

Feb. 27, 1934.

L. E. PERRINI
CARBURETING APPARATUS

1,948,825

Filed March 22, 1928

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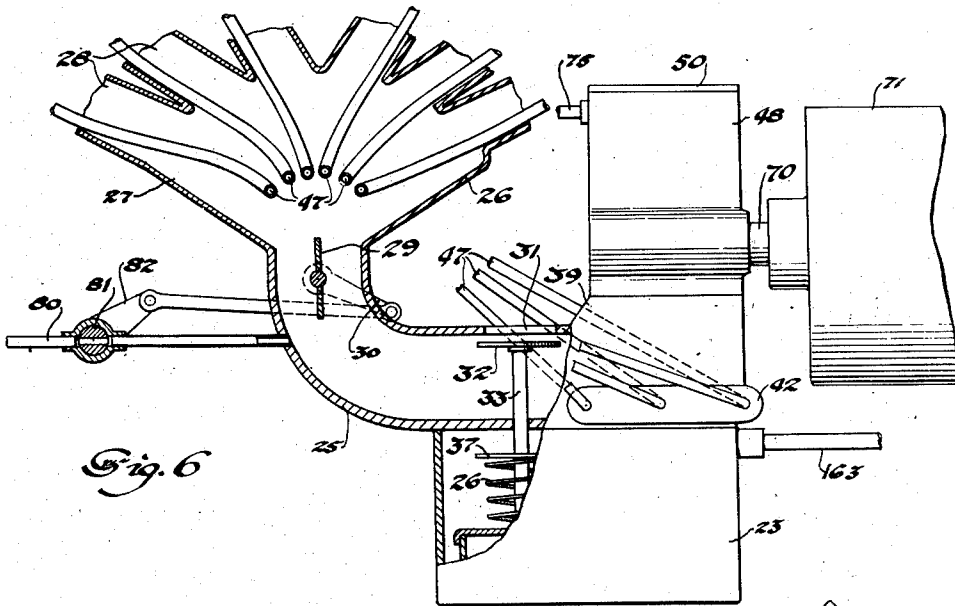


Fig. 6

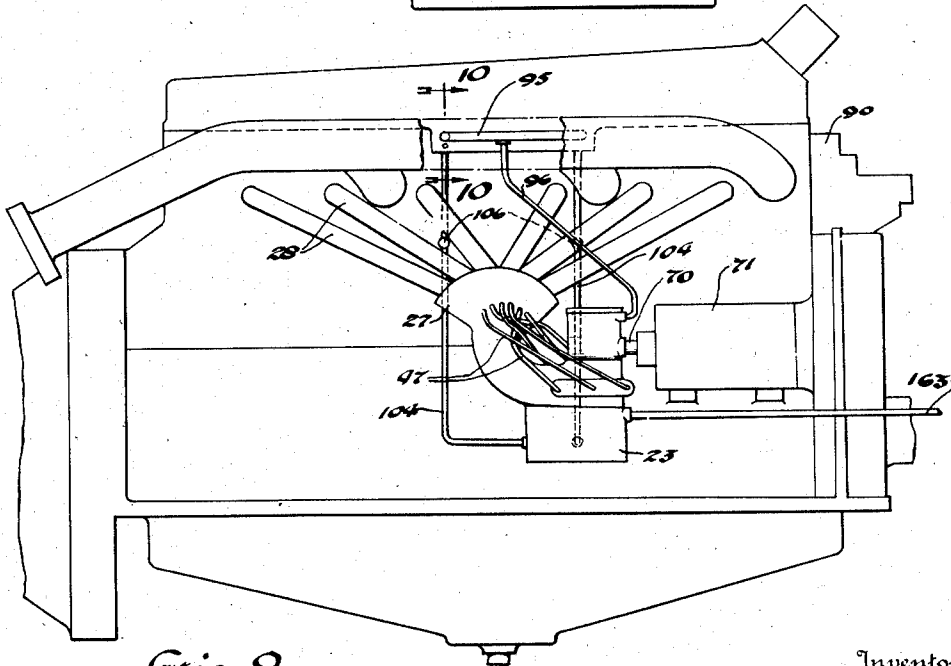


Fig. 9

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4 Sheets-Sheet 3

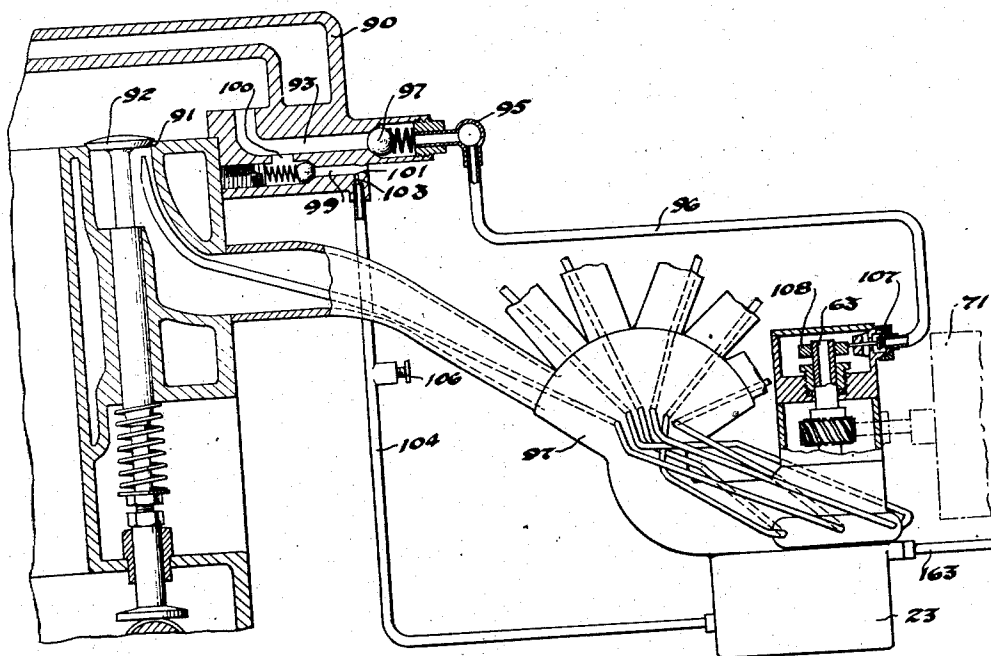
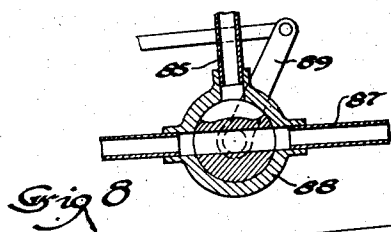
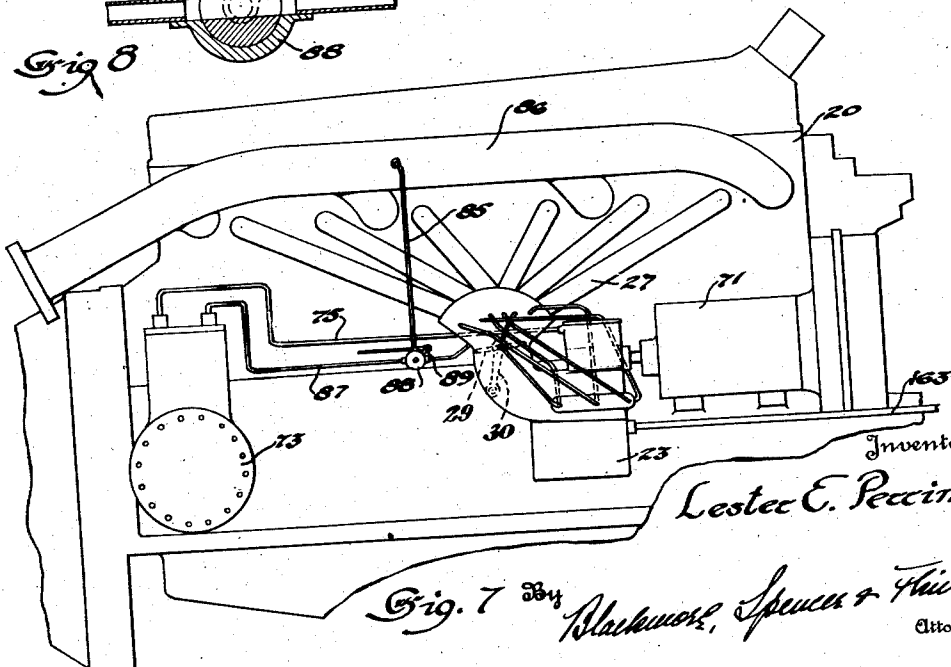


Fig. 11



5198



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UNITED STATES PATENT OFFICE

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CARBURETING APPARATUS

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18 Claims. (Cl. 123—138)

Among the problems confronting the internal combustion engine engineer has been that of providing carbureting apparatus which will effect a uniform distribution of fuel to the several cylinders of a multi-cylinder internal combustion engine. A non-uniform distribution of fuel to the several cylinders of an engine of this type results in increased fuel consumption, uneven running of the engine, and loss of power. It is, therefore, an object of this invention to provide carbureting apparatus which will effect a uniform distribution of fuel to the several cylinders of a multi-cylinder internal combustion engine.

Other objects of the invention will be obvious from a perusal of the following specification in which are described the several embodiments of my invention which are illustrated in the accompanying drawings.

In the drawings:

Figure 1 is a side elevation of an internal combustion engine on which is installed carbureting apparatus in which is embodied my invention and which includes one form of means for supplying to the fuel distributor the pressure for injecting the fuel into the cylinders of the engine.

Figure 2 is an enlarged view, mainly in section on the line 2—2 of Figure 3, of a portion of the carbureting apparatus shown in Figure 1.

Figure 3 is a fragmentary section taken on the line 3—3 of Figure 2.

Figure 4 is an enlarged fragmentary view of the discharge end of one of the fuel distributor tubes shown in Figures 1-3.

Figure 5 is a fragmentary view of a modified form of fuel distributor tube discharge end.

Figure 6 is a view, similar to Figure 2, of a slightly modified form of the apparatus illustrated in Figures 1-4.

Figure 7 is a view, similar to Figure 1, of another slightly modified form of the apparatus shown in Figures 1-4.

Figure 8 is a fragmentary view of a detail of the apparatus shown in Figure 7.

Figure 9 is a side elevation of an internal combustion engine on which is installed carbureting apparatus in which is embodied my invention and which includes a second form of means for supplying to the fuel distributor the pressure for injecting the fuel into the cylinders of the engine.

Figure 10 is an enlarged, somewhat diagrammatic view, partly in section on the line 10—10 of Figure 9, partly in elevation, and partly in section through the fuel distributor, of the apparatus illustrated in Figure 9.

Figure 11 is a view, similar to Figure 10, of a

modified form of the apparatus shown in Figures 9 and 10.

Figure 12 is a fragmentary view showing, in section, a modified form of fuel distributor.

Figure 13 is an enlarged detail view of a portion of the fuel distributor shown in Figure 12.

Figure 14 is a view taken as indicated by the line 14—14 of Figure 13.

In the drawings, referring particularly to Figures 1-4, the reference character 20 indicates a multi-cylinder internal combustion engine, in which there is provided an intake port 21, controlled by an intake valve 22, opening into each cylinder thereof.

The carbureting apparatus includes a fuel distributor 23 which includes a float bowl 24 and, above the float bowl, an air conduit 25 on one end of which there is provided an upwardly opening extension which communicates with the body portion 26 of a manifold 27. Pipes 28, equal in number to the cylinders of the engine, radiate from the body portion of the manifold and each opens at one end into the body portion thereof and at its opposite end into one of the intake ports of the engine. Within the conduit 25 and adjacent its outlet end, there is provided an ordinary butterfly throttle valve 29 operable by an arm 30.

In an intermediate portion of the upper side of the conduit 25 and above the float bowl, there is provided an air inlet opening 31 which is controlled by a valve 32 having a stem 33 extending through the lower wall of the conduit and into the float bowl. On the lower end of the stem, there is provided a piston 34 working in a dashpot 35 formed within the float bowl. A coil spring 36, which surrounds the stem 33, bears at its opposite ends against the cover of the dashpot and a washer 37 secured to the stem. The spring 36 tends to keep the valve 32 seated and the opening 31 closed and the dashpot damps the movement of the valve.

In the upper side of the conduit 25, at the end distant from the manifold 27, there is provided a circular opening 38 surrounded by a circumferential flange 39 which is, in part, formed as an extension of the end and side walls of the conduit. Within the conduit, directly above the float bowl, and coaxial with the opening 38 there is provided an upwardly opening circular recess 41 of which the lower wall of the conduit forms the bottom and which is bounded laterally, in part, by the end and side walls of the conduit and for the remainder of its circumference by the arcuate wall 42 which is spaced from the upper wall of

the conduit so as to provide a passage 43 therebetween. Fitting tightly within the recess 41 and of the same height as the wall 42 is a cylindrical block 44 which is suitably secured against movement in the recess. Bores 45, equal in number to the cylinders of the engine, equally spaced from the center of the block and equally spaced circumferentially of the block, extend into the block from the upper surface thereof. Bores 46 extend through the wall of the conduit 25 and into the block 44, each opening at its inner end into one of the bores 45. Small tubes 47, each of which opens at one end into one of the bores 46, extend from the bores 46, through a wall of the manifold, into the interior thereof. Within the manifold, each of the tubes 47 extends through one of the pipes 28 to a point adjacent an intake port of the engine with its end so arranged as to discharge fuel into the combustion chamber, between a valve 22 and its seat, when the valve is unseated.

A cylindrical tower 48 which is closed at its opposite ends by the walls 49 and 50 is seated on the flange 39 and closes the opening 38. The tower is divided by the wall 53 into an upper or pressure chamber 51 and a lower chamber 52.

The reference character 54 indicates a rotor which includes a shaft 55 which extends, through a central opening in the block 44 and through aligned openings in the lower wall of the conduit, the lower wall of the tower, and the wall 53 of the tower, from a point within the float bowl and below the fuel level thereof to a point within the pressure chamber of the fuel distributor, and is journaled in bearings 56, 57 and 58 which are formed in the block 44, the lower wall of the tower, and the wall 53 of the tower, respectively. It is to be noted that the bearing 58 is provided with packing 59 so as effectively to seal the upper chamber of the tower from the lower. The shaft 55 is provided intermediate its ends with a head 60 which is, as shown, integral therewith and seated on the block 44 with its lower surface in close contact with the upper surface thereof, and which is maintained in this relation by the coiled spring 61 which surrounds a portion of the shaft and bears at its upper end against the bearing 57 and at its lower end against the head.

Within the float bowl and surrounding the lower end of the shaft 55 is an annular float 62 which maintains the level of the fuel in the bowl constant by controlling the amount of fuel which enters from the fuel supply pipe 163.

In the portion of the shaft 55 above the head there is provided a longitudinal bore 63 which extends from the upper end of the shaft to a point adjacent the upper side of the head. The bore 63 communicates with an inclined bore 64 in the head which opens at its opposite end through the bottom of the head at a point the same distance from the axis of rotation of the shaft as the bores 45. In the portion of the shaft 55 below the head there is provided a longitudinal bore 65 which extends from the lower end of the shaft to a point adjacent the lower side of the head. The bores 63 and 65 are, as shown in the drawings, entirely out of communication with each other. The bore 65 communicates with an inclined bore 66 in the head which opens at its opposite end into a bore 67 which extends through the head from the upper to the lower surface thereof. A jet 68 opens into and is secured in the bore 66 and extends into the bore 67 and is there provided with a down-

wardly turned nozzle 69. As shown in the drawings, the internal diameter of the bore 67 is larger than the external diameter of the jet 68 and the nozzle 69, and the bore 67 is located at such a distance from the axis of rotation of the shaft 55 that it is adapted to register, at least partially, with each of the bores 45 once during each rotation of the shaft.

The reference character 70 indicates a shaft which is positively driven from the crankshaft of the engine. As shown in the drawings, the shaft 70 is the armature shaft of the generator 71 and extends through a wall of the lower chamber of the tower 48 carrying on its end within the chamber a worm gear which meshes with a pinion 72 which is keyed to the shaft 55.

There is indicated at 73 an air pump which is driven from a rotating shaft of the engine. A pipe 74 opens at one end into the manifold 26 above the throttle valve 29 and at its opposite end into the air intake of the compressor and a pipe 75 opens at one end into the air discharge of the compressor and at its opposite end into the pressure chamber of the carburetor.

The description of the operation of the apparatus shown in Figures 1 to 4 will be much simplified if, for the moment, only one cylinder of the engine is considered.

If the engine is turned over while the throttle valve 29 is partially opened, the pressure within the conduit 25 will be reduced to sub-atmospheric by the suction of the engine, the valve 32 will open against the pressure of the spring 36, and air will flow into the conduit 25 past the throttle valve 29 and into the manifold whence part of it will be withdrawn into the combustion chamber. The fuel in the float bowl being under atmospheric pressure and the nozzle 69 being under sub-atmospheric pressure, fuel will be withdrawn from the float bowl through the bores 65, 66 and the jet 68 and will be discharged from the nozzle 69 into the bore 45 which opens into the tube 47 leading to the cylinder under consideration. It will be noted that the bore 67 is of such size that there will be no metering of the fuel by the air flow past the nozzle so that the fuel flow from the nozzle 69 will be due entirely to the difference in pressure in the float bowl and on the nozzle. Simultaneously with the turning over of the engine, the shaft 70 begins to rotate, which, in turn, causes rotation of the shaft 55 and the head 60. At the same time, the pump 73 also begins to operate and withdraws air from the manifold and discharges it into the pressure chamber of the carburetor whence it passes through the bore 63 into the bore 64, thence into the bore 45, in which fuel has previously been deposited from the nozzle 69, when the head has rotated to the proper position. The air being under considerable pressure forces the fuel from the bore 45 into the bore 46, thence into the tube 47 leading to the cylinder under consideration whence it is discharged, at high velocity, between the valve 22 and its seat, into the combustion chamber which it enters in the form of a spray or in an atomized state, it being understood, of course, that the head will be so adjusted that the fuel will be discharged from the end of the tube 47 when the valve 22 is off its seat.

It is obvious that some of the air used to inject the fuel into the combustion chamber will enter the chamber with the fuel. This quantity is, however, relatively small and is insufficient to form a combustible mixture having the de-

sired proportions of fuel and air. The additional air (which is, in fact, the main supply of air) necessary to form a combustible mixture having the desired proportions of fuel and air is, as has been previously indicated, introduced into the combustion chamber directly from the manifold through the pipe 28 which opens thereinto.

The tubes leading from the successive bores 46 will, of course, lead to the cylinders in their firing order. For the purposes of illustration, the engine shown in Figure 1 is assumed to be one having a firing order of 1, 5, 3, 6, 2, 4 and, for this reason, the tubes 47 leading from the successive bores 46 are shown leading, respectively, to cylinders 1, 5, 3, 6, 2, 4.

As the head rotates, the nozzle 69 will, in turn, register with each of the successive bores 45, as a consequence of which an amount of fuel determined by the difference in pressure between that in the float bowl and that on the nozzle 69 and the speed of rotation of the rotor will be deposited in each of the bores 45 from which it will be injected into the cylinder connected to that bore when the bore 64 in turn registers with the bore 45 into which the fuel has been deposited.

If the throttle valve is opened further while the engine is running, the pressure on the nozzle 69 will be decreased and consequently the quantity of fuel discharged therefrom will be greater per unit of time. When the throttle is opened, the speed of the engine will be increased which will cause the rotor to rotate faster and deposit a greater number of charges of fuel into each of the bores 45 per unit of time. Opening of the throttle also causes the valve 32 to open further so that an increased supply of air enters the conduit 25 and flows into the manifold per unit of time so as to provide the additional air necessary for the combustion of the increased fuel supply. The increased speed of the engine will also cause the pump 73 to operate faster and, due to this fact and the fact that the pressure on the engine side of the throttle valve whence the pump obtains its air supply will be increased when the throttle is opened further, the pump will supply an increased amount of air to the pressure chamber of the fuel distributor to inject the increased number of fuel charges into the combustion chambers of the engine.

If the fuel distributor tubes are provided with discharge ends of the shape shown in Figure 5, the fuel will be discharged therefrom at a greater velocity and will enter the combustion chamber in a finer spray than if the tubes are provided with discharge ends of the type shown in Figures 1-4.

In the installation shown in Figure 6, the pipe 80 through which air is supplied to the air pump enters the apparatus below the throttle valve and is provided between the apparatus and the air pump with a valve 81 which is operable by an arm 82 which is connected thereto and which is preferably, as shown in the drawings, connected to the operating arm 30 of the throttle valve 29, so that as the throttle valve is opened to increase the speed of the engine the valve 81 will also be opened to allow an increased amount of air to flow from the air conduit 25 through the pipe 80 to the air pump. It is desirable to provide a valve, such as 81, which is adapted to be opened as the throttle valve is opened, in the air pump inlet line when the latter opens into the

apparatus below the throttle valve as otherwise the flow of air through the inlet pipe would tend to decrease as the throttle was opened due to the decrease in pressure in this part of the induction system as the throttle valve is opened. With the exceptions noted the apparatus shown in Figure 6 is identical with that shown in Figures 1-3 and operates in the same manner.

With the carbureting apparatus shown in the preceding figures, it may be difficult to close the throttle valve sufficiently to reduce the idle speed of the engine to that desired and still maintain sufficient pressure in the pressure chamber of the carburetor to inject the fuel into the combustion chambers. This objection may be overcome by providing means whereby a mixture of air and an incombustible gas, such as the engine exhaust gas, may be used to inject the fuel into the combustion chambers when desired and thereby reduce the volume of combustible mixture supplied to the combustion chambers and therefore the speed of the engine independently of the position of the throttle valve.

Means whereby exhaust gas may be introduced into the fluid used for injecting the fuel into the combustion chambers of the engine for the purpose mentioned above, applied to carbureting apparatus of the type illustrated in Figures 1 to 4, is shown in Figures 7 and 8. This means includes a pipe 85 which opens at one end into the exhaust manifold 86 of the engine and at its opposite end into the pipe 87 which leads from the carburetor 23 to the intake of the pump 73. At the junction of the pipes 85 and 87, there is located a valve 88 operable by an arm 89. It is obvious that by movement of the arm 89 the valve 88 may be turned so as to admit exhaust gas in any desired proportion to the pipe 87 and thereby control the proportion of exhaust gas and air used to inject the fuel into the combustion chambers of the engine. The valve 88 may be operated manually, or may be connected with the throttle for operation therewith, or may be operated by the intake manifold vacuum, or by any other suitable means.

In the modifications shown in Figures 9-11, I have shown means whereby the fluid pressure to inject the fuel into the combustion chambers of the engine may be obtained without the use of the pump shown in Figures 1-8.

Referring particularly to Figures 9 and 10 of the drawings, the reference character 90 indicates an internal combustion engine similar to that shown in the preceding figures, which is provided with a plurality of cylinders and an intake port 91 controlled by an inlet valve 92 opening into each cylinder. The fuel distributor 23 is similar to that shown in the preceding figures and is similarly connected to the intake ports of the engine and to the generator shaft.

Though it is to be understood that I may provide any number of passages 93 from one to the total number of cylinders of the engine, each of the passages opening at one end into one of the cylinders of the engine and communicating at its opposite end with the pressure chamber of the fuel distributor, I have shown in the drawings, for the purpose of illustration, two passages 93 extending through a wall of the engine, each of the passages opening at its inner end into one of the cylinders of the engine. The opening of each of these passages 93 into its respective cylinder is controlled by a valve 94 which is actuated by a cam 94' carried by a shaft 94'' which is positively driven from the crankshaft of the

engine and is so timed as to begin opening the valve during the intake stroke of the piston and to close it before the explosion occurs. The outer ends of both of these passages 93 open into a pipe 95 which in turn opens into a pipe 96 which opens at its opposite end into the pressure chamber of the fuel distributor. There is positioned in each of the passages 93 a spring-pressed ball valve 97 which prevents the passage of fluid from the pipe 95 into the passage 93.

It will be unnecessary to describe the operation of the device shown in Figures 9 and 10 further than to explain the operation of the means for supplying the fluid pressure for injecting the fuel into the combustion chambers as the apparatus is otherwise similar to and operates similarly to that shown in the preceding figures. During the compression stroke of either of the cylinders to which the pipe 95 is connected, the valve 94 in the combustible chamber of that cylinder is open and part of the combustion mixture therein escapes into the passage 93, past the valve 97 which is unseated against the pressure of the spring, and thence into the pipe 95. Being prevented from entering the other of the combustion chambers to which the pipe 95 is connected by the valve 97 in the passage leading to that chamber, the combustible mixture passes into the pipe 96 and thence into the pressure chamber of the fuel distributor. From the pressure chamber, the combustible mixture flows through the bores 63 and 64 into the bores 45, and being under considerable pressure forces the fuel in the bores 45 through the bores 46 and the tubes 47 into the combustion chambers of the engine.

As has been indicated, some of the combustible mixture in the combustion chambers to which the pipe 95 is connected will be discharged therefrom during the compression stroke. To prevent a shortage of combustible mixture in these combustion chambers, there is provided below each of the passages 93 a passage 99 which opens thereto at 100 and into the atmosphere at 101. In the outer end of each of the passages 99, there is formed a venturi and inwardly of the venturi is located the spring-pressed ball-valve 102 which prevents discharge of fluid from the passage 93 through the passage 99. Opening into each of the passages 99 through the wall of the venturi is a passage 103. As shown in the drawings, there are provided pipes 104, equal in number to the passages 99, each opening at one end into one of the passages 103 and at its opposite end into the float bowl of the carburetor below the fuel level thereof. In each of the pipes 104, between the engine and the carburetor, there is provided a manually operable valve 106, of any suitable type, for regulating the flow of fuel there-through.

It will be clear that when the valve 92 is open on the intake stroke air from the atmosphere will be sucked into the passage 99. The flow of air past the venturi will induce a flow of fuel from the float bowl through the pipe 104 into the passage 99, which fuel will be carried with the air into the cylinder through the passage 93 and thus supply enough mixture to compensate for that lost on the compression stroke. The valves 97 prevent a suction of fluid from the pipes 95 and 96 and the pressure chamber of the carburetor during the intake stroke. The valves 106 allow adjustment of the richness of the mixture supplied to the cylinder through the passages 99.

If desired, the valves 94 shown in Figures 9 and 10 may be replaced by a single valve 107 located

adjacent the discharge end of the pipe 96 and operable by a suitable cam 108 secured to the upper end of the rotor shaft of the fuel distributor, as shown in Figure 11, to open the discharge end of the pipe 96 to the interior of the pressure chamber of the carburetor at the proper times. With the exceptions noted, the structure shown in Figure 11 is similar to that shown in Figures 9 and 10 and the operation thereof insofar as it differs from that of the apparatus shown in Figure 11 is obvious.

Although, in the apparatus shown in Figures 9-11, I have shown two passages 93, one opening into each of two cylinders of the engine, it is obvious, as has been stated, that any number of these passages from one up to the total number of cylinders of the engine, each opening into one of the cylinders and into a pipe leading to the pressure chamber of the fuel distributor, may be provided. It is also obvious that if the number of these passages is equal to the number of cylinders of the engine the apparatus for compensating for the combustible mixture discharged from the cylinders of the engine will be unnecessary.

I may, if it is found necessary or desirable, provide means whereby a portion of the combustible mixture supplied to the pressure chamber of the fuel distributor may be replaced by an incombustible gas for the purpose previously mentioned.

In Figures 12-14, there is shown a fuel distributor in which there is provided a modified form of rotor but which is otherwise identical with the fuel distributors shown in the preceding figures. In Figures 12-14, the reference character 110 indicates the rotor which includes a shaft 111 journaled in bearings 112, 113 and 114. Between the ends of the shaft 111 and preferably integral therewith is a head 115 which is located between the bearings 112 and 113. The head 115 consists of a segmental disk which is provided with a bore 117 extending transversely thereof and opening into the bore 118 in the upper end of the shaft. Extending into the head 115 from the underside thereof at the same distance from the axis of rotation thereof as the bores 45 in the block 44 and opening into the bore 118 is a bore 119. Located between the head 115 and the block 44 and seated on the latter is a floating head 120 which surrounds the shaft 111 and is so mounted thereon as to be capable of rocking slightly with respect thereto, as indicated at 121. The head 115 is keyed to the floating head by pins 122 which are located on diametrically opposite sides of the axis of rotation of the shaft and are secured to the floating head and project into bores 123, of slightly larger diameter than the pins, in the head 115. Within the bores 123 and bearing at their opposite ends against the pins 122 and the bases of the bores are coil springs 124. At the same distance from the axis of rotation of the shaft 111 as the bores 45 and disposed at an angle of 90° from either of the bores 123 is a bore 125 extending through the floating head from the upper to the lower surface thereof. Fixed in the bore 125 and projecting above the upper surface of the floating head is a hollow pin 126 provided with a spherical end seated in a spherical recess in the head 115, which communicates with the bore 119. Circumferentially spaced from the bore 125, there is provided a bore 127 extending through the floating head at such a distance from the axis of rotation of the shaft 111 that it is adapted to register, at least partially, with each of the bores 45 once during each

rotation of the shaft. Extending out from the side of the head 115 is a hollow projection 128 which at its inner end opens into the bore 129 in the lower end of the shaft and at its outer end is provided with a down-turned nozzle 130 of smaller diameter than, and extending into, the bore 127. Between the head 115 and the bearing 113, there is located a spring 131 which holds the two heads together and maintains the floating head tightly in contact with the block 44.

The operation of the fuel distributor shown in Figures 12-14 is similar to that of the fuel distributors shown in the preceding figures. The advantages of providing the floating head between the head 115 and the block appear obvious. With this construction, it is assured that the floating head will always be in surface contact with the block 44 thus providing an effective seal, as is desirable, between the two parts to prevent loss of pressure. With the head shown in the preceding figures, it is necessary that the upper surface of the block be in a plane at a right angle to the axis of rotation of the shaft and that the lower surface of the head be in the same plane if there is to be an effective seal between the two parts. This makes necessary very accurate machine work if leaks between the head and the block are to be prevented. With the floating head such accurate work is not necessary since the head may rock slightly with respect to the shaft and the springs 124 will function to maintain it in surface contact with the block at all times even if the upper surface of the block is slightly out of the plane at right angles to the axis of rotation of the shaft.

The advantages of the hereinbefore described structures appear obvious. When the rotor is so adjusted that the fuel is injected into one of the cylinders at the proper time, since the rotor is positively driven from the crankshaft, the fuel will be injected into all of the cylinders at the proper times and thus perfect timing is insured. The problem of distribution is solved by using separate tubes for conveying the fuel charges to each cylinder and inserting a charge of fuel, automatically measured by the suction on the jet and the speed of rotation of the rotor, into each tube and positively injecting each charge into a cylinder at the proper time. Engines provided with the ordinary types of carbureting apparatus are more difficult to start when cold than when warm, due to the difficulty of supplying the cylinders with sufficient fuel when the engine is cold. It is obvious that no such difficulty will be encountered when my apparatus is used.

Though I have described with great particularity the several embodiments of my invention shown in the accompanying drawings, I desire it to be understood that the scope of my invention is not to be limited by what has been shown and described but includes all modifications within the scope of the appended claims.

I claim:

1. In combination with an internal combustion engine having a plurality of cylinders, means to supply fuel to the cylinders including a receptacle adapted to receive a supply of fuel, means for subjecting the fuel in said receptacle to fluid pressure to inject it into one of the cylinders, means whereby the fluid pressure to inject the fuel into the cylinder is obtained from one of the cylinders on its compression stroke whereby a portion of the charge from the last mentioned cylinder is discharged therefrom, and means whereby an additional supply of fuel may be sup-

plied to the last mentioned cylinder to compensate for that discharged therefrom.

2. In an internal combustion engine having a plurality of cylinders, a fuel reservoir, a tube extending into the reservoir, a plurality of receptacles rotatable with respect to the tube, said tube being adapted to withdraw fuel from the reservoir and discharge a portion of it into each of the receptacles by virtue of the difference between the pressure in the reservoir and that on the discharge end of the tube, and means to conduct the fuel from the receptacles to the cylinders of the engine.

3. In combination with an internal combustion engine having a plurality of cylinders, a plurality of receptacles, a rotatable member having therein a bore through which fuel is adapted to be supplied to each of the receptacles and an independent bore through which fluid pressure is adapted to be applied to the fuel in each of the receptacles to inject it into a cylinder of the engine.

4. In a device of the class described, a fuel reservoir, an air conduit above the reservoir, a pressure chamber above the conduit, a block in the conduit having therein a plurality of receptacles, a rotor including a shaft whose opposite ends extend into the reservoir and pressure chamber, respectively, a head on said rotor seated on the block, a bore in the end of the shaft which extends into the reservoir through which fuel is adapted to be supplied to the receptacles, and a bore in the opposite end of the shaft through which pressure is adapted to be imposed on the fuel in the receptacles.

5. In combination with an internal combustion engine having a plurality of cylinders and an inlet port controlled by an inlet valve opening into each cylinder, a manifold having a branch opening into each intake port, a carburetor including an air conduit opening into the manifold, a plurality of receptacles in the conduit, a tube leading from each of the receptacles to adjacent one of the intake ports of the engine and adapted to discharge fuel between the valve and its seat when the valve is off its seat, a tube adapted to discharge fuel successively into each of the receptacles, and means to apply pressure to the fuel in each receptacle successively to force it through one of the tubes and into the cylinder between the valve and its seat.

6. The combination with a multi-cylinder internal combustion engine having conduits for supplying air to the cylinders of the engine of means for supplying liquid fuel to the cylinders including a fuel reservoir, fuel receptacles, means for delivering into each of said receptacles from said reservoir during each cycle of the engine a charge of fuel whose quantity is dependent upon the pressure difference between the atmosphere and the air in the conduit, and means for conducting said charges to the cylinder.

7. In a device of the class described, a rotor including a shaft, a head mounted on the shaft so as to be capable of rocking slightly independently thereof and secured to the shaft so as to rotate therewith.

8. Fuel distributing apparatus for an internal combustion engine which includes an element in which there are provided a plurality of fuel receptacles, and an element which is rotatable with respect to the first mentioned element and in which there is provided a passage through which fuel is adapted to be deposited successively in each of the receptacles, and a second passage

through which pressure is adapted to be applied successively to the fuel in each receptacle to discharge it therefrom.

9. Fuel distributing apparatus for an internal combustion engine which includes an element in which there are provided a plurality of fuel receptacles, a fuel reservoir, a pressure chamber, and an element which is rotatable with respect to the first mentioned element and in which there is provided a passage through which fuel is adapted to be conducted from the fuel reservoir to each of the receptacles successively, and a second passage through which pressure from the pressure chamber is adapted to be applied successively to the fuel in each receptacle to discharge it therefrom.

10. In an internal combustion engine which includes a plurality of cylinders and an air supplying conduit communicating with the cylinders, means to supply fuel to the cylinders which includes an element in which there are provided a plurality of fuel receptacles located within the air supply conduit, and a conduit leading from each receptacle to a point adjacent one of the cylinders, an element rotatable with respect to the first mentioned element and in which there is provided a passage through which fuel is adapted to be deposited successively in each of the receptacles, and a second passage through which pressure is adapted to be applied successively to the fuel in each of the receptacles so as to inject it into the cylinders.

11. In an internal combustion engine, a conduit for supplying air to a cylinder of the engine, means for supplying liquid fuel to the cylinder including a fuel reservoir, a fuel receptacle, means for delivering into the receptacle from the reservoir during each cycle of operation of the engine a charge of fuel whose quantity is dependent upon the pressure difference between the atmosphere and the air in the conduit, means for conducting said charge from the receptacle to the cylinder, a throttle valve in the conduit, and a pump whose intake opens into the conduit on the engine side of the throttle valve and which is adapted to apply pressure to the fuel in the receptacle to force it into the cylinder.

12. In an internal combustion engine, a conduit for supplying air to a cylinder of the engine, means for supplying liquid fuel to the cylinder including a fuel reservoir, a fuel receptacle, means for delivering into said receptacle from the reservoir during each cycle of operation of the engine a charge of fuel whose quantity is dependent upon the pressure difference between the atmosphere and the air in the conduit, means for conducting the charge from the receptacle to the cylinder, a throttle in the conduit, a pump whose intake opens into the conduit on the atmospheric side of the throttle valve and which is adapted to supply fluid under pressure to inject the fuel in the receptacle into the cylinder, a valve in the intake of the pump, and an interconnection between the throttle valve and the last mentioned valve.

13. In combination with an internal combustion engine having a cylinder, an air supply conduit opening into the cylinder, means to supply fuel to the cylinder including a receptacle adapted to

receive a supply of fuel, means for subjecting the fuel in the receptacle to fluid pressure to inject it into the cylinder, said last mentioned means including an air pump arranged to withdraw air from the conduit, and means whereby combustible gas may be introduced into the air withdrawn from the conduit by the pump.

14. In an internal combustion engine which includes a plurality of cylinders, means for supplying fuel to the cylinders which includes an element in which there are provided a plurality of fuel receptacles, an element rotatable with respect to the first mentioned element and in which there is provided a passage through which fuel is adapted to be deposited successively in each of the receptacles, and a second passage through which pressure is adapted to be applied successively to the fuel in each receptacle to inject it into a cylinder, and means whereby the pressure is obtained from a cylinder of the engine.

15. Fuel distributing apparatus which includes an element in which there are provided a plurality of receptacles, a fuel reservoir, a pressure chamber, an element rotatable with respect to the first mentioned element and provided with a head capable of rocking slightly with respect to the body thereof seated on the first mentioned element, a passage in the second mentioned element through which fuel may be conducted from the reservoir and through the head successively into each of the fuel receptacles, and a second passage in the second mentioned element through which pressure from the pressure chamber may be applied successively to the fuel in each of the receptacles.

16. In combination with an internal combustion engine having a cylinder, an air supply conduit opening into the cylinder, means to supply fuel to the cylinder including a receptacle adapted to receive a supply of fuel, and means for subjecting the fuel in the receptacle to fluid pressure to inject it into the cylinder, said last mentioned means including an air pump driven from the crankshaft of the engine and arranged to withdraw air from the conduit.

17. In combination with an internal combustion engine having a cylinder, an air supply conduit opening into the cylinder, a throttle valve in the conduit, means to supply fuel to the cylinder including a receptacle adapted to receive a supply of fuel, and means for subjecting the fuel in the receptacle to fluid pressure to inject it into the cylinder, said last mentioned means including an air pump arranged to withdraw air from the conduit at a point between the throttle valve and the engine.

18. In combination with an internal combustion engine having a cylinder, an air supply conduit opening into the cylinder, a throttle valve in the conduit, means to supply fuel to the cylinder including a receptacle adapted to receive a supply of fuel, and means for subjecting the fuel in the receptacle to fluid pressure to inject it into the cylinder, said last mentioned means including an air pump arranged to withdraw air from the conduit at a point outwardly of the throttle valve, and a valve for regulating the flow of air from the conduit to the pump.

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