

June 30, 1936.

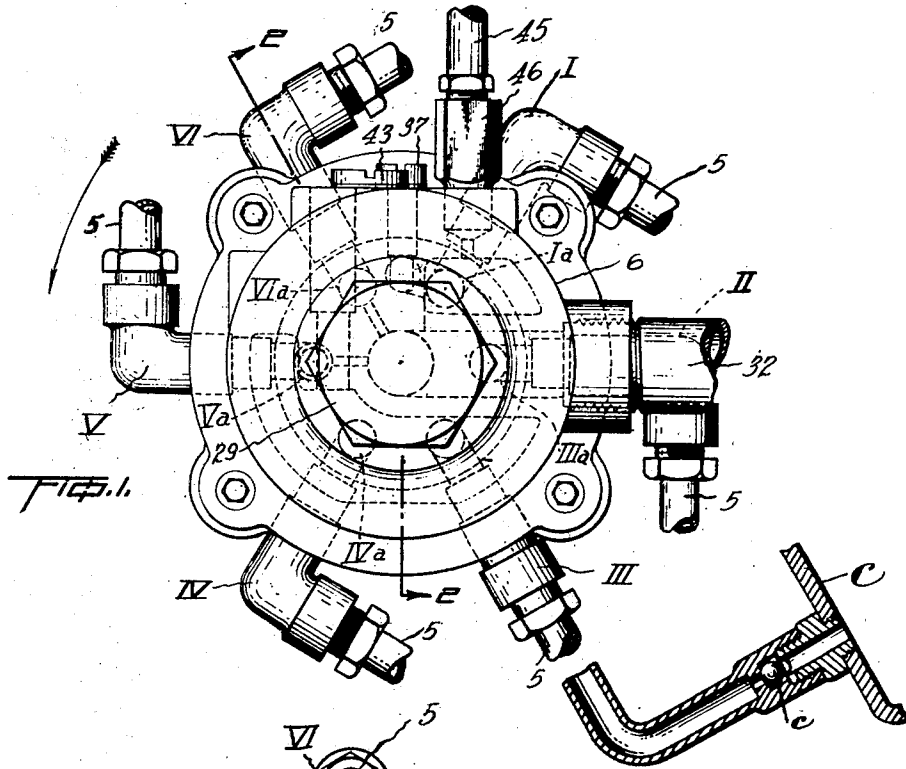
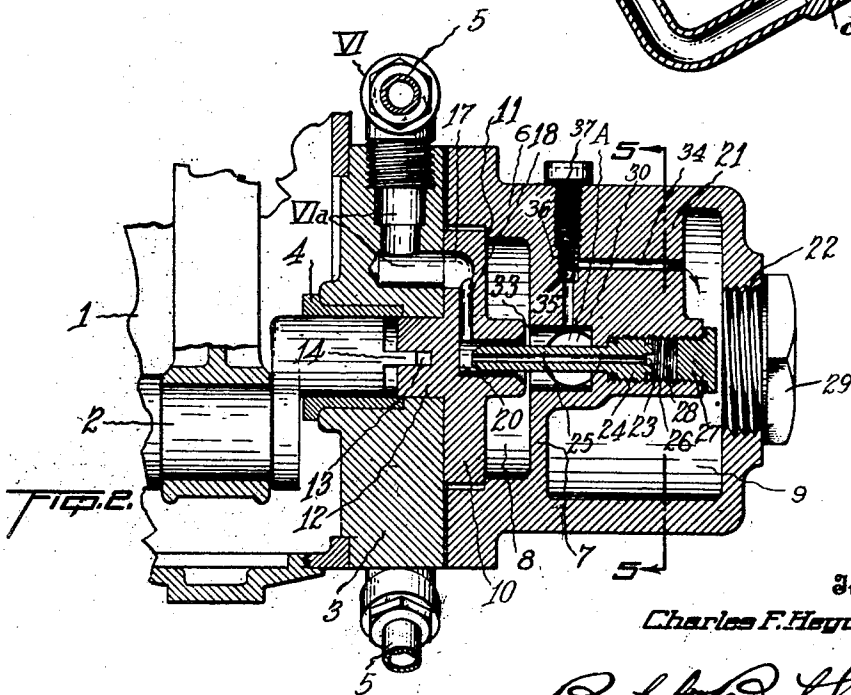
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2,046,074

AIR AND FUEL CHAMBER FOR ENGINE STARTERS

Filed May 14, 1928

2 Sheets-Sheet 1



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384

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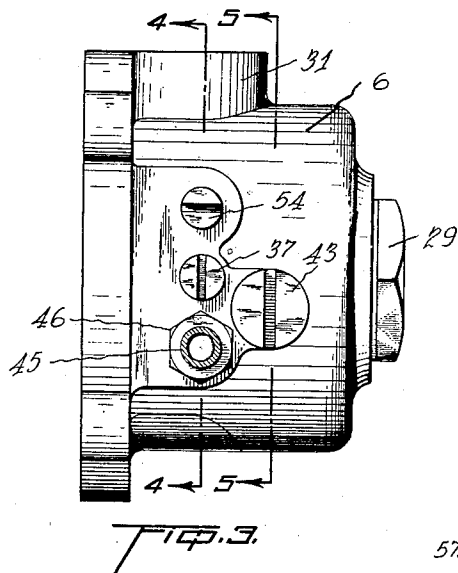
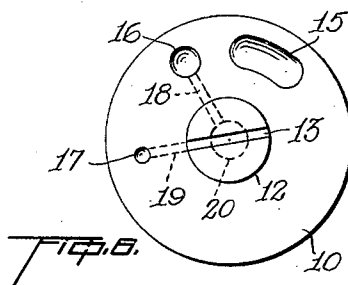
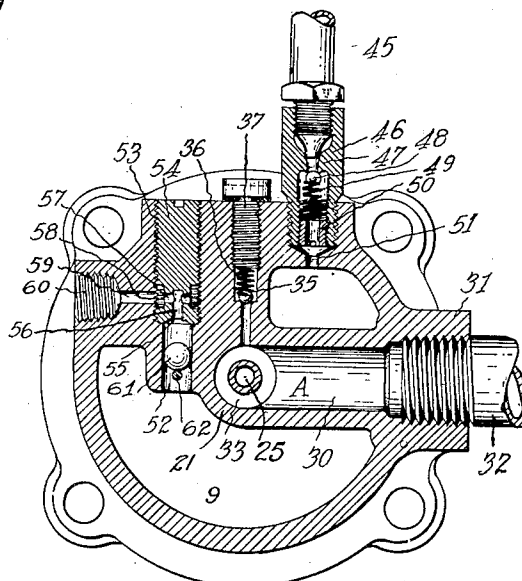
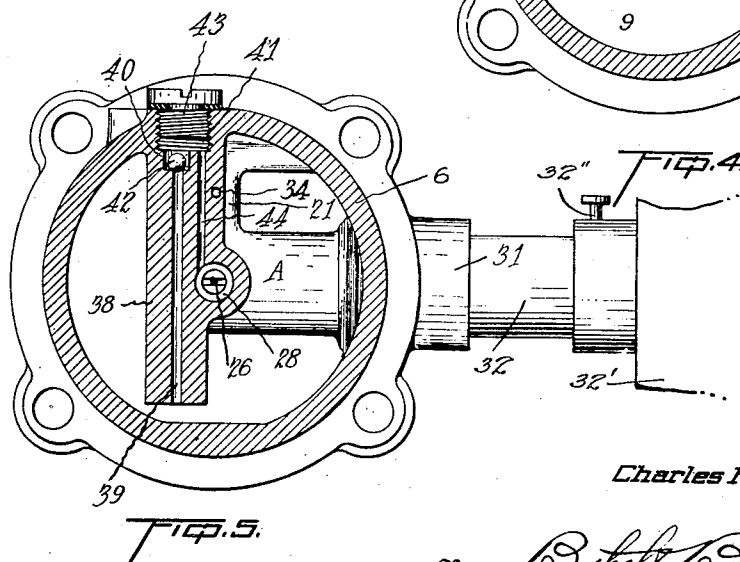
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AIR AND FUEL CHAMBER FOR ENGINE STARTERS

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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,046,074

AIR AND FUEL CHAMBER FOR ENGINE
STARTERS

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mesne assignments, to Eclipse Aviation Cor-
poration, East Orange, N. J., a corporation of
New Jersey

Application May 14, 1928, Serial No. 277,590

4 Claims. (Cl. 60—16)

The present invention pertains to a novel starter, particularly the air and fuel chambers thereof, for internal combustion engines.

Although air and fuel chambers are not novel per se, nor is it novel to provide a distributor to direct the air and fuel to the cylinders of an internal combustion engine, the present invention combines the two chambers in a single casting placed entirely at one side of the distributor. As a result of this construction, the distributor may be placed directly against the crank case, and the crank shaft in said case may be connected directly to the distributor valve disposed in the air chamber, rather than by an extended coupling which would complicate the construction.

Another important feature of the device of this application is that the fuel is delivered to the injection nozzle through a conduit which is also preferably formed as an integral part of the casting which provides the air and fuel chambers. This also is an improvement which requires that the distributor and the air chamber member be drilled in order to provide a passage from the fuel chamber to the nozzle. In like manner, and with similar resulting conveniences in construction, the means of communication between the air chamber and the fuel chamber for supplying air pressure in the latter is also formed in the casting rather than through the air chamber member and distributor. The invention further includes a check valve in the bend of the conduit adapted normally to seat and close the conduit so that no fuel will be delivered from the fuel chamber unless there is sufficient pressure therein to open the valve.

Other objects and advantages of the invention will appear as the description of the invention proceeds with reference to the accompanying drawings, in which—

Figure 1 is a side elevation of the device;
Fig. 2 is a longitudinal section thereof on the line 2—2 of Figure 1;

Fig. 3 is a plan view of the device;
Fig. 4 is a transverse section thereof on the line 4—4 of Figure 3;

Fig. 5 is a transverse section thereof on the lines 5—5 of Figures 2 and 3; and

Fig. 6 is an elevation of the distributor valve.

Reference to these views will now be made by use of like characters which are employed to designate corresponding parts throughout.

The device is adapted for application to an end of a crank case 1 which may be the crank case of a pump for supplying compressed air to

the device and which contains as usual a crank shaft 2 and is preferably made up of sections. Adjacent the crank case is positioned a distributor member or section 3 having a bushing 4 in which one end of the crank shaft is journaled as clearly shown in Figure 2. This distributor member is radially tapped for the reception of coupling members VI, V, IV, III, II, I intended to be coupled to conduits 5, preferably of equal capacity, communicating with cylinders in the firing order indicated by the reference numerals applied to said coupling members. Communicating with said coupling members are passages Ia—VIa in the member 3, which open at the face of said member which is more remote from the crank case 1. To this face is applied and connected a substantially cylindrical casting section or other body 6 which is for the most part hollow and which has a partition 7 defining an air chamber 8 and a fuel chamber 9. The air chamber is positioned directly against the distributor 3 and contains a rotary distributor valve 10 adapted to cooperate with the passages in the distributor for supplying air and fuel to the cylinders in proper order for starting purposes.

The valve engages a face of the distributor and is held in this position by a shoulder 11 formed in the casting at the wall of the chamber 8. A stud 12 extends from the distributor valve into the distributor, in line with the journaled end of the crank shaft 2 and adapted to turn in the distributor. This stud is coupled directly to the journaled end of the crank shaft by means of a slot 13 in the former which receives a tongue 14, projecting from the latter. The valve proper has a somewhat elongated transverse port 15 and superficial ports 16 and 17 communicating by means of ducts 18 and 19 respectively with a central valve inlet 20, in the manner substantially set forth in my Reissue Patents No. 16,695 and No. 16,696 of August 9, 1927, and as will be hereinafter described.

The casting 6 has an abutment 21 disposed principally in the upper part of the fuel chamber 9 and having its lower portion disposed in the axis of the casting. Access to this axial portion is obtained through a hole 22 in the rear wall of the casing, so that a threaded hole 23 may be formed in this axial portion for receiving the enlarged and threaded end 24 of a nozzle which extends into the valve inlet 20 as clearly shown in Figure 2. The enlarged threaded end 24 has a screw driver slot 26 by which the nozzle may be adjusted. A headed plug 27 closes the hole 23 but leaves a space 28 at the rear end of

the nozzle for a purpose which will presently appear. The hole 22 is ordinarily closed by a plug 29. It will be apparent that on removal of the plugs 29 and 27, access to the gas chamber and nozzle may be had for the purpose of cleaning and replacement of parts.

Extending from the abutment 21 is a radial conduit 30 terminating in a coupling 31 at the outer wall of the casting for the connection of an air pipe 32 thereto. This pipe is connected to a suitable source such as tank 32' which supplies air at the required pressure. A valve 32'' in the pipe 32 normally closes the tank to the pipe after starting of the engine. The conduit 30 is brought into communication with the air chamber 8 by a recess 33 formed at the inner end of the former and the base of the latter and containing a part of the nozzle 25 as shown in Figure 2.

Compressed air is delivered to the fuel chamber to exert pressure on the fuel, through a right angular passage 34 formed in the abutment 21 and extending from the recess 33 to the upper part of the fuel chamber 9. In the angle of this passage is disposed a check valve 35 normally closed by a spring 36 which is regulated and retained by a screw 37 entered from the outer wall of the casting.

For delivering fuel to the nozzle, another abutment 38 is formed integral with the casting in substantially the same transverse plane which passes through the space 28. This abutment is in the nature of an elongated member extending nearly to the bottom of the fuel chamber and having a longitudinal passage 39. At the upper end of this passage is formed an enlargement 40 from which extends a still larger threaded hole 41 to the outer wall of the casting. In the enlargement 40 is mounted a gravity or ball valve 42 adapted normally to seat upon and close the upper end of the passage 39. The hole 41 is obstructed but not filled, by a plug 43 threaded therein, and the unfilled portion is connected to the space 28 by a return passage 44 which forms a return bend passage in conjunction with the passage 39.

Fuel is delivered to the fuel chamber 9 through a pipe 45 connected to the chamber by a coupling member 46 as shown more clearly in Figure 4. The coupling has an intermediate restriction 47 constituting a valve seat against which a ball valve 48 is normally pressed by means of a spring 49 disposed therebeneath and bearing downwardly on a bushing 50 threaded into the coupling member. The fuel pressure is reduced by means of a restricted aperture 51 of about one-thirtysecond inch formed in the casting wall between the inner end of the coupling and the fuel chamber. The check valve opens under the pressure of fuel supplied through the pipe 45 but closes when compressed air is admitted to the fuel chamber.

The fuel chamber is also equipped with a fuel overflow formed in the abutment 21 as illustrated in Figure 4. This overflow comprises a vertical passage 52 drilled from the top of the casting and having its upper portion enlarged and threaded as at 53 so that it may be closed by a plug 54 which leaves only the smaller or lower part open. In the lower end of the plug is a valve seat 55 from which extends a comparatively short longitudinal bore 56. Radial ducts 57 extend from the bore to a peripheral channel 58 formed in the plug 54. A conduit 59 is formed to extend from this channel to the

wall of the casting where it is enlarged and threaded as at 60 for connection to a suitable overflow receptacle. In the lower part of the passage 52 is mounted a loose ball valve 61 held by a pin 62 and adapted to close against the seat 55 when there is sufficient pressure in the chamber 9.

In the operation of the device, the air pipe 32 is normally closed by suitable valve mechanism 32'' which is opened when it is desired to start the engine. When this valve is opened, which need be only until the engine is heard firing, air at high pressure fills the chamber 8 and the fuel chamber 9 over the fuel contained therein, after opening the check valve 35 in the passage 34. The air pressure in the fuel chamber also closes the fuel supply pipe 45 and the overflow line 52-59 by the check valves 48 and 61 respectively. Fuel under pressure is forced from the bottom of the tank through the passage 39, 44 into the space 28 and nozzle 25, while air under pressure is available at the port 15 and inlet 20 of the distributor valve 10. From the inlet 20, air is obviously delivered to the ports 16 and 17.

The valve 10 is geared to the crank shaft of the engine in such a manner that when the engine comes to rest the port 15 will be in communication with one or more cylinders which are in position for the power stroke, and the ports 16 and 17 in communication respectively with cylinders in position for the compression stroke and the suction stroke. With the air pipe 32 open, pure air under pressure will be delivered from the air chamber 8 through the port 15 to the cylinder on the power stroke, tending to turn the engine over. At the same time the cylinder on the suction stroke will receive air from the port 17 mixed with fuel drawn and injected into this port from the nozzle 25. A similar mixture is injected through the port 16 at the pipe VI leading to the cylinder under compression and is delivered from the pipe to the cylinder owing to the fact that the pressure of the mixture is entirely sufficient to overcome the compression pressure in the cylinder and thereby open the check valve c of the conduit 5 leading to the corresponding cylinder C in the manner illustrated in Figure 1. This mixture is fired immediately the spark occurs.

The previously mentioned valve controlling the supply of air to the chamber 8 may be closed as soon as the engine is heard firing. The compressed air acting on the surface of the fuel in the chamber 9 is then trapped by the closing of the check valve 35 and therefore continues to force a rich fuel mixture to the nozzle and distributor valve, which is absorbed into the cylinders by suction. The siphon 39, 44 supplying fuel to the nozzle will close when the pressure in the fuel chamber falls to a point insufficient to lift the check valve 40.

Although a specific embodiment of the invention has been illustrated and described, it will be understood that various alterations in the details of construction may be made without departing from the scope of the invention as indicated by the appended claims.

What I claim is:—

1. In an air and fuel supplying device for internal combustion engines, the combination of a casing having a transverse partition therein including a fuel passage, a cover plate for said casing, said cover plate having a plurality of ports equally spaced on a circle and a central drive aperture concentric with said circle, a distributing rotor disc arranged on the inner face of said cover

plate, having a drive connection extending through said aperture, and a distributing port having an eccentric end on one side of the disc adapted to align with said cover plate ports in sequence upon rotation and a concentric end on the other side of said disc adapted to receive fuel, a nozzle coaxially arranged with respect to said rotor to deliver fuel to said concentric end said nozzle having a bore therethrough connecting with said fuel passage in said partition, said passage having a check valve therein, and terminating at a point in the chamber behind the partition, means for applying a source of air pressure to the cover side of the partition, means for supplying fuel under pressure to the chamber behind the partition, means for limiting the fuel level in the chamber above the end of the fuel passage, and a passage through said partition to a point above said level in said chamber with a check valve therein for permitting flow of air under pressure from the cover side of the diaphragm to the chamber side.

2. In a starting device for internal combustion engines, a section having portions forming respectively, an air chamber and a fuel chamber, another section in physical contact with said first named section and having passages adapted for a connection to a series of cylinders, a port in said device connecting said air chamber with said fuel chamber, a distributor valve rotatable in said air chamber and having an outlet adapted to pass and register with said passages, said valve also having an inlet exposed to the air chamber for communication therewith, a nozzle having its inlet end closed to said air chamber and the other end opening into the valve inlet, and means of communication between the fuel chamber and the inlet of said nozzle.

3. In a starting device for internal combustion engines, a section having portions forming respectively, an air chamber and a fuel chamber, another section in physical contact with said first named section and having passages adapted for a connection to a series of cylinders, a port in said first named section connecting said air chamber with said fuel chamber, a distributor valve rotatable in said air chamber and having an outlet adapted to pass and register with said passages, said valve also having an inlet exposed to the air chamber for communication therewith, a nozzle having its inlet end closed to said air chamber and the other end opening into the valve inlet, and means of communication between the fuel chamber and the inlet of said nozzle.

4. In a starting device for internal combustion engines, a section having portions forming respectively, an air chamber and a fuel chamber, another section in physical contact with said first named section and having passages adapted for connection to a series of cylinders, a port in said device connecting the chambers at the upper part of the fuel chamber, a check valve in said port opening in the direction of said fuel chamber, a distributor valve rotatable in said air chamber and having an outlet adapted to pass and register with said passages, said valve having an inlet exposed to the air chamber for communication therewith, a nozzle having its inlet end closed to said air chamber and the other end opening into the valve inlet, means of communication between the fuel chamber and the inlet of said nozzle, and a check valve in said means opening in the direction of said nozzle.

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