W. W. WEEKS.

CARBURETER.

APPLICATION FILED JULY 3, 1919.

1,386,036.

Patented Aug. 2, 1921.

2 SHEETS—SHEET 1.

FIG. 1.

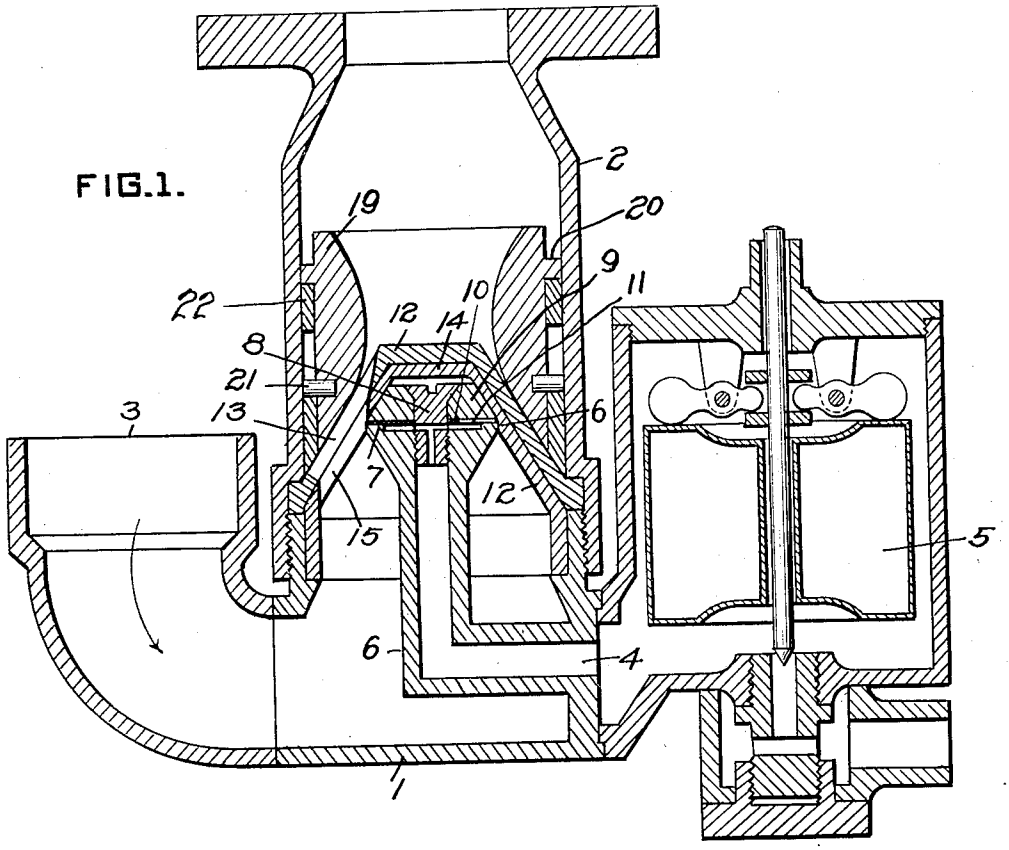
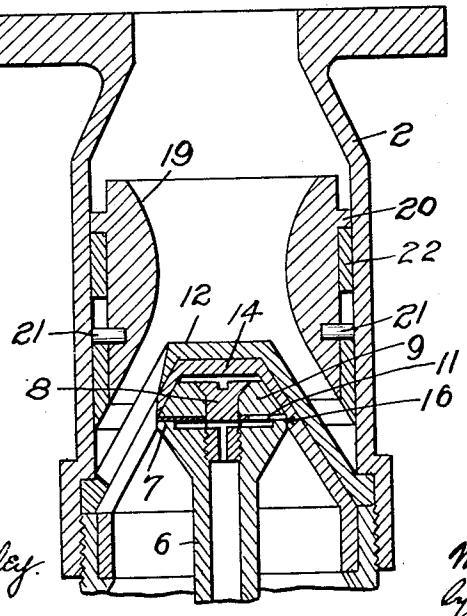


FIG. 2.



WITNESSES

J. Herbert Bradley.

Francis J. Donnasson

INVENTOR

William W. Weeks.

by Christy & Christy,

his attorneys.

W. W. WEEKS.

CARBURETER.

APPLICATION FILED JULY 3, 1919.

1,386,036.

Patented Aug. 2, 1921.

2 SHEETS—SHEET 2.

FIG. 3.

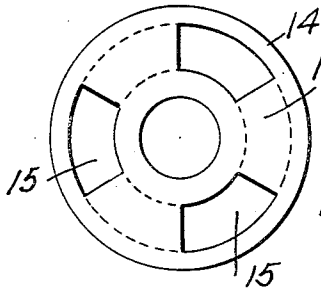


FIG. 4.

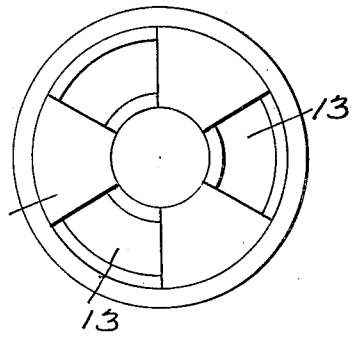


FIG. 5.

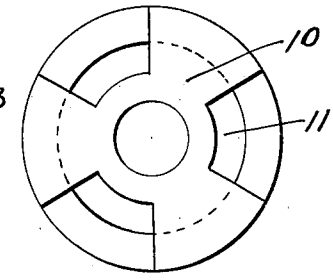
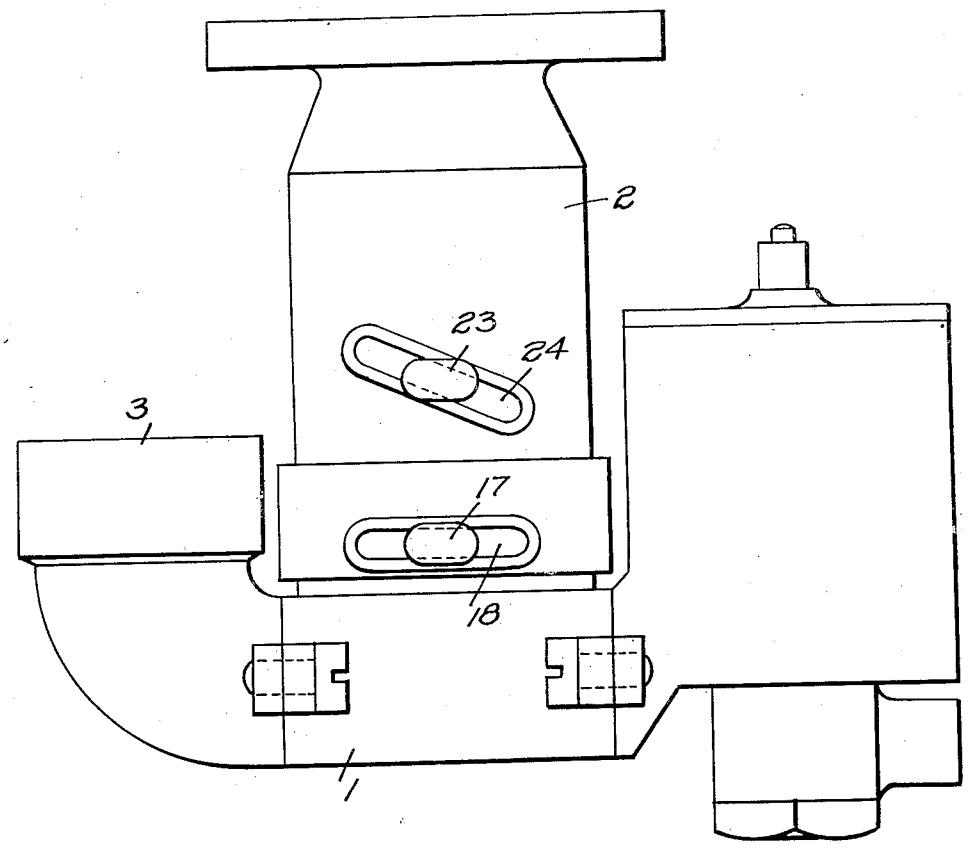


FIG. 6.



WITNESSES

J. Herbert Bradley.

Francis J. Donovan

INVENTOR

William W. Weeks,
by Christy & Christy,
his attorneys.

UNITED STATES PATENT OFFICE.

WILLIAM W. WEEKS, OF BROOKLYN, NEW YORK, ASSIGNOR OF ONE-HALF TO HAROLD W. SHONNARD, OF UPPER MONTCLAIR, NEW JERSEY.

CARBURETER.

1,386,036. Specification of Letters Patent. Patented Aug. 2, 1921.

Application filed July 3, 1919. Serial No. 308,422.

To all whom it may concern:

Be it known that I, WILLIAM W. WEEKS, residing at Brooklyn, in the county of Kings and State of New York, a citizen of the United States, have invented or discovered certain new and useful Improvements in Carbureters, of which improvements the following is a specification.

My invention relates to carbureters for internal-combustion engines, and to a type characterized by this: that fuel and air are, by the suction of the piston, drawn in substantially direct flow and in the proportions required for the ultimate combustion, from the sources of supply through the carbureter to the engine cylinder.

Internal-combustion engines are widely used on boats, on automobiles, and on aircraft, as well as in stationary installations, and they have to meet, and to operate efficiently under, widely varying conditions. There is the matter of the density of the atmosphere, which varies widely through the range of practicable elevation above sea level; there is the matter of hygrometric condition of the air, through rain and sunshine; and the matter of temperature, with diurnal and seasonal fluctuation; there are conditions of wind and tide and heavy roads. All these are beyond the control of the driver of the engine; and, in addition to them, there are the matters of heavy loads and light, and of high speed and low, to all of which the engine must be adaptable.

My invention is directed to two matters, chiefly: efficient atomization of the fuel by the air and thorough mingling of air and fuel, and an air intake so controlled that it will readily adapt itself to the immediate conditions of service and may be manually adjusted to meet general changes in atmospheric conditions.

In the accompanying drawings Figure 1 is a view in vertical and medial section of a carbureter somewhat diagrammatically arranged, which embodies my invention; Fig. 2 is a view on the same plane of a portion only of the same apparatus, showing certain of the component elements in other positions, to which, as conditions require, they may be shifted. Figs. 3 and 4 are plan views of a certain valve and of a grid, in coöperation with which the valve functions. These parts are here shown detached, although certain immediately associated parts are indicated. Fig. 5 is a plan view, and to larger scale than the other figures, of a certain shim which enters into the construction. For the sake of clearness, the underlying associated parts are indicated in this drawing also. Fig. 6 is a view in side elevation of the entire carbureter.

The casing of the carbureter is conveniently made up of two parts, 1 and 2, essentially cylindrical in shape, united by screw-threaded engagement, and standing, when in service, in the vertical position shown. Into the lower part 1 of the casing lead an air inlet 3 and a fuel inlet 4, and from the upper part 2 of the casing communication is immediate, as the shape of the casting indicates, with the manifold, through which the explosive mixture passes to the engine cylinder.

I direct particular attention, first, to the construction and arrangement of the nozzle through which fuel passes to the carbureter. The fuel in liquid form (hydrocarbon oil, for example, of the particular composition and gravity termed gasolene) passes from a suitable source of supply (such as the tank shown, in which with the aid of a supply valve controlled by the float 5 a constant level is maintained) through the lead 4 to the tube 6. Tube 6 is axially arranged and rises vertically in the cylindrical space made continuous in the union of casing parts 1 and 2. The diameter of the tube, uniform throughout the greater part of its length, is, at the upper end, greatly increased, forming a shallow circular enlargement of the bore, walled about by the rim 7. Upon this rim 7 (which is the upper edge of tube 6) rests a shim 10, and upon shim 10 rests a cap 9, the whole being secured and tightly clamped by a screw 8, entering the screw-threaded bore of tube 6. In the body of screw 8 are drilled two passageways, the one extending axially upward through the seated screw, and the other extending transversely and completing communication through the seated screw from the bore of tube 6 below to the shallow enlargement of the bore above. The shim 10, essentially circular, is cut away in sector-shaped cuts, as clearly shown in Fig. 5.

With the fuel nozzle so constructed and arranged, it will be observed that the liquid fuel, rising under sufficient head in tube 6,

enters a constricted passageway, and emerges from the head of the nozzle radially, through narrow slots which extend in a broken circumference in a plane transverse to the length of the cylindrical casing. This nozzle stands centrally in a vertically disposed cylindrical passageway through which (subject to the control presently to be described) a stream of air flows upward. It will be observed that this rising stream sweeps across the slots of the fuel nozzle, in a direction at an angle to their extent, and that the fuel flows from the nozzle in a direction approximately transverse to the flow of the stream of air. The sweep of the stream across the orifice of the fuel nozzle, the fuel supply being properly maintained, effects the atomization of the fuel, and the atomized fuel is carried forward, it will be observed, in the center of a vertically flowing stream. As the stream flows on the desired mixing is effected.

I come now to describe, next, the control of the flowing streams of air and of fuel. Across the cylindrical chamber, conveniently secured between the parts 1 and 2 of the casing, is a partition, which conveniently takes the form of an upwardly tapering, essentially conical, grid 12. It is a grid, in that it is provided with a plurality of sector shaped openings 13 with intervening sector shaped webs 12, a construction which will be clearly understood on comparing Figs. 1 and 4. This grid subdivides the stream of air, just as the shim 10 subdivides the stream of fuel.

When the parts are assembled, the sector shaped cuts in shim 10 and the sector shaped openings in grid 12 stand in vertical alinement.

Between the fuel nozzle and the grid is arranged a rotary valve 14, controlling at once the ports of the fuel nozzle and the openings of the grid. Its upper-surface conforms to the lower surface of the conical grid 12; its lower surface is provided with a cylindrical area 16 which overlies the edge of the shim 10 and the ports of the fuel nozzle; and it is provided with sector shaped ports 15, arranged and proportioned to correspond with the cuts 11 in shim 10 and with the openings 13 in grid 12. Conveniently, this valve member is provided with a flange or apron which extends over the inner face of the cylindrical casing for a substantial distance on the intake side of grid 12, overlying a slot 18 in the casting (*cf.* Fig. 6). Through that slot a stud or pin 17 extends from valve 14, and this stud is accessible from the outside to rotate the valve to the particular position desired.

The port arrangement is conveniently that shown in Figs. 5, 4, and 3. The sector shaped cuts and openings may be of any desired number; the drawing shows three, and that number is satisfactory. The intervals between adjacent cuts and spaces are in circumferential extent as great as the cuts and spaces themselves; and, as shown, each sector shaped cut and space extends through an interval of 60°, and each interval between cuts and spaces measures 60°. Accordingly, when the valve 14 is so placed that its webs 16 overlie the cuts 11 of shim 10 and spaces 13 of grid 12 completely, both fuel and air are completely cut off; when the valve is so shifted that its ports 15 are in fuel register with cuts 11 and spaces 13, the freest possible flow both of fuel and of air may take place; while, in all intermediate positions, the partial openings of fuel ports and air ports are proportionate in degree. In all degrees of opening the stream of air, subdivided, for purposes of control, in passing the partition, into sector shaped divisions, sweeps the orifice of the axially arranged fuel nozzle, and so sweeping this orifice effects the desired atomization. The atomized fuel is as has been said carried on in the middle of the vertically rising stream, and as the stream flows on the desired mixing is effected.

This feature is present in my improved carbureter, and is found in the member 19, here formed as an air valve (relatively movable, as will presently be described) within the passageway beyond the fuel nozzle. Its characteristics will be sufficiently understood on inspection of the drawings; the bore of this air valve gradually diminishes, in proper longitudinal curvature, from that of the unobstructed passageway to the desired minimum, and then gradually enlarges again.

First of all, it is to be remarked that the air passageways through the grid 12 (the effective areas of which may be varied or predetermined by the position of valve 14), exceed in their maximum extent the extreme needs of service. The chamber in which the valve 19 (which as clearly appears in the drawings is a Venturi tube) is arranged in a vertically arranged cylindrical casing, and accordingly said Venturi tube will, when free to do so, rest of its own weight in its lowest permissible position. The tapering and longitudinally curving surface of the Venturi tube and the tapering surface of the grid coöperate as the drawings show, and to this end: when said Venturi tube responds completely to gravity it rests on or near the surface of the grid, and in this position it chokes or obstructs in greatest degree (it never completely covers) the effective area of the air passageways through the grid; and, as it rises from this lowermost position, the effective area of the air passageways proportionately increases. And it should be carefully noted in this connection that, while the air passageways

are so variable in effective area, the Venturi tube has no effect upon the fuel passageways 11, to effect any variation in them whatever. (Thus the valve function of the Venturi tube is distinguished from that of the valve 14.)

The Venturi tube rises from its lowermost position when the difference in pressure at its upper and lower ends (due to the suction of the engine) exceeds a certain critical amount, of which its weight is the measure, and the degree of rise will be proportionate to the intensity of the suction effect.

In still further degree I adapt this "floating" Venturi tube to the widely varying conditions of service, by making adjustable its range of movement, and bringing the adjustment in this respect under the control of the operator. Referring again particularly to Figs. 1 and 2, it will be observed that the Venturi tube 19 slides within a bushing 22, its movement relative thereto being limited by pins 21 which protrude from the Venturi tube into slots in the bushing, while the bushing itself is movable longitudinally within the casing. This movement of the bushing 22 within the casing is under adjustment and control: an oblique slot 24 is formed through the casing wall itself (*cf.* Fig. 6) and through this slot extends a pin 23 from bushing 22. As pin 23 is moved longitudinally in slot 24, bushing 22 is moved longitudinally of the casing, and the range within which the Venturi tube 19 is movable automatically as described, is adjusted relatively to grid 12.

Both these adjustments (of valve 14 by means of pin 17, and of range of Venturi tube movement by means of pin 23) are made subject to the instant control of the operator. When for instance the installation of the engine is in an automobile, levers are provided, under the hand of the driver when in his seat, by means of one of which he can shift valve 14, and by means of the other he can shift sleeve 22. If fuel supply be insufficient to develop power required, he will shift valve 14; if air supply be insufficient, owing to moisture in the atmosphere, he will shift sleeve 22, while the automatic movement already described of the floating Venturi tube will make correction of the supply of air relative to the supply of fuel at any given position of the valve 14.

When starting the engine, if the power required be relatively small, the fuel valve (14) is set at relatively small opening, and the Venturi tube at or near the high limit of its range. If on the other hand the power required be relatively great, the fuel valve will be set with relatively large opening and the Venturi tube at or near the low limit of its range. Under either condition, the fuel valve having been appropriately adjusted, the automatic functioning of the Venturi tube, in response to motor suction, will proportion the ratio of mixture (air to fuel) as may be required to meet changes in speed, due to such as up or down grade travel, without alteration in the position of the fuel valve. But, if increased power is required to meet changes in conditions, the fuel valve will be readjusted accordingly.

In the structure shown in the drawings a fuel valve 14 Fig. 2, solely in control of the fuel and jointly with Venturi tube 19 in control of the air, is located between said Venturi tube and the fuel jet. When this Venturi tube is moved toward the closed position the fuel and air are likewise cut off in direct proportion, but the area of the ports in said valve are of such dimensions as to admit excess air in proportion to fuel in any position. Therefore, owing to unabated suction created within the carbureter (due to the momentum of the vehicle running under the previous fuel adjustment) the Venturi tube will momentarily retain its position of suspension, admitting excess air relatively to the reduced amount of fuel now flowing and creating a weakened or dilute mixture. The effect of this will be a reduction in speed and correspondingly of motor suction, and the Venturi tube will fall, until a ratio of mixture of maximum energy for the amount and quality of fuel flowing is again established; and, inasmuch as the Venturi tube will so respond to every change in motor suction, said valve will in descending progressively diminish the excess air passing through the valve 14, and will find its final position at a point to afford the most effective combustion.

To meet changes in atmospheric conditions the range within which the Venturi tube may float is raised or lowered by means of the lever 23 in slot 24, Fig. 6, as required.

A further feature of the action of the Venturi tube is to be noted. This occurs when rapid increase of speed is desired, involving of course a corresponding increase in power. The valve 14 is suddenly opened; then, because of the inertia of the vehicle, the motor suction is insufficient to immediately further elevate the Venturi tube. The first effect is the production of a mixture rich in fuel, a consequent abnormal rise in power and a rapid advance in speed; increased speed at once expresses itself in increased motor suction, and this in turn raises the Venturi tube. The ultimate effect then is the reëstablishment of a normal mixture, but with increase in volume.

I claim as my invention—

1. In a carbureter for an internal-combustion engine, the combination of an air passageway, a grid with a sector-shaped opening set athwart said passageway, a fuel nozzle centrally arranged within said passage-

way and provided with an aperture extending in an arc of a circle transversely of the passageway, and a rotary valve controlling at once the opening in said grid and the aperture in said nozzle, the arrangement being such that the stream of air as it flows through the valve orifice sweeps the aperture of the fuel nozzle, substantially as described.

2. In a carbureter for an internal-combustion engine, the combination of an air passageway adapted at its end to be brought into connection with an engine, a grip arranged athwart said passageway, a fuel nozzle arranged within said passageway and provided with apertures extending transversely of the grid openings and adjacent the grid openings, whereby the stream of air in passing through said openings sweeps the fuel apertures, and a floating Venturi tube arranged within said passageway and above said grid and forming part of the passageway, the said Venturi tube constituting a valve for the apertures in said grid, substantially as described.

3. In a carbureter for an internal-combustion engine, the combination of an air passageway adapted to be brought into communication with an engine, a conical upwardly tapering grid arranged athwart said passageway, a fuel nozzle with apertures extending transversely of said passageway arranged centrally within said passageway and adapted to be swept by the stream of air as it passes said grid, a rotary valve controlling at once the openings in said grid and the apertures in said nozzle, and a floating Venturi tube arranged above and movable above said grid and coöperating with said grid and constituting a movable closure above the openings of said grid of diminishing effect as a closure, from the outer ends of said openings inwardly, the movement of the Venturi tube effecting change in the ratio of volumetric delivery of air and of fuel, substantially as described.

4. In a carbureter for an internal-combustion engine, the combination of a passageway adapted at its end to be brought into communication with an engine, a conical tapering grid arranged athwart said passageway, a fuel nozzle centrally arranged within said passageway and adapted to be swept by the air stream in its passage through the grid, a floating and longitudinally movable Venturi tube arranged within said passageway above said grid and constituting with respect to the openings in said grid a valve of diminishing effect from the periphery of the grid inwardly, means for limiting the range through which said Venturi tube may move longitudinally, and means for adjusting the limiting means last mentioned, substantially as described.

In testimony whereof I have hereunto set my hand.

WM. W. WEEKS.

Witnesses:
CHARLES F. STRATMANN,
CHARLES LAEMMLE, Jr.