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FUEL SUPPLY APPARATUS FOR INTERNAL COMBUSTION ENGINES

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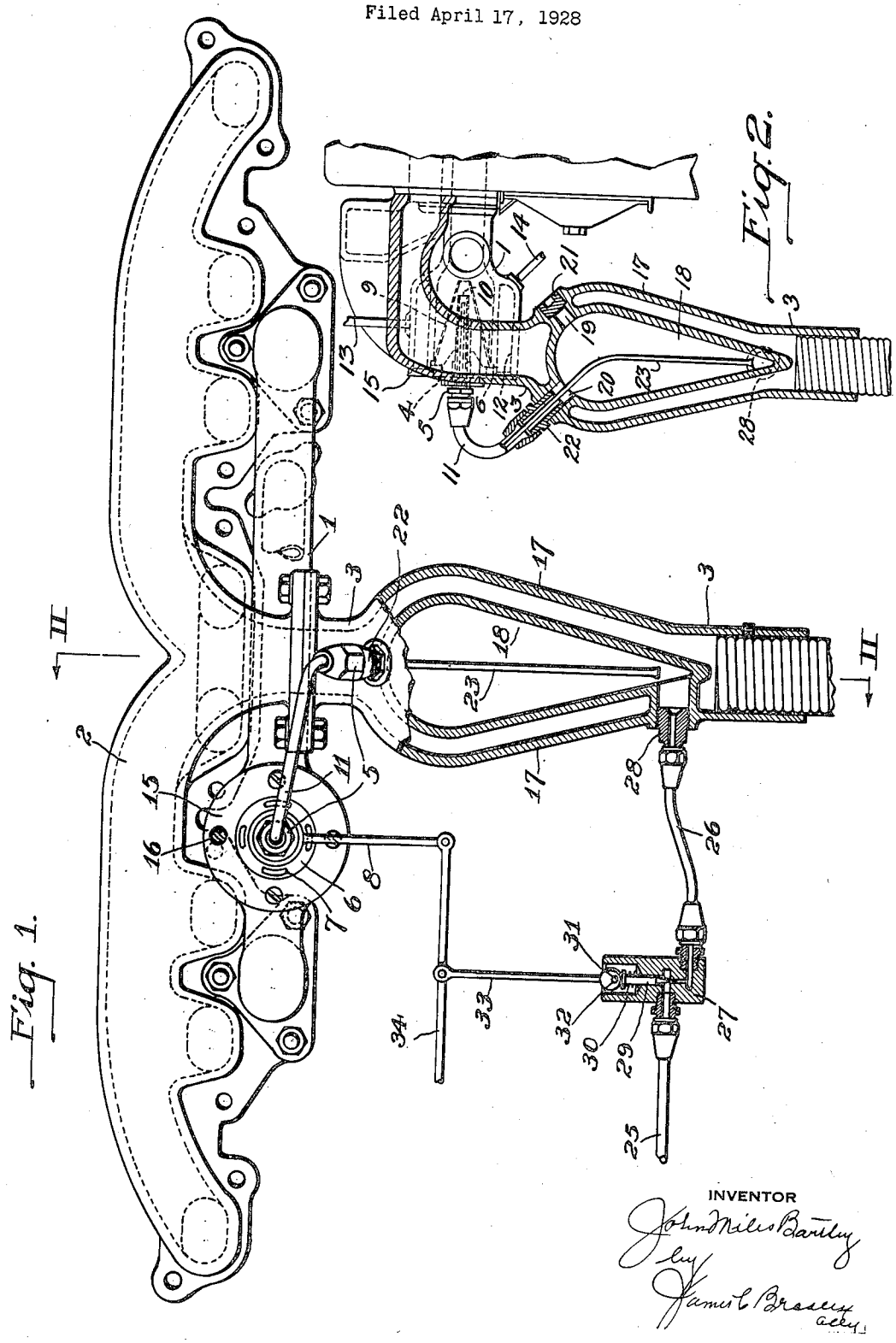

Fig. 1.

Fig. 2.

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FUEL-SUPPLY APPARATUS FOR INTERNAL-COMBUSTION ENGINES.

Application filed April 17, 1928. Serial No. 270,608.

The invention relates to fuel supply means for internal combustion engines, and has for its primary objects, (1) the improvement and simplification of the apparatus shown in my application, Serial No. 229,064; (2) the provision of an improved form of gas superheating or expansion chamber; (3) the provision of improved means in connection with the expansion chamber for starting the engine before the walls of the expansion chamber have been heated to the proper temperature for normal operation; (4) the provision of means of the character last specified which are automatic in character and require no separate manipulation in switching from the starting operation to the normal operation; (5) the provision of an improved air nozzle construction; and (6) the provision of a construction whereby the operation of the air inlet means provides a cooling device for the oil which is circulated by the oil pump of the engine. One embodiment of the invention is shown in the accompanying drawings, wherein:

Figure 1 is a partial end elevation and partial section. And Fig. 2 is a section on the line II—II of Fig. 1.

Referring to the drawings, 1 is the inlet conduit or manifold of an internal combustion engine, from which the usual passages lead to cylinders of the engine, and 2 is the exhaust manifold discharging through the vertical exhaust pipe 3. The inlet conduit 1 is provided at its end with the head or cover plate 4 carrying the coupling 5 and with inlet passages through which air is supplied, such passages being regulated by a valve plate 6 mounted for rotation and provided with openings 7 adapted to register with the passages through the head. The valve plate is provided with an arm 8 suitably connected to the throttle lever of the engine, so that the amount of air admitted may be regulated to any desired degree by swinging the arm. Extending forwardly from the head 4 is the conical air inlet nozzle 9, and lying concentrically of this nozzle is the gas nozzle 10, such nozzle extending through the coupling 5 and constituting a continuation of the gas supply pipe 11. An oil cooling chamber 12 is formed in the air inlet manifold surrounding the nozzle, such chamber lying in the line of the oil circulated by the oil pump of the engine and including the pipes 13 and 14. A suitable screen may be placed in this chamber, if desired, provision for cleaning being provided by the removable annular head 15, secured by the machine screws 16.

The exhaust pipe 3 is provided with an expanded part 17, in which is located the gas superheating chamber 18. This chamber has its lower portion of conical shape with its walls converging until they meet at the lower end of the chamber. The upper end of the chamber is dome-shaped with a pair of passages 19 and 20 leading therefrom, the passage 19 being closed by the screw plug 21. The other passage carries the coupling 22, to which the pipe 11 is connected. Extending longitudinally of the chamber is the pipe or starting tube 23, such pipe having its lower end slightly expanded and terminating adjacent the lower extremity of the chamber. This pipe is extended through the coupling and through the pipe 11, with its outlet end 24 (Fig. 2) terminating in the dry gas nozzle 10 just short of the end of such nozzle.

A hydrocarbon fuel is supplied to the lower end of the chamber 18 from the gasoline tank, via the pipes 25 and 26 and the valve casing 27, the pipe 26 being connected to the chamber 18 by the coupling 28. The valve casing 27 is provided with a needle valve 29, normally pressed upward by the spring 30. The valve is moved toward closed position by the cam 31 carried by the shaft 32, and this shaft is rotated by the arm 33. This arm 33 and the arm 8 are both connected to the throttle lever of the engine by the link 34, so that the valve 29 controlling the gas supply and the valve plate 6 controlling the air supply are both moved toward open position as the throttle lever is moved in one direction, and toward closed position as such lever is moved in the reverse direction, as in my pending application heretofore referred to.

The starting tube 23 comes into play when the engine is first started up, and before the chamber 18 is heated by the exhaust to a point at which the hydrocarbon vapor is superheated and transformed into a dry gas. At this period of starting, the hydrocarbon liquid flowing into the bottom of the chamber 18 through the pipe 26 is sucked up through the pipe 23 and delivered through the outlet end 24 of such pipe into the nozzle 9. The suction from the engine cylinders provides the necessary pull to accomplish

this result, and vaporize the liquid as it emerges into the end of the air nozzle, the velocity of the air at this point being relatively high due to the conical form of the nozzle. The engine operates in this manner until the chamber 18 becomes highly heated by the exhaust. When this occurs, the hydrocarbon liquid is vaporized, even before entering the chamber, and the gas as thus formed passes up around the tube 23 and through the expansion chamber to the outlet 20 and thence through the pipe 11 to the dry gas nozzle 10. I have found that after the chamber 18 is heated to a normal operating temperature so that the gas passing therethrough has a temperature of about 465 degrees F., the tube 23 practically ceases to function, substantially all of the gas which is formed in the chamber passing up through the chamber around the starting tube and very little passing through such tube. The switch from the starting condition to operating condition, is thus automatic and requires no manipulation of the apparatus, the device shifting from a saturated gas to a dry superheated gas as soon as the engine and exhaust pipe are thoroughly heated up. The advantages incident to the use of the superheating chamber, including economy in gas consumption, smoothness in operation, freedom from carbon deposit in the engine cylinders, and avoidance of any dilution of the crank case oil by the hydrocarbon fluid, are present in this apparatus as in that of my copending application above referred to.

The air nozzle 9, as shown and described in connection with the dry gas nozzle 10, insures a powerful drag upon the gas chamber and hydrocarbon line connected thereto, and also provides a thorough mixing of the hot dry gas and the relatively cool air flowing in through the nozzle 9. The outer end of the inlet manifold 1, in which the air nozzle 9 is located, is very effectively cooled by the incoming air, so that the oil passing through the cooling chamber 12 is materially reduced in temperature with the usual advantage incident to the use of cool oil as a lubricant, as compared with a heated oil. The present construction involves a substantial improvement and simplification over the apparatus of my copending application, heretofore referred to, and has certain other advantages over prior constructions which will be readily apparent to those skilled in the art.

What I claim is:

1. The combination with an internal combustion engine having an upright exhaust pipe, and a superheating chamber extending therealong, and arranged one inside the other, of an air inlet pipe leading from the atmosphere to the cylinders of the engine, a conduit leading from the upper end of said chamber into the air inlet pipe, a second conduit leading from a point adjacent the lower end of the chamber into said air inlet pipe, and means for supplying a hydrocarbon fluid to the lower end of said chamber.

2. The combination with an internal combustion engine having an upright exhaust pipe, and a superheating chamber extending therealong, and arranged one inside the other, of an air inlet pipe leading from the atmosphere to the cylinders of the engine, a conduit leading from the upper end of said chamber into the air inlet pipe, a second conduit leading from a point adjacent the lower end of the chamber into said air inlet pipe, and means for supplying a hydrocarbon fluid to the lower end of said chamber, said conduits being arranged in concentric relation throughout the length of the first conduit.

3. The combination with an internal combustion engine having an upright exhaust pipe, and a superheating chamber extending therealong, and arranged one inside the other, of an air inlet pipe leading from the atmosphere to the cylinders of the engine, a tapering air nozzle leading into the air pipe, a pipe leading from the upper end of said chamber into the nozzle adjacent the forward end of such nozzle, a second pipe leading from the lower portion of the chamber into the nozzle adjacent its forward end, and means for supplying a hydrocarbon fluid to the lower end of the chamber.

4. The combination with an internal combustion engine having an upright exhaust pipe, and a superheating chamber extending therealong, and arranged one inside the other, of an air inlet pipe leading from the atmosphere to the cylinders of the engine, a tapering air nozzle leading into the air pipe, a pipe leading from the upper end of said chamber into the nozzle adjacent the forward end of such nozzle, a second pipe leading from the lower portion of the chamber into the nozzle adjacent its forward end, and means for supplying a hydrocarbon fluid to the lower end of the chamber, said pipe being arranged in concentric relation throughout the length of the first pipe.

5. The combination with an internal combustion engine having an upright exhaust pipe having an enlargement therein, of a conical superheating chamber extending longitudinally in the enlargement with its walls spaced away from those of the enlargement and converging till they meet at the lower end of the chamber, an air inlet pipe leading from the atmosphere to the cylinders of the engine, a conduit leading from the upper end of the chamber into the inlet pipe, an upright pipe with its lower end opening into the chamber and located just above the lower end of such chamber, extending longitudinally thereof, and leading into said air inlet pipe, and means for supplying a hydrocarbon fluid to the lower end of the chamber.

6. The combination with an internal combustion engine having an upright exhaust pipe having an enlargement therein, of a conical superheating chamber extending longitudinally in the enlargement with its walls spaced away from those of the enlargement and converging till they meet at the lower end of the chamber, an air inlet pipe leading from the atmosphere to the clylinders of the engine, a conduit leading from the upper end of the chamber into the inlet pipe, an upright pipe with its lower end opening into the chamber and located just above the lower end of such chamber, extending longitudinally thereof and of said conduit, terminating at its upper end adjacent the end of the conduit, and means for supplying a hydrocarbon fluid to the lower end of the chamber.

7. The combination with an internal combustion engine having an upright exhaust pipe and a superheating chamber extending therealong and arranged one inside the other, of an air inlet pipe leading to the cylinders of the engine and opening to the atmosphere at its end, a nozzle projecting into said end longitudinally of the pipe, a connection from the upper end of the chamber to the nozzle, an oil cooling chamber surrounding said inlet end of the pipe, and means for supplying a hydrocarbon fluid to the lower end of the chamber.

8. The combination with an internal combustion engine having an upright exhaut pipe and a superheating chamber extending therealong and arranged one inside the other, of an air inlet pipe leading to the cylinders of the engine and opening to the atmosphere at its end, a pipe leading from the upper end of said chamber and having its outlet end extended into the end of the air inlet pipe, an oil cooling chamber in the line of the oil circulation of the engine, surrounding said end of the air inlet pipe, and means for supplying a hydrocarbon fluid to the lower end of the chamber.

In testimony whereof, I have hereunto subscribed my name this 11th day of April, 1928.

JOHN MILES BARTLEY.