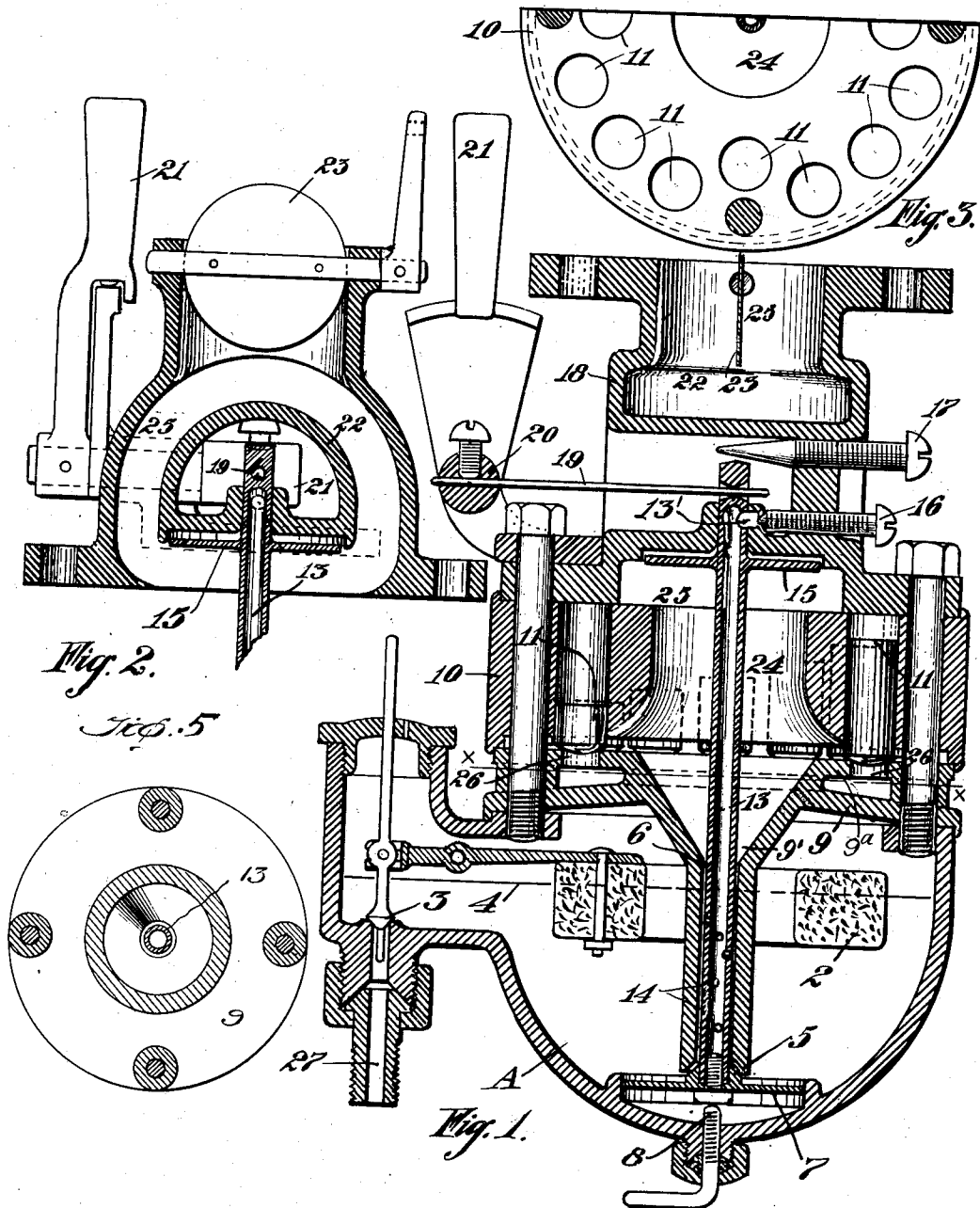


J. F. TWIGG.  
SPEED REGULATING CARBURETER.  
APPLICATION FILED NOV. 8, 1909.

1,047,595.

Patented Dec. 17, 1912.



WITNESSES

*A. S. Berry, Fig. 1.*  
*A. S. Maynard*

INVENTOR  
JOHN F. TWIGG.  
BY *G. H. Strong*  
ATTORNEY

# UNITED STATES PATENT OFFICE.

JOHN F. TWIGG, OF SAN FRANCISCO, CALIFORNIA.

## SPEED-REGULATING CARBURETER.

1,047,595.

Specification of Letters Patent.

Patented Dec. 17, 1912.

Application filed November 8, 1909. Serial No. 526,784.

*To all whom it may concern:*

Be it known that I, JOHN F. TWIGG, a citizen of the United States, residing in the city and county of San Francisco and State of California, have invented new and useful Improvements in Speed-Regulating Carbureters, of which the following is a specification.

My invention relates to carbureters, and particularly to a carbureter effective to automatically regulate the speed of internal combustion engines.

This invention has for its object the provision of a means for governing the speed of gas engines without the aid of any instrumentalities other than the peculiar construction of the carbureter whereby the richness of the explosive gas delivered to the engine is the factor by which the speed of the engine is controlled.

Inasmuch as the speed of any engine is varied by the load on the engine and is in proportion to the operative force in the engine it follows that if, in gas engines, the richness of the gas explosive mixture is varied during the running of the engine and the load is constant the speed will vary; increasing with a rich gas and decreasing with a poor gas. To that end I have provided a carbureter involving elements coöperative to vary the richness of the explosive gas delivered to the engine by reducing the proportion of vapor and increasing the volume of air when the speed increased; and, vice-versa, increasing the vapor volume and reducing the fresh air when the engine slows. Therefore the present invention provides a device having the dual functions of governing the speed of the engine and to atomize the liquid fuel to form a combustible vapor.

The invention consists of the parts and construction, and combination of parts hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is a vertical, central, transverse section through the device. Fig. 2 is a section of the bonnet of the mixing cylinder taken at right angles to Fig. 1 and showing the throttle valve in elevation. Fig. 3 is a fragmentary plan of the mixing cylinder showing the air valves. Fig. 4 is a diagram showing the comparative lengths of the air

valves, graduated to the curve of atmospheric pressure. Fig. 5 is a cross sectional view on the line X—X of Fig. 1.

In the present embodiment of my invention I employ a suitably shaped body or reservoir A within which is a float 2 having suitable connections with a valve 3 disposed over an inlet passage for gasoline which is delivered to the reservoir from a connection 27.

The fluid is normally maintained at a level indicated at 4 and may rise in a hollow stem 6 projecting down well toward the bottom of the body A and formed upon an upwardly and outwardly flared cover 9 flanged to snugly seat, and be bolted on the body. The cover 9 is also formed with an upper face or flange 9<sup>a</sup> beneath which air may freely circulate and may pass into ports 26 to be hereinafter described, the flange 9<sup>a</sup> being connected to the main cover 9 by a number of bosses through which the bolts may pass.

Superposed upon the cover, 9, is an intermediate case, 10, having a central chamber 24 and being countersunk on its lower end to provide a hollow shallow annular channel or recess above the several circular ports 26 arranged in the flange, 9<sup>a</sup>. There is also provided, in the casing 10, a plurality of plungers or valves 11 of different lengths, slidable in a series of cylindrical passages in the casing, located substantially over the air ports 26 in the cover flange 9<sup>a</sup> and adapted to seat thereon by force of gravity. The top of the casing 10 is covered by a bonnet 90 or throttle head 18 having a semi-circular flue or vapor passage 25 the lower portion communicating with the chamber 24, and in the upper portion of the bonnet is mounted the usual throttle valve 23.

Near the bottom of the body A and effective to close the tubular stem 6 to cut off the rise of liquid therein is a conical valve 5 which may be provided with a relatively flat, large flange 7 having a working fit in a pocket formed in the bottom of the body A. The position of the valve 5 relative to its seat on the stem 6 may be nicely adjusted by a suitable device as the screw 8. When the valve 5 is in open position gasoline flows up into the stem 6. I have shown the valve 5 as being secured to a tube 13 extending up through the stem 6 and of such a

diameter to have a free movement therein. The lower portion of the tube is perforated at 14 and its upper end projects through and is guided in a flat transverse portion of the wall 22 of the bonnet 18, in which guiding portion there is a small air port 13' open to the atmosphere and closable by a screw-plug 16, the air tube 13 being perforated adjacent the port 13' so that fresh air can flow down the tube.

The bonnet, 18, is formed with an arcuate hollow dome forming an inclosed gas passageway, 25, and above the flat wall, 22, of the dome is an open passageway permitting air to flow into the small port, 13', controlled by the valve, 16. The flat portion of the bonnet just above the chamber 24 is slightly recessed or pocketed to receive a disk or diaphragm 15 which is secured to or formed with the tube 13 which is normally under the downward thrust of a suitable resilient member or spring 19.

The degree of pressure of the spring 19 is determined by adjusting the rocker shaft 20 to which it is secured, the adjustment of this shaft being accomplished by means of a suitable handle 21 secured on its outer end. When the lever 21 is moved toward the bonnet the spring 19 exerts greater pressure on the tube 13; when moved back or away, it releases the tube. The upward movement of the valve-carrying air tube may be predetermined by a conically pointed screw 17, in the bonnet 18, against which the upper end of the tube will abut.

When the engine to which the device is applied is running the operation of the speed governing carbureter is as follows: The suction of the engine creates a vacuum in the passage 25 and in the chamber 24 which draws fresh air through the port 13', down the tube 13 and escapes therefrom through the ports 14 mixing with the fluid in the tubular stem 6. From the mixing stem the vapor flows upward into mixing chamber 24 where it is mixed with a suitable proportion of air which has been drawn in through the ports 26 beneath the puppet valves 11. The puppet valves 11 are lifted by atmospheric pressure of air circulating freely below flange 9a, whenever a partial vacuum is obtained in the carbureter chambers.

When the resilient spring rod 19 has been set to depress the valve tube 13 at a certain pressure according to the speed of the engine, if the engine tends to race or increase its speed due to variation of load the velocity of out-flowing gas from chamber 24 will tend, by impact against the disk 15, to lift the air tube 13 and its associated valve 5 and thereby effect reduction in the flow of fluid into the downwardly projecting stem 6 thus reducing the volume of vapor mixed by the escape of air through the air ports 14. Manifestly, then, if the richness of the

vapor is reduced the explosive force in the engine will be less and its speed checked and governed. Simultaneously with the tendency of the valve 5 to close due to gas impact against its tube head or disk 15 a volume of fresh air is forced into the mixing chamber 24 by atmospheric pressure lifting the exposed ends of plunger valves 11, and allowing air to pass ports 26 and the shallow, annular chamber formed in the bottom of the valve case 10.

If the engine is designed to run at high speed the spring 19 will be set to press down its valve tube 13 to resist a certain impact of gas against the disk 15, and if the engine is to be run slow the tension of the spring is lessened, and when so set for a given speed the least increase will act on the sensitive valve 5 to cut down the gasoline and deplete the explosive force of the vapor.

It will be seen then, that I have provided a device having two separate and distinct functions; first, to generate an explosive vapor, and second, to govern the speed of the engine by automatically varying its explosive efficiency, yet the two functions are intimately associated. The principle consists in utilizing the force created by the velocity of the air or explosive mixture going through the inlet pipe or carbureter, to govern the amount of liquid fuel passing to the mixing chamber, allowing at all times the full volume of air to enter engine cylinder through carbureter.

The valves 11 (normally sixteen in number) are round, and of brass or other metal, and from the shortest to the longest are graduated in length and weight on a curved or convex line.

To explain more clearly what is meant by the weights of valves being on a concave curve of atmosphere pressure, for example—if the engine is started or running slow, at a given area in inlet, there will be a light vacuum in carbureter, and as the speed of the engine is increased the vacuum increases, but not with the square of speed. It multiplies at a greater rate, as the speed of the engine increases. For instance, say that if engine is running 200 revolutions per minute, there is one-half inch of vacuum in carbureter, if increased to 250 R. P. M. it would be, say  $\frac{3}{4}$  inch of vacuum; if 300 R. P. M. it would be  $1\frac{1}{4}$  inches, if speed is increased to 350 R. P. M., the vacuum would be  $1\frac{3}{4}$  inches, and so on, multiplying at an upward ratio as the speed of the engine increases. The valves are regulated in graduated weights, so as to lift only as the demand of speed and vacuum requires, as shown by diagram, Fig. 4, allowing a small amount of air at slow speed, and more as speed runs up.

The valves 11 are made to a neat working fit in valve chamber 10, with slight opening to the suction so as to maintain a partial

vacuum behind the same while the engine is running, and to prevent as much as possible a dancing or vibrating movement to the valve.

5 It will be seen that at slow speed the vacuum will be light, hence only the smaller or lightest air valves will open, and as the speed of engine increases, the vacuum will increase, raising the larger or heavier air valves. Simultaneously as the vacuum in-  
10 creases, more air will be drawn through the air tube 13, and down to and through lower ports 14, thus carrying through the stem 6 to the mixing chamber 24 a proportionally  
15 larger amount of the fuel.

In the practical operation of internal combustion engines, on account of the irregular motion of piston on each stroke (the piston reaching its highest velocity at about  
20 the middle of the stroke, and gradually slowing toward and stopping at end of each stroke), there is a like motion of the fluid in the inlet or carbureter, hence the fluid force is greater at one part of stroke than the  
25 other. This irregular motion will cause a dancing or vibrating motion to the interrupting disk 15, and cause an uncertain flow through the valve 5. For this reason the valve 5 is connected to or made part of the  
30 disk or piston of the dash-pot 7, and fitted so as to give a dash-pot effect, and giving to the valve 5 a gradual opening and closing movement, thus preventing vibration. The liquid above and below the piston in dash-  
35 pot gives the desired resistance.

In some instances it is not desired when governing the engine to have the governor close off fuel altogether; but when the engine is running with the minimum load, to  
40 reduce the richness of the explosive mixture so that it will barely ignite, assuring at each cycle an impulse weak or strong according to load on engine. For this purpose, the governor stop 17 is placed above  
45 the stem of disk 15, and by screwing the tapered end in or out, will regulate the stopping point of the governor valve 5.

The arcuate wall 22 protects the back of the disk 15 from back firing or explosions in the inlet pipe, and also against the rebounding of vapor or air in the inlet pipe.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

55 1. The combination in a carbureter, of a float chamber, a float adapted to rise and fall therein, a fuel inlet valve controlled by said float, a cover for the float chamber having a horizontal, annular perforated flange  
60 forming an annular open channel, a central stem of the cover extending through the float toward the bottom of the float chamber, an air inlet tube movable in and extending through said stem and forming a narrow  
65 annular channel, said tube having openings

communicating with the narrow channel, a cylinder having a mixing chamber above and in communication with the annular passage of the stem, and means in said cylinder for admitting fresh air through the perforated flange into the mixing chamber. 70

2. The combination in a carbureter, of a float chamber, a float therein, a fuel valve controlled thereby, a cover for the float chamber having an annular channel open to the atmosphere, a central stem on the cover  
75 extending below the surface of the liquid in the float chamber, an air tube extending downwardly within said stem and forming therewith a narrow annular passage, said  
80 tube having openings to admit air into the channel, a superposed cylinder into which the vapor is delivered, and valves exposed to the atmosphere and freely slidable in re-  
85 spective chambers formed in said cylinder, said valves being of different lengths and weights and capable of being actuated successively by the increased vacuum in the mixing chamber caused by suction from an engine. 90

3. The combination in a carbureter, of a float chamber, a float, an inlet valve connected with and controlled by the float, a cap or cover for the float chamber having a central extension below the surface of the liquid  
95 in the float chamber, an air tube extending downwardly within said extension and forming therewith a narrow annular channel, said tube having openings to admit air to mix with the liquid, and having a diaphragm  
100 at its upper end subject to actuation by the moving vapor, a superposed chamber into which the mixture is delivered, a rising and falling governor valve connected to and automatically actuated by the air tube seat-  
105 ing upon the lower end of the extension, and means for regulating the movement of said valve.

4. The combination in a carbureter, of a float chamber, a float therein, an inlet valve  
110 connected with and controlled by the float, a cap or cover for the float chamber having a central extension below the surface of the liquid in the float chamber, an air tube extending downwardly within said extension  
115 and forming therewith a narrow channel, said tube having openings to admit air to mix with the liquid, a superposed chamber into which the mixture is delivered, a valve, means on said tube adapted to actuate the  
120 same and close the valve, said valve seating upon the lower end of the extension, means for regulating the movement of said valve, and a dash-pot and piston connected with the valve to steady its movement. 125

5. The combination in a carbureter, of a float chamber, a float, a liquid inlet valve controlled by the movements of the float, a cap or cover for the chamber having a central downwardly extending tube terminating  
130

below the fluid level in the float chamber, an air inlet passage located concentrically within the tube and forming therewith an annular channel, a valve controlled inlet to the upper end of said tube, openings made through the sides of the tube below the level of the liquid in the float chamber, a valve and regulating means carried by the lower end of said tube controlling the admission of liquid into the annular channel, a mixing chamber and vapor passage surrounding the upper part of the tube, and a disk or diaphragm connected to said tube against which the passing vapor acts to control the opening of the last-named valve and govern the amount of fuel passing to the mixing chamber.

6. The combination in a carbureter, of a float chamber, a float, a tubular extension downwardly from the top of the float chamber terminating below the fluid level, a centrally located air admission tube forming with the extension an annular channel, said tube having openings communicating with said channel, a valve at the lower end admitting liquid into the channel, a superposed mixing chamber and vapor outlet, and a disk or diaphragm connected to said tube against which the moving vapor acts to control the opening of the last named valve.

7. The combination in a carbureter, of a float chamber, a float, a tubular extension downwardly from the top of the float chamber terminating below the fluid level, a centrally located air admission tube forming with the extension an annular channel, said tube having openings communicating with said channel, a valve at the lower end admitting liquid into the channel, a superposed mixing chamber and vapor outlet, a disk or diaphragm connected to said tube against which the moving vapor acts to control the opening of the last named valve, and a tapering screw movable transversely above the top of the tubular valve stem to regulate the amount of opening of the valve.

8. The combination in a carbureter, of a float chamber, a float, a tubular extension downwardly from the top of the float chamber terminating below the fluid level, a centrally located air admission tube forming with the extension an annular channel, said tube having openings communicating with said channel, a valve at the lower end admitting liquid into the channel, a superposed mixing chamber and vapor outlet, a disk or diaphragm connected to said tube against which the moving vapor acts to control the opening of the last named valve, a tapering screw movable transversely above the top of the tubular valve stem to regulate the amount of opening of the valve, and a spring acting to normally retain the valve in its open position.

9. The combination in a carbureter, of a

float chamber, a float, a tubular extension downwardly from the top of the float chamber terminating below the fluid level, a centrally located air admission tube forming with the extension an annular channel, said tube having openings communicating with said channel, a valve at the lower end of said tube for admitting liquid into the channel, a superposed mixing chamber and vapor outlet, supplemental vertically disposed air passages opening into the mixing chamber, and cylindrical valves slidable in said passages, said valves being graduated in length and weight corresponding to the degrees of atmospheric pressure caused by the vacuum created in the carbureter at various speeds of the engine.

10. The combination in a carbureter through which an engine draws its motive fluid, of a liquid-containing chamber, a cover therefor, a tubular member extending from the cover downwardly into the containing chamber below the liquid therein, an air admission tube passing through said tubular member and of a smaller diameter than the latter to provide a channel, a mixing chamber with which said channel connects, said air tube having open connections with the channel below the liquid level in said chamber, and valves controlling the admission of air and liquid to said channel, one of the valves being adapted to control the volume of air admitted to said tubular member.

11. The combination in a carbureter through which an engine draws its motive fluid, of a containing chamber, a cover therefor, a tubular member extending downwardly from the cover into the containing chamber below the level of the liquid therein, the lower end of said tubular extension being provided with a seat beneath the surface of the liquid, a movable perforated air-admission tube extending through the tubular member and separated from the latter to form an intervening channel within which air and liquid meet, a valve on the lower end of said air tube closable upon said seat, and a disk or diaphragm fixed to the upper part of said air tube and subjected to the impact of the passing vapor and automatically controlling the opening of the said valve.

12. The combination in a carbureter, through which an engine draws its motive fluid, of a liquid containing float chamber and a superposed mixing chamber, a cover below the mixing chamber having a tubular extension projecting downwardly into the float chamber below the level therein, and having a valve seat beneath the liquid, a vertically movable perforated air-admission tube, concentric and forming with the extension an annular channel, within which the air and liquid meet, said tube carrying a liquid controlling valve, a disk or diaphragm fixed to the tube and subjected to

the impact of the passing vapor, to thereby control the opening of the valve, a submerged dash-pot in the float chamber, and a plunger therefor movable in unison with the valve and tube.

13. The combination in a carbureter, through which an engine draws its motive fluid, of a liquid-containing float chamber and a superposed mixing chamber, a cover below the mixing chamber having a tubular extension projecting downwardly into the float chamber below the level therein, and having a valve seat beneath the liquid, a vertically movable perforated air-admission tube, concentric and forming with the extension an annular channel, within which the air and liquid meet, said tube carrying a liquid controlling valve, a dash-pot plunger at the lower end of the tube, and a disk or diaphragm at the top of the tube subjected to the impact of the passing vapor, said parts co-acting to regulate the admission of liquid, and prevent fluctuating movements of the valve.

14. The combination in a carbureter through which an engine draws its motive fluid, of a reservoir for liquid fuel, a mixing chamber above the reservoir, a mixing stem extending through the mixing chamber, and into the reservoir below the level of the liquid contents thereof, a tubular member inclosing the stem having its upper end connecting with the mixing chamber, said tubular member having its lower end extending below the level of the liquid contents of the reservoir, a valve on the lower portion of said stem controlling the admission of fluid to the tubular member, a disk or diaphragm on the upper end of the stem and subject to the impact of the passing vapor, means for admitting air to the stem, said stem having perforations connecting with the interior of said tubular member, and means for steadying the movement of the first named valve.

15. The combination in a carbureter, through which an engine draws its motive fluid, of a reservoir for liquid fuel, a mixing chamber above the reservoir, a mixing stem extending through the mixing chamber, and into the reservoir below the level of the liquid contents thereof, a tubular member inclosing the stem having its upper end connecting with the mixing chamber, said tubular member having its lower end ex-

tending below the level of the liquid contents of the reservoir, a valve on the lower portion of said stem controlling the admission of fluid to the tubular member, a disk or diaphragm on the upper end of the stem and subject to the impact of the passing vapor, means for admitting air to the stem, said stem having perforations connecting with the interior of said tubular member, means for steadying the movement of the first named valve, and a spring opposing the force of the vapor on the disk at the upper end of said stem.

16. The combination in a carbureter through which an engine draws its motive fluid, of a liquid containing chamber or conduit, a liquid controlling valve, a disk or a diaphragm connected to the liquid controlling valve, a tubular perforated mixing stem on which the disk is mounted, said disk being subject to the impact of the passing vapor to enter the opening of its connected valve, a mixing chamber, a tubular member inclosing the stem and connecting with said mixing chamber, means admitting air to said stem, and means connected with said valve to steady its movement, and a spring opposing the force of the vapor on said disk or diaphragm, and a device to steady the movements of the valve.

17. The combination in an apparatus for supplying a combustible mixture to an internal combustion engine, of a device to control the engine supply, said device including a liquid controlling valve, yielding means to normally open the valve, and means connected with the valve and subject to the impact of the passing vapor to close the valve.

18. The combination in an apparatus for supplying a combustible mixture to an internal combustion engine, of a device to control the engine supply, said device including a liquid controlling valve, yielding means to normally open the valve, means connected with the valve and subject to the impact of the passing vapor to close the valve, and a device to steady the movements of the valve.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOHN F. TWIGG.

Witnesses:

CHARLES A. PENTFIELD,  
FREDERICH E. MAYNARD.