

Jan. 23, 1945.

G. R. ERICSON

2,368,012

INTERNAL-COMBUSTION ENGINE

Filed May 5, 1943

2 Sheets-Sheet 1

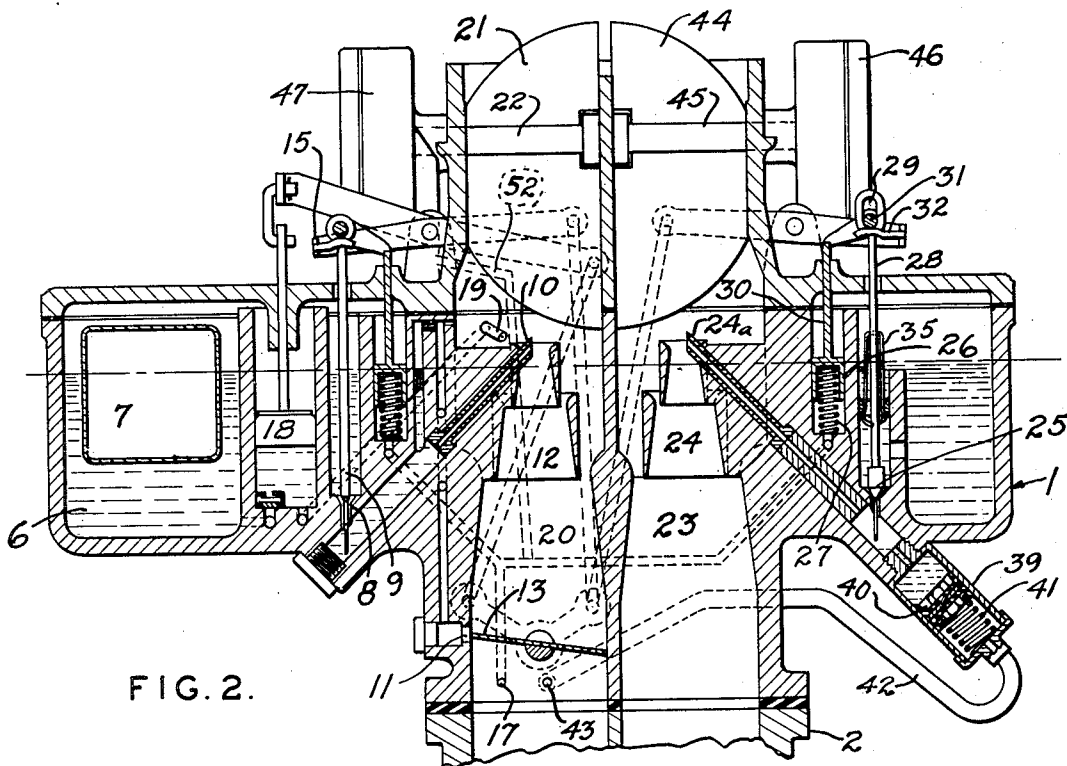


FIG. 2.

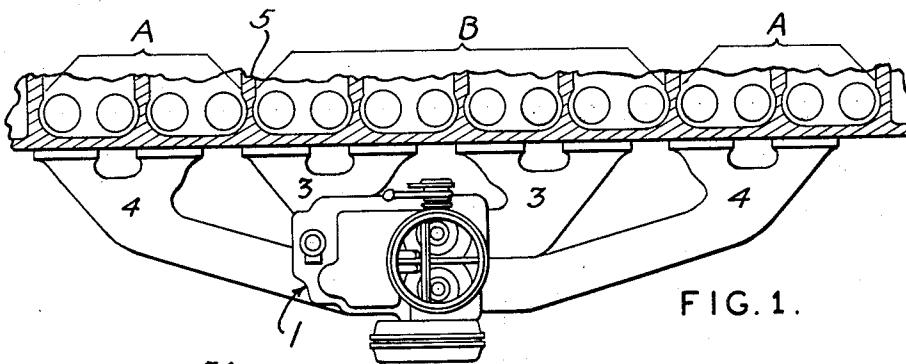


FIG. 1.

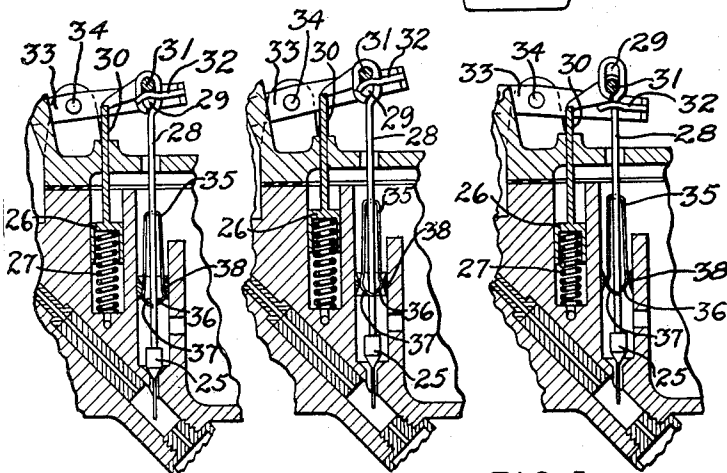


FIG. 3.

FIG. 4.

FIG. 5.

INVENTOR
GEORGE R. ERICSON
Donald U. Rich
ATTORNEY

Jan. 23, 1945.

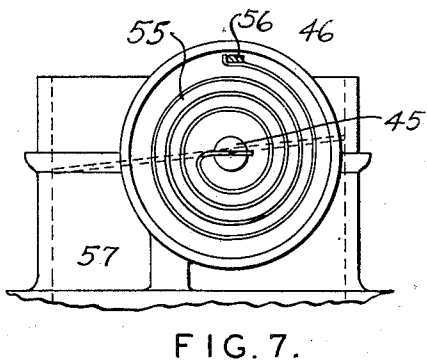
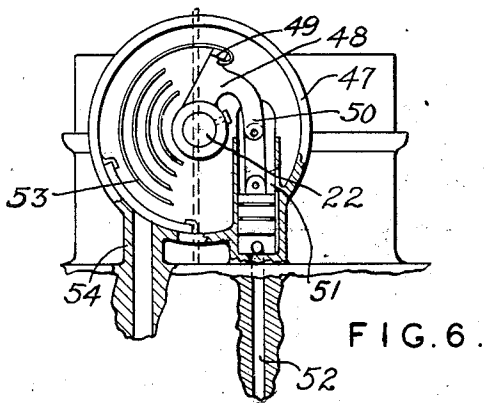
G. R. ERICSON

2,368,012

INTERNAL-COMBUSTION ENGINE

Filed May 5, 1943

2 Sheets-Sheet 2



INVENTOR
GEORGE R. ERICSON
Donald U. Rich
ATTORNEY

UNITED STATES PATENT OFFICE

2,368,012

INTERNAL-COMBUSTION ENGINE

George R. Ericson, Kirkwood, Mo., assignor to
Carter Carburetor Corporation, St. Louis, Mo.,
a corporation of Delaware

Application May 5, 1943, Serial No. 485,951

13 Claims. (Cl. 123—127)

This invention relates to internal combustion engines and particularly to automotive engines of the multicylinder type. The invention is an improvement of the devices shown in my earlier filed applications, Serial No. 453,116, filed July 31, 1942, and Serial No. 468,564, filed December 10, 1942.

In devices of the character shown in the previous applications, the fuel is cut off from some or all of the cylinders in accordance with the power requirements of the engine, as indicated by the vacuum in the intake manifold. Cutting off the fuel in this way leaves one or more groups of cylinders without any fuel charge to produce power, but still operating to suck dry air through a manifold past a partly closed throttle valve. This results in a considerable pumping loss and substantially increases the total motor friction. I have found that it is possible to substantially increase the fuel economy by leaving the air supply to one group of cylinders unthrottled and uncontrolled, so that the control valve for the fuel for that group of cylinders operates to set the cylinder group in full operation or to completely discontinue the production of power by that group.

In order to operate a cylinder group without a throttle, it is necessary to make the fuel control valve turn on or cut off completely and positively, so that the engine will never be supplied with a mixture which is too lean to fire steadily, but still containing enough fuel to produce an occasional backfire in the manifold or to cause surging by firing occasionally in the cylinder. In order to meet this requirement, I control the fuel valve by a combination of suction and throttle position and incorporate an improved snap action mechanism which positively holds the valve on its seat, or else positively holds it off. I control the snap action mechanism, so that it will turn on the fuel in the auxiliary cylinder group when the suction in the manifold leading to the main cylinder group falls to approximately 4 inches of mercury, but after it is once turned on the snap action valve remains open and keeps the auxiliary cylinder group in operation until the manifold vacuum in the main manifold has risen to approximately 12 or 15 inches of mercury. This enables the operator to find a throttle position which will cause the engine to deliver substantially any desired torque. If the fuel in the auxiliary cylinders were turned on at substantially the same manifold suction at which it was turned off, the driver would have to be continually changing the throttle position

to maintain the desired speed, especially when climbing a hill; else, the motor would start to hunt between the speed just below and just above that at which the critical vacuum for operating the fuel valve is produced.

Where multicylinder engines have two groups of cylinders supplied by separate manifolds, it is common practice to supply both manifolds with fuel mixture from a "dual" carburetor, having two throttles and two sets of venturis, nozzles, and accelerating pumps, but only one air inlet and one choke mechanism. I have found that such an arrangement does not give good results where one throttle is omitted and its barrel is to be run dry part of the time. I have found that better operation is to be obtained by completely separating the air inlets to the two mixing conduits. The operation during starting and warming up is still further improved by using separate choke valves, controlled by different types of mechanism.

The invention will be better understood upon consideration of the following description and accompanying drawings, in which

Fig. 1 is a diagrammatic view of a carburetor, manifold, and a partial section of an eight cylinder motor.

Fig. 2 is a sectional diagram of a carburetor and manifold embodying my invention.

Fig. 3 is a sectional diagram showing a fuel control valve in closed position.

Fig. 4 is a sectional diagram showing a fuel control valve in open position.

Fig. 5 is a sectional diagram showing a fuel control valve in open position but ready to be closed by the vacuum.

Fig. 6 is a diagram of the automatic choke control used in the throttled barrel of the carburetor.

Fig. 7 is a diagram of the automatic choke control used in the unthrottled barrel of the carburetor.

The reference character 1 indicates the main body casting of a carburetor, which is mounted on the riser flange 2 of a dual intake manifold having separate branches 3 and 4 leading to the inner and outer cylinder groups of an eight cylinder engine which is generally indicated at 5. It may be noted that the particular engine shown is of the eight-in-line type, in which the four cylinders in the middle operate as one group, firing at intervals of 180 degrees in the rotation of the crank shaft, and the other four cylinders comprise another group, having power strokes interspersed at equal intervals between the power strokes of the other four cylinders.

The carburetor is provided with the usual fuel chamber 6, which is indicated to be of the constant level type, the level being maintained by float mechanism generally indicated at 7. It may be noted that the fuel chamber may be of any type, and the fuel may be maintained under pressure if desired. The fuel is delivered from the float chamber through a calibrated metering passage 8 controlled by the metering rod 9 to a branched passage which leads to the main nozzle 10 and the idle port 11. The main nozzle discharges into a conventional Venturi stack 12, and the idle passage discharges at the edge of the throttle valve 13, as is conventional in plain tube carburetor construction. The throttle is connected to the metering rod 9 by means of a one-way connection 15, and the metering rod, which is normally biased upwardly to the "rich" position by a spring, is drawn downwardly by suction applied from below the throttle through the passage indicated at 17. This construction is known to those skilled in the art, and for further details reference may be had to Patent # Re. 21,610 to F. W. Cloedy et al. A throttle operated accelerating pump 18 is provided, for the purpose of delivering auxiliary charges of fuel through the nozzle 19.

The carburetor so far described supplies fuel to the mixing conduit 20, which is connected to the outside intake manifold 4, and the outside cylinder group A is thus constantly supplied with fuel during the operation of the motor. For starting purposes an unbalanced choke valve 21 is mounted in the air inlet on the shaft 22, which is connected to an automatic choke control mechanism, preferably of the type shown in Coffey Patent #2,085,351, or of the type shown in my previous Patent #1,915,851, it being noted that the choke position is the resultant of three main forces, to wit, the temperature, the rate of air flow past the choke valve, and the suction posterior to the throttle.

The inside group of cylinders B is supplied with fuel mixture by the mixing conduit 23, which is provided with a Venturi stack 24 similar to the stack in the mixing conduit 20. This mixing conduit is supplied with fuel from the same float chamber 6 as is the conduit 20, but the supply is intermittent, in accordance with the power required from the engine. No throttle is used in conduit 23, and no idle port is provided. This side of the carburetor is either in full, wide open throttle operation, or is operated dry, without any fuel at all.

The fuel supplied to the nozzle 24a is controlled by the valve 25, and the position of the valve is controlled by suction and throttle position. The suction operated piston 26, normally held in upward position by the spring 27, may be drawn downwardly by suction from below the throttle, applied by means of a passage which is connected to the port 17. The valve 25 has a stem 28 provided at its upper end with a slot 29, and this is connected to the stem 30 of the piston 26 by means of the cross pin 31. A finger 32 carried by the lever 33 underlies the cross pin 31, and the lever 33 is pivoted to the carburetor body as at 34, so that the finger 32 is moved upwardly when the throttle valve 13 is opened.

The valve stem 28 is drilled to receive a spring 35, which is bent as indicated at 36 and 37 to slide over the "hump" 38 in such a manner as to cause the valve to be held either in its upper or its lower position, the bent portions 36 and 37 are slightly different in height, and this ar-

range makes it practically impossible for the valve to retain a position in which it is nearly but not quite seated. The resiliency of the spring 27 contributes to the efficiency of the snap action, as the valve cannot be displaced from its seat without the exertion of enough force to completely open it.

In order to cause the fuel discharge to be started instantly when the valve 25 is opened, I mount a cylinder 39, containing a floating piston 40, at the base of the nozzle 24a. The piston is normally held in upward position by means of the spring 41, but may be drawn downwardly by suction applied from below the throttle in the mixing conduit 20 through the conduit 42, which is connected to the port 43. The piston 40 is provided with a double expansible packing as shown, so as to be leak-proof in both directions, and also to provide some friction. By this arrangement the movement of the piston 40 may be substantially synchronized with the operation of the valve 25.

In order to provide for efficient cold starting, a choke valve 44 is mounted on an eccentric shaft 45 in the air inlet of the mixing conduit 23, and a thermostatic coil 46 is provided to close the choke when the temperature is low. This choke valve is independent of the suction below the throttle, and is moved toward open position against the action of the thermostat only by the direct action of the air flow. The heating means for warming up the thermostat is not shown, but may be the same as shown in the previously mentioned Patents #2,085,351 or #1,915,851.

In operation, the engine is started on all eight cylinders, with the fullest possible charge supplied to the central group of cylinders, but as soon as the engine begins to pick up speed, the vacuum in the outer intake manifold 4 is built up to about twelve or fifteen inches of mercury, which is sufficient to draw the piston 26 downwardly against the spring 27, and cut off the fuel valve 25. The engine then continues to operate on the outside group of cylinders, which is supplied by the mixing conduit 20.

It will be understood that the valve 13 may be opened sufficient for starting purposes without forcing the valve 25 open by means of the finger 32, but if the operator opens the throttle beyond approximately the one-third open position, the valve 25 is opened regardless of the suction which may exist in the outlet of the mixing conduit 23. After the valve 25 has been opened, it will remain open until the suction has been increased to approximately twelve inches of mercury, so that the operator may return the throttle to almost idle position before cylinder group B is cut out. This arrangement enables him to find a throttle position to provide practically any amount of torque within the range of the engine.

When the valve 25 is closed, it will not re-open until the suction below throttle 13 has fallen to about four inches of mercury, so that a considerable range of driving on four cylinders is possible, and the operator is enabled to obtain maximum fuel economy.

Figs. 6 and 7 show details of the choke controlling device. In Fig. 6, choke shaft 22 extends into a housing 47 and carries arm 48 having an axially extending lip 49 and a curved extension terminating in a piston (not shown) slidable in a cylinder 51, as described in the mentioned Coffey patent. Cylinder 51 connects to suction posterior to throttle 13 by means of a passage 52 (Fig. 2). A thermostatic coil 53 mounted in

the housing is centrally fixed and has its free outer end hooked around lip 49 for actuating the choke in the closing direction when the temperature is low. Heat is supplied to the housing through a passaged boss 54. The control in Fig. 7 comprises simply a thermostatic coil 55 in housing 46 and centrally fixed on choke shaft 45. The outer end of the coil is hooked about a pin 56 on the housing wall. Heat is supplied through a passaged boss 57.

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

I claim:

1. In an internal combustion engine having a plurality of cylinder groups, separate intake conduits for supplying fuel mixture to said groups, a manually operated throttle valve for controlling the supply of fuel to one of said groups, the conduit supplying the other group of cylinders being unthrottled, a fuel valve for controlling the supply of fuel to said other group, and means responsive to the load demand on the engine for controlling said fuel valve.

2. In an internal combustion engine having a plurality of cylinder groups, separate intake conduits for supplying fuel mixture to said groups, a manually operated throttle valve for controlling the supply of fuel to one of said groups, the conduit supplying said other group being unthrottled, a fuel valve for controlling the supply of fuel to said other group, and means responsive to pressure posterior to said throttle for controlling said fuel valve.

3. In an internal combustion engine having a plurality of cylinder groups, separate intake conduits for supplying fuel mixture to said groups, a manually operated throttle valve for controlling the supply of fuel to one of said groups, the conduit supplying said other group being unthrottled, a fuel valve for controlling the supply of fuel to said other group, means responsive to pressure posterior to said throttle for controlling said fuel valve, and means operated by said throttle for opening said fuel valve when said throttle is moved to fully opened position.

4. In an internal combustion engine having a plurality of cylinder groups, separate intake conduits for supplying fuel to said groups, separate fuel supply nozzles for supplying fuel to said conduits, a throttle valve for one of said conduits, the other conduit being unthrottled, a fuel valve for controlling the supply of fuel to said unthrottled conduit, and means controlled by said throttle for operating said fuel valve.

5. In an internal combustion engine having a plurality of cylinder groups, a separate fuel intake conduit for supplying each of said groups, a main fuel passage discharging into each of said conduits, a metering orifice in each of said passages, one of said conduits being unthrottled, and a throttle in the other conduit for regulating the supply of fuel to the engine.

6. In an internal combustion engine having a plurality of cylinder groups, a separate fuel intake conduit for supplying each of said groups, a main fuel passage discharging into each of said conduits, a metering orifice in each of said passages, one of said conduits being unthrottled, and a throttle in the other conduit for regulating the flow of fuel through both conduits.

7. In an internal combustion engine having a plurality of cylinder groups, a separate fuel intake conduit for supplying each of said groups, a main fuel passage discharging into each of said

conduits, a metering orifice in each of said passages, one of said conduits being unthrottled, a valve controlling the metering orifice on said unthrottled side, a throttle in the other conduit controlling the supply of fuel therethrough, and means to control said valve in accordance with the position of said throttle.

8. In an internal combustion engine having a plurality of cylinder groups, a separate fuel intake conduit for supplying each of said groups, a main fuel passage discharging into each of said conduits, a metering orifice in each of said passages, one of said conduits being unthrottled, a valve controlling the metering orifice on said unthrottled side, a throttle in the other conduit controlling the supply of fuel therethrough, and means to control said valve in accordance with suction posterior to said throttle.

9. In an internal combustion engine having a plurality of cylinder groups, a separate fuel intake conduit for supplying each of said groups, a main fuel passage discharging into each of said conduits, a metering orifice in each of said passages, one of said conduits being unthrottled, a valve controlling the metering orifice on said unthrottled side, a throttle in the other conduit controlling the supply of fuel therethrough, and means to control said valve in accordance with the position of said throttle, and to supply an extra charge of fuel to said unthrottled conduit upon opening of said valve.

10. In an internal combustion engine having a plurality of cylinder groups served by separate intake ducts, means forming a throttled mixing conduit for supplying fuel to one of said ducts, means forming an unthrottled mixing conduit for supplying fuel to the other intake duct, valve means for controlling the supply of fuel to said unthrottled mixing conduit, a manually operated throttle for said throttled mixing conduit, means controlled by vacuum posterior to said throttle for actuating said fuel valve, and means resisting the final closing and initial opening movements of said valve.

11. In an internal combustion engine having a plurality of cylinder groups served by separate intake conduits, means forming a throttled mixing conduit for supplying fuel to one of said conduits, means forming an unthrottled mixing conduit for supplying fuel to the other intake conduit, valve means for controlling the supply of fuel to said unthrottled mixing conduit, a manually operated throttle for said throttled mixing conduit, means controlled by vacuum posterior to said throttle for actuating said fuel valve, and means resisting the final closing and initial opening movements of said valve, said valve actuating and resisting means being constructed and arranged to cause said valve to remain in closed position until the vacuum has fallen to a comparatively low value, but to cause said valve to remain in open position after it has once been opened until the vacuum rises to a substantially higher value.

12. In an internal combustion engine having a plurality of cylinder groups, separate mixing conduits supplying fuel to said groups, a throttle for one of said mixing conduits, the other conduit being unthrottled, an unbalanced choke valve mounted in the throttled inlet, heat responsive means tending to close said choke valve and means responsive to suction posterior to the throttle tending to open said choke valve, a second choke valve in the unthrottled conduit, and heat responsive means tending to hold said sec-

4 and choke valve in closed position when the temperature is low, said second choke valve being moved to open position by the direct action of air flow and being independent of the suction posterior to said throttle in the other mixing conduit.

13. In an internal combustion engine having a plurality of cylinders with separate intake ducts therefor, a mixing conduit for supplying fuel to

at least one of said ducts, a throttle for controlling the rate of flow through said mixing conduit, an unthrottled auxiliary mixing conduit, and means controlled in accordance with the power requirements of the engine for supplying fuel to 5 said auxiliary mixing conduit, or discontinuing said supply as required.

GEORGE R. ERICSON.