Aug. 15, 1944. G. R. ERICSON ET AL 2,355,716

INTERNAL-COMBUSTION ENGINE

Filed May 16, 1940

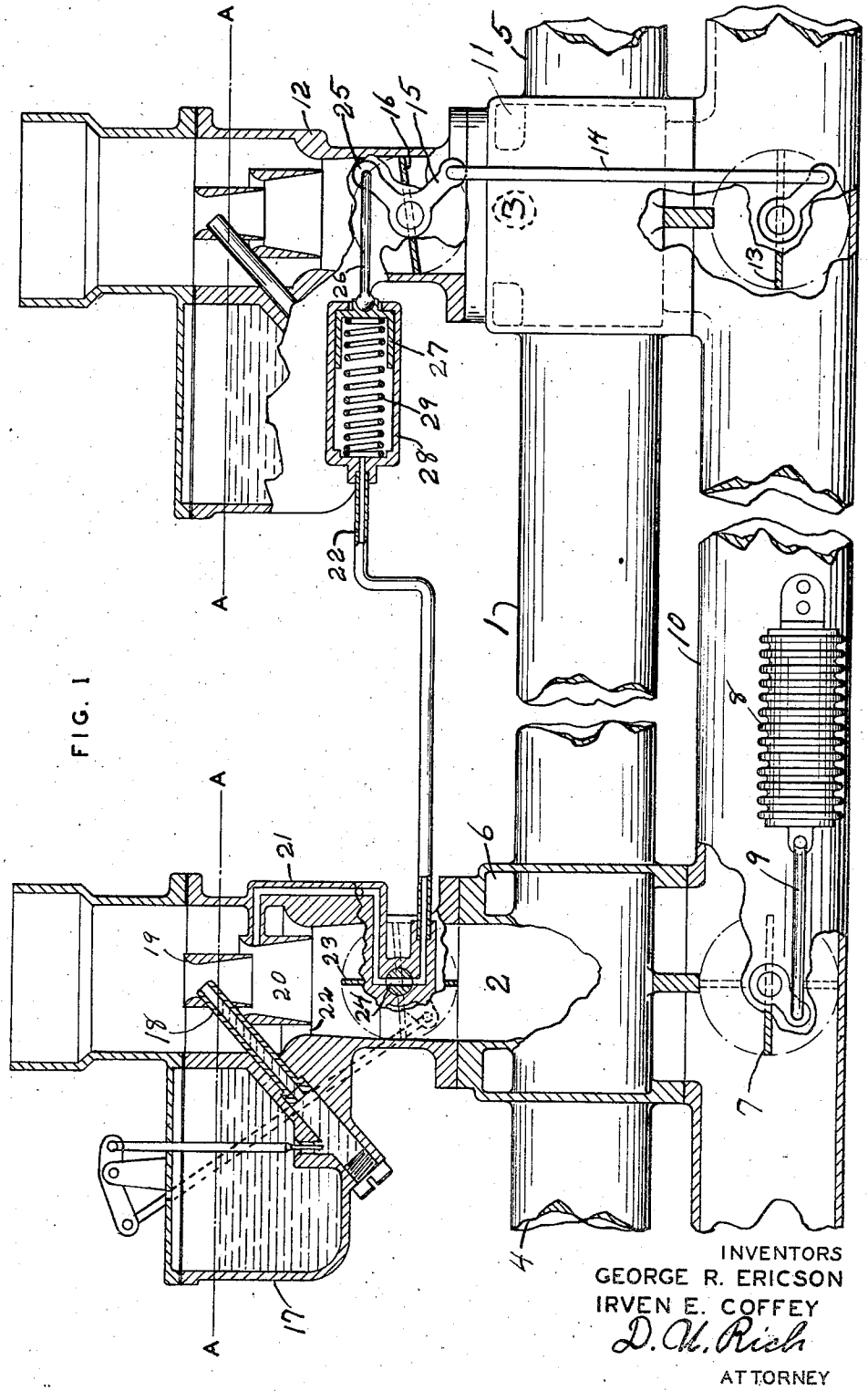


FIG. 1

INVENTORS
GEORGE R. ERICSON
IRVEN E. COFFEY
D. K. Rich
ATTORNEY

Patented Aug. 15, 1944

2,355,716

UNITED STATES PATENT OFFICE

2,355,716

INTERNAL-COMBUSTION ENGINE

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

Application May 16, 1940, Serial No. 335,590

11 Claims. (Cl. 123—127)

This invention relates to internal combustion engines and particularly to multi-cylinder engines in which a number of cylinders are supplied from a single intake manifold system. It has been shown that the pulsations occurring in the intake manifold at certain engine speeds cause faulty distribution of mixture both as to volume and quality, so that when higher speeds are attained the admission of mixture to the engine becomes restricted by the inertia of gases moving in the wrong direction in the intake manifold and by variations in mixture quality between different cylinders, as well as by the restriction presented by the various passages of the carburetor.

Another difficulty that has been found in operating internal combustion engines over wide ranges of speeds and loads is due to the limitations of throttle range or volume range in modern carburetors. For instance, a plain tube carburetor having a venturi of sufficient size and capacity to supply the fuel requirements of the engine under wide open throttle high speed conditions fails to develop a substantial suction under low speed wide open throttle conditions.

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 disadvantage 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 pulsations resulting from back flow from the various cylinders under certain conditions will be damped so as to produce a 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.

Other objects and advantages will appear from the following description and accompanying drawing, referring to which the single figure is a schematic representation of a main carburetor and an auxiliary carburetor mounted on associated intake and exhaust manifolds of the engine.

The 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. It will be understood that 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. The construction of the auxiliary hot spot 11 and the auxiliary heat valve 13 are the same as of the main hot spot and heat valve except that the auxiliary heat valve is controlled by a connection 14 with the operating lever 15 of the auxiliary throttle 16.

The main carburetor 17 is of a 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 down-draft triple venturi type having a main nozzle 18 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 Patent 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 Venturi tubes but in the pres-

ent instance a primary Venturi tube 18 receives the main nozzle, a secondary Venturi tube 20 receives the connection 21 of the auxiliary carburetor control device, and the main Venturi tube 22 receives the discharge from the primary and secondary Venturi tubes. A manually operated throttle 23 is provided and the throttle shaft is drilled to form a valve 24 with the passage 21—22 so as to begin opening this passage at about three quarter open throttle and thereby prevent the operation of the auxiliary carburetor when the main carburetor is being operated at part throttle.

The auxiliary carburetor may be substantially the same in construction as the main carburetor except for the operation of the throttle 16. The auxiliary throttle operating lever 15 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 plain of the throttle plate 16 and the position of the piston 27 is so arranged as to produce a decreasing ratio of valve movement as the valve is opened.

In the operation, the operator controls the manual throttle 23, and during low speed and idling conditions the auxiliary throttle 16 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 23 wide open there will not be enough suction at the throat of the secondary venturi 20 to act through the passage 21 and valve 24 to move the piston 27 to the left against the auxiliary throttle closing spring 29, but with the throttle 23 wide open, or nearly so, suction in the secondary venturi will increase, as the engine speed increases, to a point at which the throttle 16 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 increases 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 along 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 increases 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.

The exclusive use of all such modifications as come within the scope of the appended claims is contemplated.

We claim:

1. In an internal combustion engine having an intake passage, means forming a plurality of mixing conduits for supplying fuel to said passage, said mixing conduits being connected to said passage at longitudinally spaced intervals, a manually operated throttle valve for one of said conduits and an automatically operated balanced throttle valve for the other of said conduits, said automatic valve being controlled by suction developed at a point anterior to said manually operated throttle.

2. In an internal combustion engine having intake passage means, means forming a plurality of mixing conduits for supplying fuel to said passage means, a manually operated throttle valve for one of said conduits and an automatically operated throttle valve for the other of said conduits, said automatic valve being controlled by suction developed at a point anterior to the manually operated throttle, and means controlled in accordance with the position of said manually operated throttle for preventing the opening of said automatic throttle except when said manually operated throttle has been opened to a predetermined degree.

3. In an internal combustion engine, an intake manifold having a plurality of longitudinally spaced mixture inlets, a main mixing conduit connected to one of said inlets and an auxiliary mixing conduit connected to the auxiliary inlet and means controlled by the operator but dependent on the attainment of a predetermined rate of flow through said main conduit to said engine for opening said auxiliary conduit, the longitudinal spacing of the mixture inlets being ample to permit the mixture from the auxiliary inlet to damp the back pressure pulsations.

4. 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, devices actuated, respectively, by said manual throttle and pressure changes in said main mixing conduit for controlling said second valve.

5. In an internal combustion engine, an intake manifold having a plurality of longitudinally spaced mixture inlets, a main mixing conduit connected to one of said inlets and an auxiliary mixing conduit connected to the auxiliary inlet, a manually operated throttle valve for said main mixing conduit, an auxiliary balanced valve for said auxiliary mixing conduit and means controlled by suction developed anterior to the throttle in said main mixing conduit for controlling said auxiliary valve.

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 auxiliary inlet, a manually operated throttle valve for said main mixing conduit, an auxiliary valve for said auxiliary mixing conduit, a suction operated device for operating said auxiliary valve, a conduit for applying suction to said suction device, and a valve controlled by said manually operated throttle for controlling said suction conduit.

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 auxiliary inlet, a manually operated throttle valve for said main mixing conduit, a normally closed auxiliary valve for said auxiliary mixing conduit, means including a device operated by suction developed in said main mixing conduit for controlling said auxiliary valve, and means dependent on the opening of said manually operated valve for effecting the operation of said auxiliary 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 auxiliary inlet, a manually operated throttle valve for said main mixing conduit, an auxiliary valve for said auxiliary mixing conduit, means controlled by suction developed in said main mixing conduit for controlling said auxiliary valve, a heating device for heating the fuel delivered by said auxiliary mixing conduit, control means for said heating device, and means forming an operative connection between said control means and said auxiliary valve.

9. In an internal combustion engine, a fuel mixture inlet manifold, fuel mixture forming means, a manually operated throttle valve, a second balanced valve for restricting the flow of fuel mixture to said manifold, and means including a manually operable member and a member operable in accordance with engine suction for controlling said second valve.

10. In an internal combustion engine having a plurality of cylinders and an intake manifold, a main carburetor for supplying fuel to said intake manifold, and means for dampening pulsations from said manifold comprising a second carburetor connected to said manifold at a point spaced from said main manifold, and means operated by the suction anterior to the throttle of said main carburetor for opening the throttle of the second carburetor at high speeds.

11. The method of operating an internal combustion engine including an intake manifold and mixture conduits communicating with said manifold, which comprises arranging the mixture conduits at such spaced points in said manifold that the mixture from one of the conduits will dampen manifold back pressure pulsations, and automatically controlling the flow mixture passing through one of said mixture conduits by vacuum conditions in the other mixture conduit.

GEORGE R. ERICSON.
IRVEN E. COFFEY.