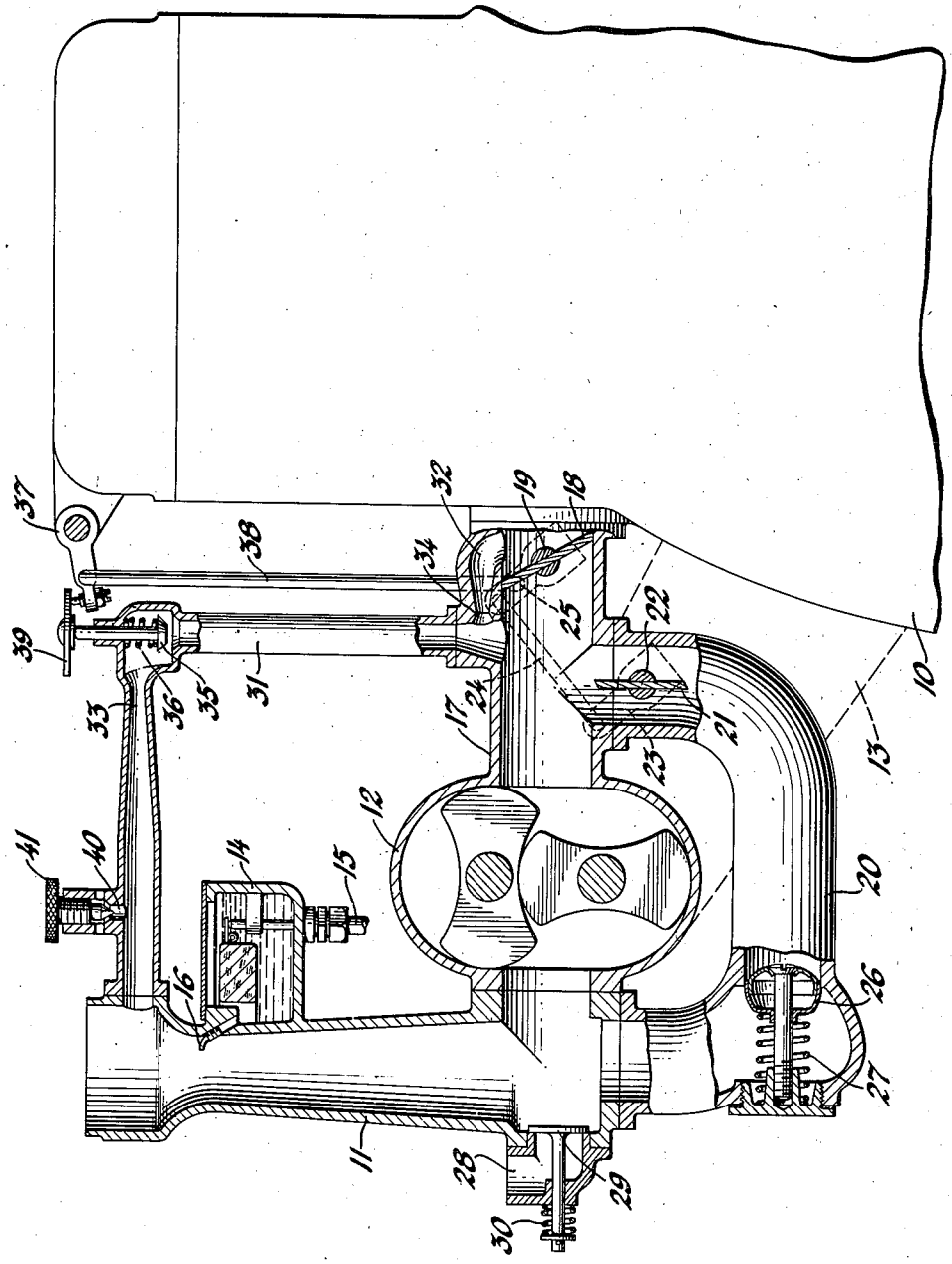
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CARBURETING APPARATUS

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CARBURETING APPARATUS

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8 Claims. (Cl. 123—119)

This invention relates to internal combustion engine carbureting apparatus.

The invention has to do principally with, although it is not applicable only to, carbureting apparatus which includes a pump which draws a current of air past a nozzle and reduces the pressure at the discharge end of the nozzle to such a value that liquid fuel is sprayed into the current of air and forms with it a combustible mixture which is forced into the cylinders of the engine by the pump.

The principal, but not the only, object of the invention is to provide in carbureting apparatus of the type described means which will enable the engine on which it is installed to idle properly at a predetermined low speed.

For a better understanding of the nature and objects of the invention, reference is made to the following specification in which there is described the preferred embodiment of the invention which is illustrated in the accompanying drawing.

The single figure of the accompanying drawing shows, mainly in section, carbureting apparatus in which my invention is embodied installed on a two-stroke cycle internal combustion engine.

The carbureting apparatus of the internal combustion engine 10 which is shown in the drawing includes a Venturi duct 11 whose outer end communicates with the atmosphere and whose inner end is connected to the intake side of a pump 12 of the type known as a Roots blower which may be driven from the crankshaft of the engine through a chain 13. The duct 11 supports a constant level reservoir 14 to which liquid fuel is supplied through a pipe 15 and from which fuel may be delivered into the duct 11 at the throat of the Venturi section through a nozzle 16.

To the discharge side of the pump 12, there is connected one end of a duct 17. The other end of the duct 17 may communicate directly with a single cylinder of the engine 10 or with a number of cylinders of the engine through a manifold. In the duct 17, there is located a butterfly type throttle valve 18 which is mounted on a shaft 19 to which there is connected an arm (not shown) through which the position of the valve may be changed to vary the effective area of the duct. To the duct 17 between the throttle valve 18 and the pump 12 and to the duct 11 near the pump, there are connected the opposite ends of a recirculating duct 20. In the recirculating duct, there is located a butterfly type valve 21 which is mounted on a shaft 22. The valve 21 is connected to the throttle valve 18, through an arm 23 which is fixed on the shaft 22, a link 24 and an arm 25 which is fixed on the shaft 19, so that it is closed as the throttle valve is opened and opened as the throttle valve is closed. In the recirculating duct 20, there is also located a poppet valve 26 which is urged toward its closed position by a spring 27 and is moved toward its open position when the valve 21 is open and the pressure in the duct 17 exceeds that in the duct 11 by a predetermined amount.

If carbureting apparatus constructed in accordance with the foregoing portion of this specification is designed so that it will supply the maximum demands of the engine 10 and furnish the engine with a combustible mixture which contains the desired proportions of fuel and air when it is operating at moderate speeds, it will be defective in two particulars, viz., (1) it will not idle the engine properly, i. e., smoothly at a uniform low speed, because when the throttle valve 18 is closed to a satisfactorily low idle speed position the rate of flow of air through the duct 11 falls to such a small value that insufficient fuel to carburet it adequately is discharged from the nozzle 16 and the inevitable variations in the pressure within the duct 17 between the pump 12 and the throttle valve 18 are directly reflected in the rate of introduction of carbureted air into the engine and (2) it will supply the engine with an undesirably rich combustible mixture when it is operating at very high speeds.

To eliminate the last mentioned defect, I provide in the duct 11 between the nozzle 16 and the pump 12 an orifice 28 and a poppet valve 29 which is urged to the position in which it closes the orifice by a spring 30. When the engine is operating at low or moderate speeds, the valve 29 is held in the position in which it closes the orifice 28 by the spring 30. But when the engine is operating at extremely high speeds, the suction within the duct 11 opens the valve 29 against the resistance of the spring 30 and sufficient air to reduce the richness of the combustible mixture supplied to the engine to the desired extent is, consequently, admitted into the duct 11 through the orifice 28.

To make the engine 10 idle properly, I provide a recirculating tube 31 which connects the portion of the duct 17 on the atmospheric side of the throttle valve 18 with the portion of the duct 11 on the atmospheric side of the nozzle 16 and, preferably in the wall of the duct 17, a tubular passage 32 which interconnects the portions of

the duct 17 on the atmospheric and engine sides of the throttle valve 18 and has in it flow limiting means, preferably in the form of a Venturi section 34.

The adjuncts last described enable the engine to idle properly. The passage 32 with the Venturi section 34 in it minimizes variations in the volume of the carbureted air which enters the engine and thus variations in the speed of the engine when the throttle valve 18 is closed. The recirculating tube 31 maintains the ratio of fuel to air in the mixture of fuel and air which enters the engine at the proper value when the throttle valve is closed.

To explain how the passage 32 with the Venturi section 34 in it effects the result ascribed to it, I point out that the throttle valve 18 is fitted so that when it is closed carbureted air can enter the engine only through the passage 32 and that the Venturi section 34 is so designed that its critical pressure is below that which exists in the duct 17 on the atmospheric side of the throttle valve when the throttle valve is closed and only sufficient combustible mixture to enable the engine to idle at the desired speed can enter it through it.

To explain how the recirculating tube 31 effects the result ascribed to it, I point out that when the throttle valve 18 is closed some of the combustible mixture in excess of that required by the engine is conducted by the recirculating tube from the duct 17 on the atmospheric side of the throttle valve 18 into the duct 11 on the atmospheric side of the fuel nozzle 6 whence, with some uncarbureted air from the atmosphere, it is returned by the pump 12 to the duct 17. The uncarbureted air drawn from the atmosphere into the duct 11 by the pump 12 is thus, without reduction of the rate of flow of air past the nozzle 16, reduced to a volume that the fuel discharged from the nozzle 16 is sufficient to carburet adequately.

As the throttle valve 18 is opened, the rate of discharge of fuel from the nozzle 16 increases more rapidly than the rate of flow of air through the duct 11 and less and less and finally no combustible mixture from the recirculating tube 31 is needed to maintain the ratio of fuel to air in the combustible mixture which enters the engine at the proper value. To prevent the combustible mixture which enters the engine becoming too rich by reason of this circumstance, there is preferably provided means to decrease the volume of combustible mixture fed into the duct 11 through the recirculating tube as the throttle valve is opened. The poppet valve 35 which is urged toward its closed position by a spring 36 serves this purpose. A finger 37 which is pivotally mounted on the engine 10 is connected to the arm 25 on the throttle valve shaft 19 by a link 38 so that it engages under a head 39 on the stem of the valve 35 and holds it open when the throttle valve is closed but moves downwardly and permits the spring 36 to move the valve toward its closed position as the throttle valve is opened and to its closed position by the time that the throttle valve is opened to the position in which no combustible mixture from the recirculating tube is needed to maintain the ratio of fuel to air in the combustible mixture which enters the engine at the proper value.

There is also preferably provided in the recirculating tube 31 flow limiting means, preferably in the form of a Venturi section 33, so designed that no more combustible mixture than the maximum required can be fed into the duct 11 through the recirculating tube at any time the valve 35 is open and a vent 40 through which combustible mixture may be discharged into the atmosphere from the recirculating tube if the introduction of all of it into the duct 11 produces a too rich combustible mixture. To regulate the vent 40 a screw 41 is provided.

It will, of course, be understood that although the carbureting apparatus herein disclosed was primarily designed for use on a two-stroke cycle engine, it may be employed on engines of other types.

This application is a substitute for my application, Serial No. 42,010, which was filed on September 25, 1935.

I claim:

1. Internal combustion engine carbureting apparatus which includes a duct for conducting air from the atmosphere to the engine, a blower for moving air through the duct from the atmosphere to the engine, means through which fuel may be introduced into the duct, a valve for regulating the passage of combustible mixture from the carbureting apparatus to the engine, a passage for conducting combustible mixture from the engine side to the atmospheric side of the blower and the specified means, and a valve for regulating the passage of combustible mixture from the engine side to the atmospheric side of the blower and the specified means connected to the first specified valve so that it is closed when the first specified valve is opened and opened when the first specified valve is closed.

2. Internal combustion engine carbureting apparatus which includes a duct for conducting air from the atmosphere to the engine, a blower for moving air through the duct from the atmosphere to the engine, means through which fuel may be introduced into the duct, a passage for conducting combustible mixture from the engine side to the atmospheric side of the blower and the specified means, and a vent in the passage through which combustible mixture may be discharged into the atmosphere from it.

3. Internal combustion engine carbureting apparatus which includes a duct for conducting air from the atmosphere to the engine, a blower for moving air through the duct from the atmosphere to the engine, means through which fuel may be introduced into the duct, a valve for regulating the passage of combustible mixture from the carbureting apparatus to the engine, a passage for conducting combustible mixture from the engine side to the atmospheric side of the blower and the specified means, a valve for regulating the passage of combustible mixture from the engine side to the atmospheric side of the blower and the specified means connected to the first specified valve so that it is closed when the first specified valve is opened and opened when the first specified valve is closed, and flow limiting means in the passage.

4. Internal combustion engine carbureting apparatus which includes a duct for conducting air from the atmosphere to the engine, a blower for moving air through the duct from the atmosphere to the engine, means through which fuel may be introduced into the duct, a valve for regulating the passage of combustible mixture from the carbureting apparatus to the engine, a passage for conducting combustible mixture from the engine side to the atmospheric side of the blower and the specified means, a valve for regulating the passage of combustible mixture from

the engine side to the atmospheric side of the blower and the specified means connected to the first specified valve so that it is closed when the first specified valve is opened and opened when the first specified valve is closed, a venturi in the passage for limiting the flow of combustible mixture through it, and a vent in the passage through which combustible mixture may be discharged into the atmosphere from it.

5. Internal combustion engine carbureting apparatus which includes a duct for conducting air from the atmosphere to the engine, a blower for moving air through the duct from the atmosphere to the engine, means through which fuel may be introduced into the duct on the atmospheric side of the blower, a valve on the engine side of the blower for regulating the passage of combustible mixture from the carbureting apparatus to the engine, a passage for conducting combustible mixture from the duct between the blower and the specified valve to the duct on the atmospheric side of the specified means, and a valve for regulating the passage of combustible mixture from the duct between the blower and the specified valve to the duct on the atmospheric side of the specified means connected to the first specified valve so that it is closed when the first specified valve is opened and opened when the first specified valve is closed.

6. Internal combustion engine carbureting apparatus which includes a duct for conducting air from the atmosphere to the engine, a blower for moving air through the duct from the atmosphere to the engine, means through which fuel may be introduced into the duct on the atmospheric side of the blower, a valve on the engine side of the blower for regulating the passage of combustible mixture from the carbureting apparatus to the engine, a passage for conducting combustible mixture from the duct between the blower and the specified valve to the duct on the atmospheric side of the specified means, a valve for regulating the passage of combustible mixture from the duct between the blower and the specified valve to the duct on the atmospheric side of the specified means connected to the first specified valve so that it is closed when the first specified valve is opened and opened when the first specified valve is closed, and flow limiting means in the passage.

7. Internal combustion engine carbureting apparatus which includes a duct for conducting air from the atmosphere to the engine, a blower for moving air through the duct from the atmosphere to the engine, means through which fuel may be introduced into the duct, a valve for regulating the passage of combustible mixture from the carbureting apparatus to the engine, a passage for conducting fluid from the atmospheric to the engine side of the specified valve when it is closed, a passage for conducting combustible mixture from the engine side to the atmospheric side of the blower and the specified means, and flow limiting means in the first specified passage.

8. Internal combustion engine carbureting apparatus which includes a duct for conducting air from the atmosphere to the engine, a blower for moving air through the duct from the atmosphere to the engine, means through which fuel may be introduced into the duct on the atmospheric side of the blower, a valve on the engine side of the blower for regulating the passage of combustible mixture from the carbureting apparatus to the engine, a passage for conducting combustible mixture from the atmospheric to the engine side of the specified valve when it is closed, a venturi in the passage for limiting the flow of combustible mixture through it, a passage for conducting combustible mixture from the duct between the blower and the specified valve to the duct on the atmospheric side of the specified means, a valve for regulating the passage of combustible mixture from the duct between the blower and the specified valve to the duct on the atmospheric side of the specified means connected to the first specified valve so that it is closed when the first specified valve is opened and opened when the first specified valve is closed, and a venturi in the passage for limiting the flow of combustible mixture through it.

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