W. E. VER PLANCK.

CARBURETER.

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1,176,627.

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Fig.1.

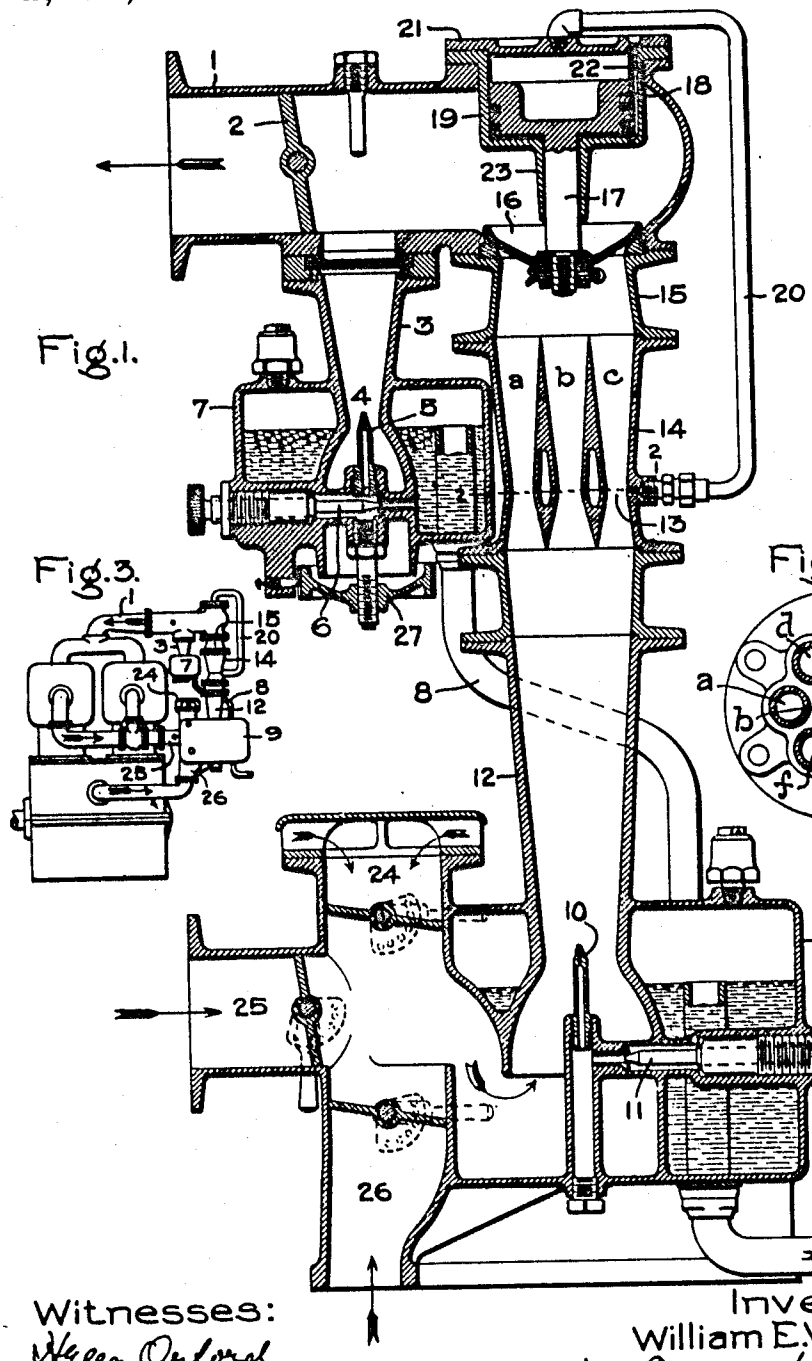
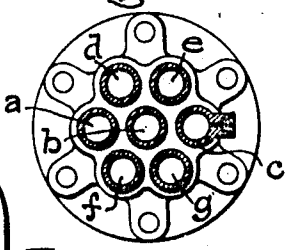


Fig.3.

Fig.2.



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CARBURETER.

1,176,627. Specification of Letters Patent. Patented Mar. 21, 1916.

Application filed February 29, 1912. Serial No. 680,682.

To all whom it may concern:

Be it known that I, WILLIAM E. VER PLANCK, a citizen of the United States, residing at Erie, in the county of Erie, State of Pennsylvania, have invented certain new and useful Improvements in Carbureters, of which the following is a specification.

This invention relates to carbureters for internal combustion engines, and more especially to carbureters of the twin type, such, for example, as those having a smaller carbureter for starting the engine and a larger carbureter which is automatically brought into service as the engine comes up to speed, but the invention is applicable to other types.

One object of my invention is to improve the automatic valve, which controls the main combustible charge, so as to render its opening positive and insure that it will be held open without throttling the flow of mixture through the port or passage which it controls.

Another object is to insure a better intermixture of the air with the gasolene vapor in the mixing tube and a more complete vaporization of the gasolene by providing a plurality of Venturi tubes through which the charge is drawn.

It has been found in practice that a decided advantage results from my improvements, both in economy of gasolene consumption and in the increased maximum output of the engine.

In the embodiment of the invention shown by way of illustration in the accompanying drawing, Figure 1 is a vertical section of the carbureter; Fig. 2 is a section on the line 2—2 of Fig. 1; and Fig. 3 is a side view of an engine and its carbureter.

The intake pipe 1, through which the charge is fed to the engine, is controlled by the throttle valve 2. Immediately in the rear of said valve is the inlet from the smaller carbureter 3 which has a Venturi throat 4 in which is located the nozzle 5 controlled by the needle valve 6. The surplus gasolene, supplied by any suitable means, overflows from the reservoir 7 through the pipe 8 to the lower reservoir 9 which feeds gasolene past the needle valve 11 to the nozzle 10. The nozzle 10 is located in the throat of the larger mixing tube 12, whose shape is that of a Venturi tube. Directly above the large end of the Venturi tube 12, the mixing tube is divided into preferably seven tubes, *a*, *b*, *c*, *d*, *e*, *f*, *g*, and each of these minor tubes has a Venturi throat 13.

The upper section 15 of the mixing tube 12 serves to reunite the separate streams of mixture coming from the minor tubes, *a*, *b*, *c*, *d*, *e*, *f*, *g*, and its upper end opens into the intake pipe 1. This opening or port is controlled by the automatic valve 16 and the conformation of the outer surface of this valve, taken in connection with that of its seat at the mouth of the mixing tube, forms a kind of annular Venturi tube or throat when said valve is slightly open or just "cracked." The stem 17 of this valve is connected with a piston 18 working in a cylinder 19 located above and in line with the mixing tube 12. This piston is of considerable weight so as to keep the valve 16 closed while the engine is starting up or running at low speed and until the suction in the intake pipe 1 reaches a predetermined value. Ordinarily said weight or an equivalent spring must be not only overcome by the suction of the engine but this load must be carried all the time, a condition which puts an objectionable throttling on the engine. I prevent this throttling by providing a pipe 20 leading from the constriction or throat 13 of the auxiliary mixing tube 14 where the flow of fluid causes a reduction in pressure to a region above said piston or other movable abutment. The pipe 20 could be connected to the throat of the main tube 12, if desired. The upper end of the cylinder 19 is closed by the cap 21 through which said pipe enters the cylinder. A duct 22 admits air at atmospheric pressure to the lower end of the cylinder, the vacuum in the intake pipe being kept out by the packing effect of a long tubular neck 23 depending from the lower head of the cylinder and fitting the valve stem 17 rather closely. Thus atmospheric pressure is maintained on the lower side of the piston while the upper side is subjected to a lower pressure. Air is admitted to the lower end of the mixing tube 12 through three inlets, 24, 25, 26, leading respectively from the atmosphere, a region heated by the engine exhaust, and the crank case. These inlets are controlled by adjustable valves so that the quantity and temperature of the air supply can be regulated as desired. The disk or cover 27 can be adjusted to regulate the atmospheric

air supply to the carbureter 3. This carbureter can also be supplied with heated air.

In operation, the smaller carbureter furnishes the mixture for the engine while it is starting or running at a low speed but as soon as it reaches a predetermined speed the suction is sufficient to lift the automatic valve 16 slightly and draw in the mixture through the larger tube 12 and the plurality of minor tubes in series therewith. The action of the Venturi tubes is to cause a very rapid movement of the air and vapor through their throats and a thorough vaporization and mixing as the fuel and air pass up through the series of tubes. This action is augmented by the Venturi shape of the annular opening under the valve 16 and results in an increased economy in gasolene consumption. When the automatic valve opens sufficiently, the flow of mixture causes a reduction in pressure at the constriction 13 by reason of the Venturi shape of the tube, thus enabling the atmospheric pressure on the under side of the piston 18 to lift the valve quickly to its wide open position, and moreover to hold it there so long as the mixture continues to flow past said constriction with a certain degree of rapidity. In a rapidly running multi-cylinder engine this flow is practically continuous. The engine is thus freed from the necessity of overcoming the load of a spring or a weight such as is ordinarily used to close the automatic valve and the carbureter is therefore relieved from all throttling except that due to the Venturi shape of the tubes. This throttling is, however, so slight as to be practically negligible. The engine is accordingly enabled to take in the maximum possible charge and its maximum output is correspondingly increased.

In accordance with the provisions of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof; but I desire to have it understood that the apparatus shown is only illustrative, and that the invention can be carried out by other means.

What I claim as new, and desire to secure by Letters Patent of the United States, is:—

1. In a carbureter, a mixing tube comprising a plurality of open Venturi tubular passages or throats arranged in series relation as regards the flow of fluid, whereby said fluid flows successively through them and has its velocity alternately increased and retarded, and nozzle means for delivering fuel to one of said passages or throats.

2. The combination in a carbureter having a Venturi throat, of a nozzle for supplying fuel to said throat, and a plurality of Venturi tubes arranged in parallel with each other and in series with said throat.

3. In a carbureter, the combination of a mixing tube having a plurality of Venturi throats arranged in series as to the flow of fluid therethrough, and means that divides one of said throats into a plurality of Venturi tubes.

4. The combination with the mixing tube of a carbureter having a Venturi throat, of a nozzle arranged in and delivering fuel to the throat, means delivering air to said throat, and a second Venturi tube or throat arranged in series relation to the first through which the mixture flows on its way to the mixing tube.

5. The combination with the mixing tube of a carbureter having a Venturi throat, of a nozzle arranged in and delivering fuel to the throat, means delivering air to said throat, and means in said tube dividing a portion thereof which is beyond said Venturi throat into a plurality of Venturi shaped passages arranged in parallel to each other.

6. A mixing tube for a carbureter having a Venturi throat at its inlet end and a plurality of Venturi throats arranged beyond said throat, one of the second throats having its axis coincident with the axis of the tube and the other being grouped around the central throat between it and the outer wall of the tube.

7. The combination with the intake pipe of an internal combustion engine, of a carbureter having its mixing tube connected thereto, said mixing tube having a Venturi shape, a valve controlling the flow of fluid from the mixing tube to the intake pipe, said valve being biased toward closed position and tending to open under the suction action of the engine, and means for causing the reduction of pressure at the throat of said tube to effect an opening movement of said valve.

8. The combination with the intake pipe of an internal combustion engine, of a carbureter having its mixing tube connected thereto, said mixing tube having a Venturi shape, a valve controlling the flow of fluid from the mixing tube to the intake pipe, said valve being biased toward closed position and tending to open under the suction action of the engine, a movable abutment connected with the valve, and a pipe connecting the throat of the tube with the region above the abutment, whereby the reduction in pressure at said throat is communicated to the abutment to effect an opening movement of the valve.

9. The combination with the intake pipe of an internal combustion engine, of a carbureter having its mixing tube connected thereto, said mixing tube having a Venturi shape, a valve controlling the flow of fluid from the mixing tube to the intake pipe, said valve being biased toward closed posi-

tion and tending to open under the suction action of the engine, a heavy piston connected with said valve, and a pipe leading from the throat of said tube to the region above said piston.

10. The combination with a conduit supplying a charge of combustible fluid, of a valve controlling the flow through the conduit, the valve and its coöperating seat forming an annular Venturi passage between them when the valve is raised from the seat, said passage having a region of minimum area intermediate its ends and increasing in area from said region toward each end of the passage.

11. The combination with a conduit supplying a charge of combustible fluid to an engine, of a device in the conduit on which the flowing fluid acts to cause a change of pressure in said device, a valve for controlling the flow through said conduit, said valve being biased to closed position and tending to open under the suction action of the engine, a movable abutment connected with the valve, and conduit means for conveying pressure from said device to the abutment.

12. The combination with a conduit supplying a charge of combustible fluid to an engine, of a valve in the conduit that tends to open under the suction action of the engine, and means responsive to the flow of fluid through the conduit that moves the valve to full open position and holds it there independently of the opening action of said suction as soon as the suction opens the valve and starts said flow.

13. The combination with the mixing tube of a carbureter having a Venturi throat, of a valve controlling the flow through said tube, and arranged beyond the throat, a movable abutment connected with the valve and exposed on one side to atmospheric pressure which tends to open said valve, and a conduit connecting said throat with the region on the other side of the abutment to reduce the pressure thereon so that said atmospheric pressure will effect an opening movement of the valve.

14. The combination with the intake pipe of an internal combustion engine, of a carbureter having its mixing tube connected thereto, said mixing tube comprising a plurality of Venturi sections through which the mixture flows in series in passing to the intake pipe.

15. The combination with the intake pipe of an internal combustion engine, of a carbureter having its mixing tube connected thereto, said mixing tube comprising a portion forming a Venturi section, and a second portion forming a plurality of Venturi sections in parallel with each other and in series with the first Venturi section.

16. The combination with the intake pipe of an internal combustion engine, of a carbureter having its mixing tube connected thereto, said mixing tube comprising a plurality of Venturi sections arranged in series as to the flow therethrough, a valve controlling the passage of mixture from the mixing tube to the intake pipe, and means operated by the reduction of pressure at the throat of one of said Venturi sections to effect an opening movement of said valve.

17. The combination with the intake pipe of an internal combustion engine, of a plurality of carbureters having their mixing tubes connected directly thereto, the mixing tube of one of said carbureters comprising a Venturi section, a valve controlling the passage of mixture from the mixing tube having the Venturi section to the intake pipe, and means operated by the reduction of pressure at the throat of said Venturi section to effect an opening movement of said valve.

18. The combination with the intake pipe of an internal combustion engine, of a plurality of carbureters having their mixing tubes connected thereto, the mixing tube of one of said carbureters comprising a plurality of Venturi throats arranged in series as regards the flow therethrough, a valve controlling the flow of mixture from the mixing tube having the Venturi throats to the intake pipe, and means operated by the reduction of pressure at one of said throats to effect an opening movement of said valve.

19. The combination with the intake pipe of an internal combustion engine, of a small carbureter and a large carbureter having their mixing tubes connected thereto, the mixing tube of the large carbureter having a Venturi section, a valve controlling the flow of mixture from the mixing tube of the large carbureter to the intake pipe, said valve being biased to closed position and tending to open under the suction of the engine, and means operated by the reduction of pressure which occurs at the throat of the Venturi section when the suction becomes sufficient to slightly open said valve and cause a flow through said Venturi section, which acts to move said valve to full open position and hold it there.

20. The combination with the intake pipe of an internal combustion engine, of a carbureter having its mixing tube connected thereto, said mixing tube comprising a Venturi section, and a valve controlling the flow of mixture from the mixing tube to the intake pipe, said valve and its seat being so shaped that when the valve is off the seat an annular Venturi passage is formed between them.

21. The combination with the intake pipe of an internal combustion engine, of a small carbureter and a large carbureter having their mixing tubes connected thereto, the mixing tube of the large carbureter compris-

ing a plurality of Venturi sections arranged in series, and a valve controlling the flow of mixture from the mixing tube of the large carbureter to the intake pipe, said valve and its seat being so shaped that when the valve is off the seat an annular Venturi passage is formed between them.

In witness whereof, I have hereunto set my hand this twenty-third day of February, 1912.

WILLIAM EVERETT VER PLANCK.

Witnesses:
J. W. SHERWIN,
DORMAN WEAVER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."