a heating jacket through which exhaust gases may flow around the intake manifold, the flow being controlled by a valve 7 which is operated by a thermostat 8. The specific construction of the thermostat may be chosen as desired, but in the construction shown the thermostat is of the type which is filled with an expansible fluid so as to push on the link 9 when the heat exceeds a predetermined degree, thereby opening the valve 7 to the position shown in solid lines in the drawing and permitting the exhaust gases to flow out through the exhaust manifold 10 without necessarily flowing through the hot spot 6. The auxiliary hot spot 11 is applied at the junction of the auxiliary carburetor 12 with the intake manifold, and is of the same construction as the main hot spot 6. The heat valve 13 is of the butterfly type having a portion hinged at 14 and operated by direct suction. The valve as a whole is controlled by a connection 15 with the operating lever 16 of the auxiliary throttle 17.

The main carburetor 18 is of well known plain tube type. While this carburetor is only diagrammatically shown, it may be said that it is a plain tube carburetor of the downdraft triple Venturi tube type having a main nozzle 19 which may be of the general character shown in the Bicknell Patent 1,848,615. The automatic choke is not shown but may be of the type shown in Coffey 2,085,351 or Ericson 1,915,851. The idling device is also omitted from the drawing but a typical idle may be found in the Ericson Patent 1,915,851. This main carburetor may have one or any number of venturis but in the present instance a primary venturi 20 receives the main nozzle, a secondary venturi 21 receives the connection 22 of the auxiliary carburetor suction control device, and the main venturi 23 receives the discharge from the primary and secondary venturis. A manually operated throttle 24 is provided.

The auxiliary carburetor may be substantially the same in construction as the main carburetor except for the operation of the throttle 17. The auxiliary throttle operating lever 16 is provided with an arm 25 connected by means of the link 26 to a piston 27 which is mounted in the cylinder 28 and biased in throttle closing direction by a compression spring 29. The construction

of this spring is of some importance as it is desired to have a comparatively low rate of pressure build up from the closed throttle position to the open throttle position. To this end a spring of comparatively great length and low strength is used and compressed to only a fraction of its original length so that the rate of change per unit of movement of the piston is comparatively small. To the same end the angle of the arm 25 with respect to the plane of the throttle plate 17 and the position of the piston 27 is so arranged as to produce a decreasing rate of valve movement as the valve is opened.

Throttle valve 24 actuated by a manually controlled arm 30 which has an extension arm 31 is connected to arm 32 of the auxiliary carburetor throttle valve 17 by a one way connection composed of a loose piston 33 in cylinder 34 and rods 35 and 36 respectively. Throttle valve 24 may be opened without effecting an opening movement of the throttle valve 17 but when both throttle valves are open a closing movement of throttle valve 24 will effect a corresponding closing movement of throttle valve 17.

In the operation the operator controls the manual throttle 24, and during low speed and idling conditions the auxiliary throttle 17 is substantially closed except for the idle passage which may be provided if desired. It will be understood of course that some slight opening of the throttle valve 16 may be provided for with the usual stop screw. Under low speed operating conditions even with the manual throttle 24 wide open there will not be enough suction at the throat of secondary venturi 21 to act through the passage 22 to move the piston 27 to the left against the auxiliary closing throttle spring 29, but with the throttle valve 24 wide open, or nearly so, suction in the secondary venturi will build up to a point at which the throttle 17 will be opened by the suction. This point is preferably at around 40 miles an hour in the operation of the average car, but may be higher, if desired. Once the auxiliary carburetor throttle begins to open, further increase in the speed of the automobile will cause it to open at a fairly rapid rate thereby increasing the rate of air admission to the manifold but without causing the manifold suction to fall below the point at which the spring 29 originally begins to yield.

The introduction of the auxiliary carburetor mixture at a point substantially spaced on the manifold from the main carburetor substantially damps the pulsations due to back pressure from the cylinders at the point in the cycle just prior to the closing of the intake valve and the additional passage through which the mixture may flow very substantially, increase the total amount of mixture flowing to the engine by eliminating resistance to flow as well as by damping pulsations.

It will be understood that mixture control devices of the type known as accelerating pumps, pick up devices and economizers or step up devices may be used. These, however, are preferably omitted from the auxiliary carburetor and used only in the main carburetor as the speed of operation at which the auxiliary carburetor comes in is such that no pick up device is necessary and the auxiliary carburetor is calibrated to deliver a power mixture only, so that the use of an economizer would be pointless.

We claim:

1. In an internal combustion engine having a

plurality of cylinders, an intake manifold for supplying fuel to said cylinders, a first and second carburetor, a manually operated throttle for said first carburetor, a second throttle valve for said second carburetor, suction means in constant communication with said first carburetor for opening said second throttle valve in response to the velocity of air passing through the said first carburetor and means for closing said second throttle valve in response to the closing movement of said manually operated throttle.

2. In an internal combustion engine having a plurality of cylinders, an intake manifold for supplying fuel to said cylinders, a first and second carburetor, a manually operated throttle for said first carburetor, a second throttle valve for said second carburetor, suction means in constant communication with said first carburetor for opening said second throttle valve in response to the velocity of air passing through the said first carburetor, and means for closing said second throttle corresponding to the closing movement of said manually operated throttle.

3. In an internal combustion engine having an intake passage, means forming a main and auxiliary mixing conduits for supplying fuel to said passage, a manually operated throttle valve for said main conduit, throttle valves for the auxiliary conduits, suction means in open communication with said main conduit for opening said throttle valves in response to engine speed and means for closing said second throttle in response to the closing of said manually operated throttle.

4. In an internal combustion engine having an intake passage, a main mixing conduit and an auxiliary mixing conduit for supplying fuel to said passage, a manually operated throttle valve for said main conduit, a second throttle for said auxiliary conduit, suction means in open communication with said main mixing conduit for opening said second throttle in response to engine speed, resilient means resisting the opening of said second throttle and positive means for closing said second throttle.

5. In an internal combustion engine having an intake passage, a main mixing conduit and an auxiliary mixing conduit, a manually operated throttle valve for said main conduit, a second throttle for said auxiliary conduit, suction means in open communication with said main mixing conduit for opening said second throttle responsive to engine speed and means limiting the opening movement of said second throttle to correspond to the degree of opening of said manually operated throttle.

6. In an internal combustion engine, an intake manifold having a plurality of mixture inlets, a main mixing conduit connected to one of said inlets and an auxiliary mixing conduit connected to the other inlet, a manually operated throttle valve for said main mixing conduit, a second valve for said auxiliary conduit, means normally holding said second valve in substantially closed position, means connected to said main conduit and controlled by the velocity of air passing therethrough for opening said second valve, and means dependent on the closing movement of said manually operated valve for closing said second valve.

7. In an internal combustion engine, an intake manifold having a plurality of mixture inlets, a main mixing conduit connected to one of said inlets and an auxiliary mixing conduit connected to the other inlet, a manually operated throttle

valve for said main mixing conduit, a second valve for said auxiliary conduit, suction means in open communication with said main mixing conduit for opening said second valve and means connecting said valves for limiting the extent of opening of said second valve.

8. In an internal combustion engine, an intake manifold having a plurality of mixture inlets a main mixing conduit connected to one of said inlets and an auxiliary mixing conduit connected to the other inlet, an exhaust manifold having a temperature responsive valve for deflecting the exhaust gases to heat the mixture from said main mixing conduit when the engine is cold, a deflecting valve for directing exhaust gases to heat the mixture from said auxiliary mixing conduit operative only when said auxiliary mixing conduit is functioning, said deflecting valve having a portion pressure operated for by passing a portion of the exhaust gases.

9. In an internal combustion engine, an intake manifold having a plurality of mixture inlets, a main carburetor and an auxiliary carburetor connected to said inlets, a manually operated throttle valve in said main carburetor and an automatically operated throttle valve in said auxiliary carburetor, an exhaust manifold having a temperature responsive valve for directing exhaust gases to heat the mixture from said main carburetor when the engine is cold and a deflecting valve for directing exhaust gases to heat the mixture from said auxiliary carburetor when said automatically operated throttle valve is opened, said deflecting valve having a portion responsive to pressure for relieving pressure in said exhaust manifold.

10. In an internal combustion engine, an intake manifold having a plurality of mixture inlets, a main carburetor and an auxiliary carburetor connected to said inlets, a manually operated throttle valve in said main carburetor and an automatically operated throttle valve in said auxiliary carburetor, an exhaust manifold having a temperature responsive valve for directing exhaust gases to heat the mixture from said main carburetor when the engine is cold and a deflecting valve for directing exhaust gases to heat the mixture from said auxiliary carburetor when said automatically operated throttle valve is opened, said deflecting valve having a portion operative when a predetermined pressure is built up in the exhaust manifold.

11. In an internal combustion engine an intake manifold having a plurality of mixture inlets, a mixing conduit connected to each inlet, a throttle valve in each mixing conduit, manually operable means for opening and closing one of said valves, automatic means for opening the other valves successively in response to engine speed, and means positively responsive to said manually operable means for closing all of said valves simultaneously.

12. In an internal combustion engine, an intake manifold having a plurality of mixture inlets, a main mixing conduit and an auxiliary mixing conduit, a manually operated throttle valve in said main conduit, a second throttle valve in said auxiliary conduit, suction means responsive to engine speed for opening said second throttle valve and means connecting said throttle valves for closing said second throttle valve.

13. In an internal combustion engine, an intake manifold having a plurality of mixture in-

lets, a main carburetor and an auxiliary carburetor connected to said inlets, a manually operated throttle valve in said main carburetor and an automatically operated throttle valve in said auxiliary carburetor, an exhaust manifold having a temperature responsive valve for directing exhaust gases to heat the mixture from said main carburetor when the engine is cold and a deflecting valve for directing exhaust gases to heat the mixture from said auxiliary carburetor when said automatically operated throttle valve is opened.

14. In an internal combustion engine, an intake manifold having a plurality of mixture inlets, a main carburetor and an auxiliary carburetor connected to said inlets, a manually operated throttle valve in said main carburetor and an automatically operated throttle valve in said auxiliary carburetor, an exhaust manifold having a temperature responsive valve for directing exhaust gases to heat the mixture from said main carburetor when the engine is cold and a deflecting valve for directing exhaust gases to heat the mixture from said auxiliary carburetor when said automatically operated throttle valve is opened, the movement of said deflecting valve being controlled by the movement of said automatically operated throttle valve.

15. In an internal combustion engine, an intake manifold having a plurality of mixture inlets, a main carburetor and an auxiliary carburetor connected to said inlets, a manually operated throttle valve in said main carburetor and an automatically operated throttle valve in said auxiliary carburetor, an exhaust manifold having a temperature responsive valve for directing exhaust gases to heat the mixture from said main carburetor when the engine is cold and means for heating the mixture from said auxiliary carburetor when said automatically operated throttle valve is opened.

16. In an internal combustion engine, an intake manifold having a plurality of mixture inlets, a main mixing conduit connected to one of said inlets and an auxiliary mixing conduit connected to the other inlet, an exhaust manifold having a deflecting valve for directing exhaust gases to heat the mixture from said auxiliary mixing conduit and suction means for actuating said deflecting valve.

17. In an internal combustion engine, an intake manifold having a plurality of mixture inlets, a main mixing conduit connected to one of said inlets and an auxiliary mixing conduit connected to the other inlet, an exhaust manifold having a deflecting valve for directing exhaust gases to heat the mixture from said auxiliary mixing conduit and suction means for closing said deflecting valve.

18. In an internal combustion engine, an intake manifold having a plurality of mixture inlets, a main mixing conduit connected to one of said inlets and an auxiliary mixing conduit connected to the other inlet, an exhaust manifold having a deflecting valve for directing exhaust gases to heat the mixture from said auxiliary mixing conduit and suction means for closing said deflecting valve, and means for positively opening said deflecting valve as said main throttle valve is closed.

GEORGE R. ERICSON.
IRVEN E. COFFEY.