July 28, 1925. 1,547,296

F. H. BULLARD

CARBURETOR

Filed Jan. 7, 1922 3 Sheets-Sheet 1

Fig. 1.

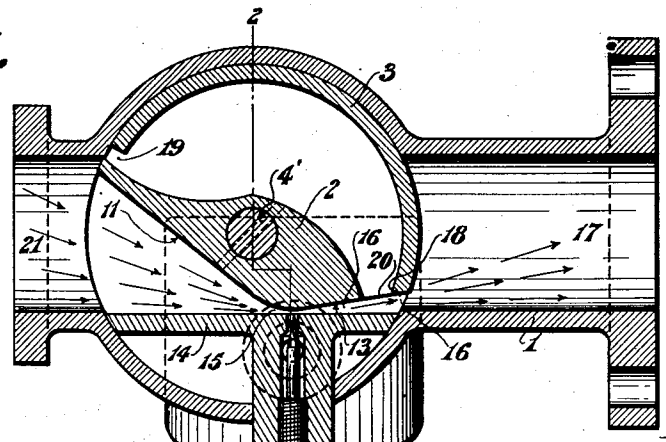


Fig. 3.

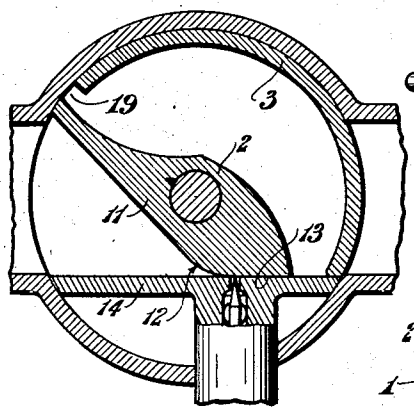
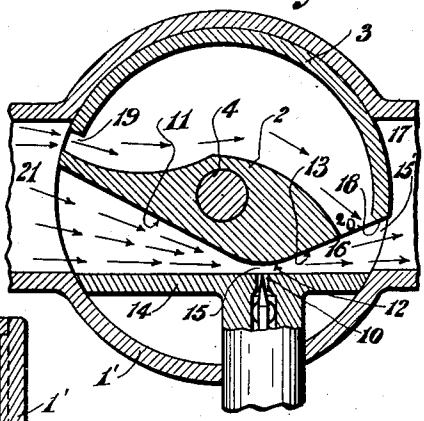


Fig. 4.



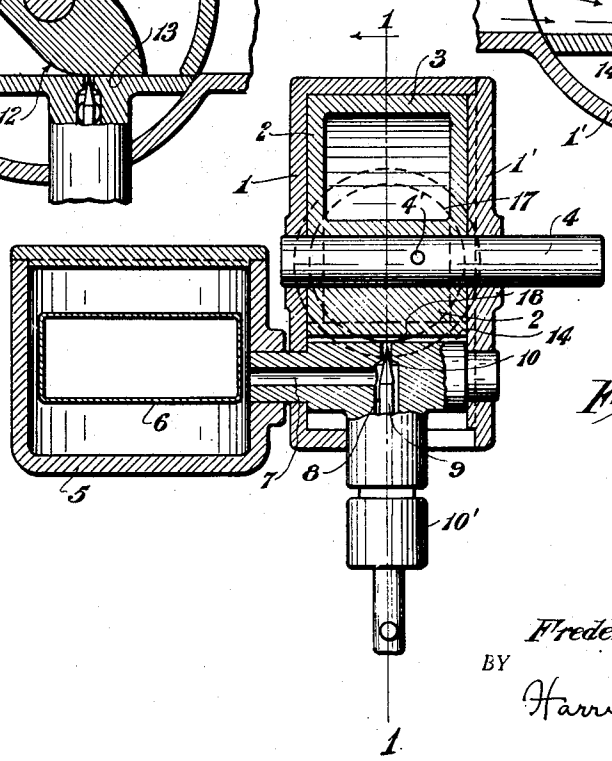


Fig. 2.

INVENTOR,
Frederick H. Bullard,
BY
Harry W. Bowen.
ATTORNEY.

July 28, 1925. 1,547,296

F. H. BULLARD

CARBURETOR

Filed Jan. 7, 1922 3 Sheets-Sheet 2

Fig. 5.

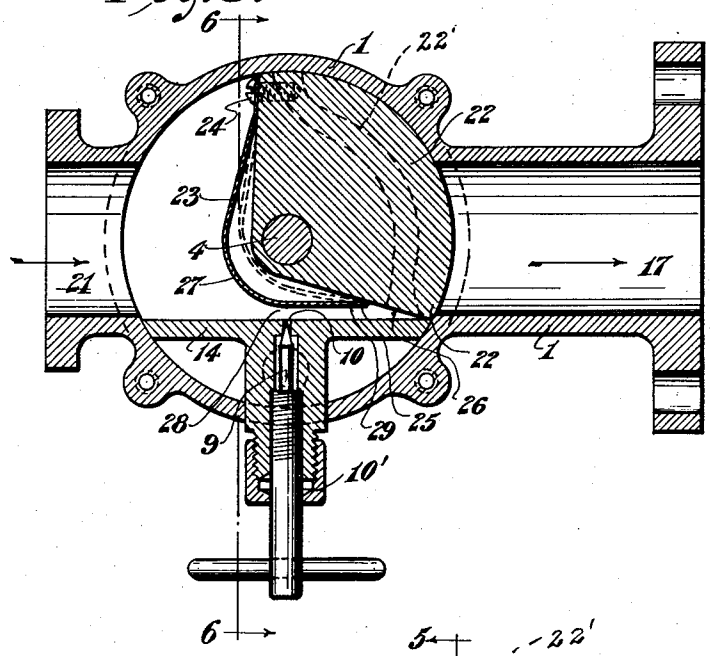
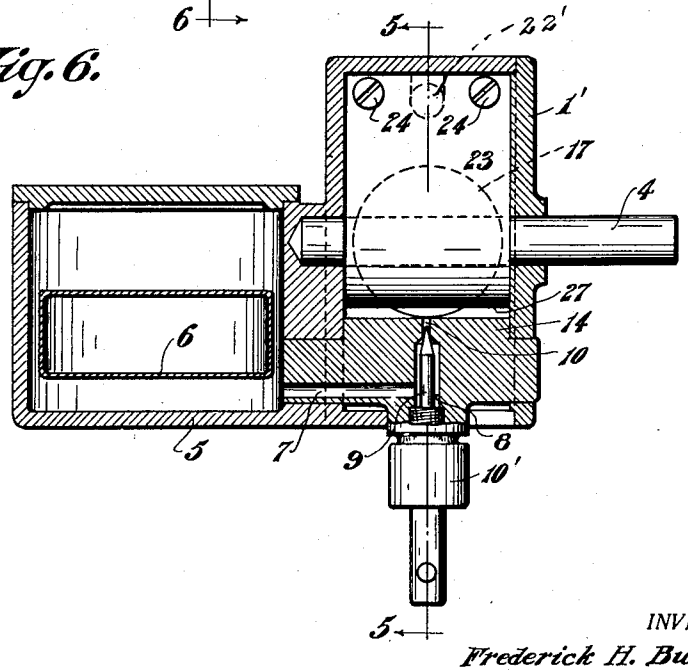


Fig. 6.



INVENTOR,
Frederick H. Bullard,
BY
Harry W. Bowm.
ATTORNEY.

July 28, 1925. 1,547,296

F. H. BULLARD

CARBURETOR

Filed Jan. 7, 1922 3 Sheets-Sheet 3

Fig. 7.

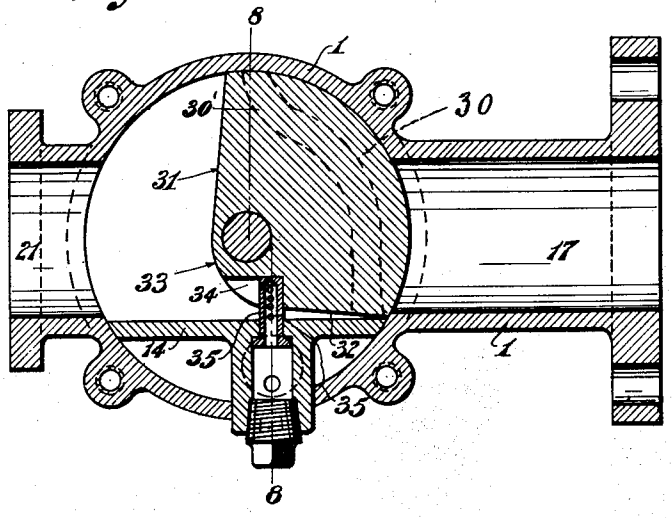
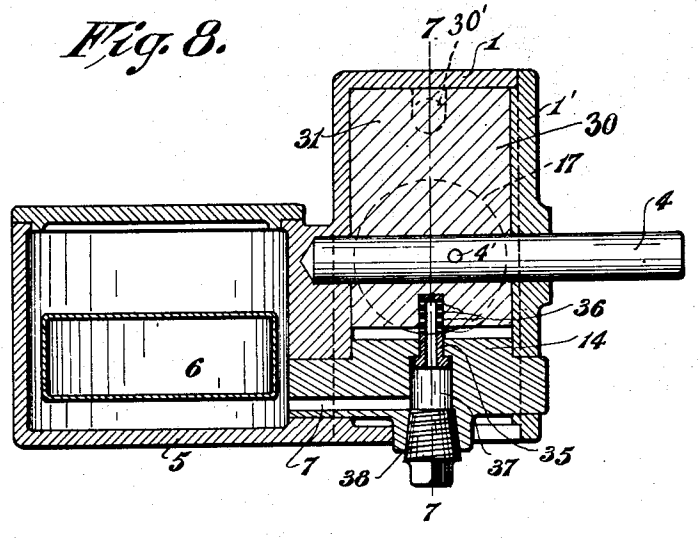


Fig. 8.



INVENTOR,
Frederick H. Bullard,
BY
Harry W. Bowen.
ATTORNEY.

Patented July 28, 1925. 1,547,296

UNITED STATES PATENT OFFICE.

FREDERICK H. BULLARD, OF SPRINGFIELD, MASSACHUSETTS.

CARBURETOR.

Application filed January 7, 1922. Serial No. 527,599.

To all whom it may concern:

Be it known that I, FREDERICK H. BULLARD, a citizen of the United States of America, residing at Springfield, county of Hampden, and State of Massachusetts, have invented certain new and useful Improvements in Carburetors, of which the following is a specification.

This invention relates to improvements in carburetors.

An object of the invention is to provide a carburetor that is simple in construction and one that will supply the correct mixture of air and gasoline at all speeds of the engine.

It is a well known fact in the operation of internal combustion engines, using gasoline as fuel, and running at a given number of revolutions per minute, that there is a mixture of gasoline and air which will give the maximum of power and economy. The proportions of this mixture are fixed within comparatively narrow limits. It is the function of the carburetor to provide this mixture, and supply it to the engine cylinder in the necessary quantity.

The speed of the engine is controlled by varying the quantity of mixture admitted to the engine cylinder; this is ordinarily effected by a valve placed in the intake passage between the carburetor and the cylinder, in other words the incoming charge is throttled, and the degree of throttling controls the engine speed. The action of the throttle valve produces two effects; it positively limits the quantity of mixture that can pass into the engine cylinder in a given period of time, and it changes the quality of the mixture, or proportions of air and gasoline, by causing the current of air to pass the gasoline supply nozzle at a higher or lower velocity in feet per minute according to the degree of opening of the throttle valve since the speed of the engine varies with the opening of the valve in the supply pipe.

These two functions of the throttle action have been found to be necessary for the complete control of the engine speed and its economical operation. It is obvious that a device which will automatically and positively perform these two important functions of mixing the air and gasoline in the proper proportions, and controlling the quantity of the mixture admitted to the engine cylinder, is approaching the ideal in a carburetor.

In the carburetors commonly in use the proportions of air and gaseline in the mixture are controlled almost entirely by the velocity in feet per minute of the air current passing the gasoline supply nozzle. The primary air tube is made small enough so that the air current will have a high velocity at low engine speeds, and an auxiliary spring controlled air inlet is provided to supply the extra air needed at high engine speeds; bringing about the paradox that the engine speed will not be accelerated until the auxiliary air supply begins to open, and the auxiliary air supply valve will not begin to open until the engine speed is accelerated.

In the carburetor herein described the quantity of gasoline taken up is dependent on the velocity of the air current as usual, but the air passages are so constructed and arranged that the velocity of the air current is controlled, the proper proportion of air and gasoline is automatically insured for all positions of the control member without the use of any auxiliary spring controlled valve, and the quantity of mixture needed is supplied to the engine cylinder, this action is positive and does not depend upon the acceleration of the engine.

Referring to the drawings:

Fig. 1 is a vertical sectional view on the line 1—1 of Fig. 2 showing in cross section, one position of the control member which turns in the casing, also the auxiliary air supply openings through the movable control member. In this view the control member is shown in a partially open position.

Fig. 2 is a vertical sectional view on the line 2—2 of Fig. 1.

Fig. 3 is a view similar to Fig. 1 showing the control member in closed position.

Fig. 4 is a view similar to Fig. 1 but showing the control member opened to a greater extent than in Fig. 1 to permit the air to flow through the auxiliary openings.

Fig. 5 is a vertical sectional view on the line 5—5 of Fig. 6 of a modification in which the control member is provided with a thin flexible spring.

Fig. 6 is a sectional view on the line 6—6 of Fig. 5 showing the fuel supply and float therein.

Fig. 7 is a sectional view on the line 7—7 of Fig. 8 showing a further modification of

the control member and gasoline outlet and

Fig. 8 is a sectional view on the line 8—8 of Fig. 7.

Referring to the drawings in detail:

1 designates the casing of the carburetor, 2 the control member located therein. This member is formed integral with the semi-cylindrical portion 3 which has a close fit and bearig on the sides and top portions of the casing, as shown. 4 designates a shaft to which the control member 2 is connected in any suitable way as by means of a pin 4′. By operating the shaft 4 the control member 2 and the portion 3 are rotated together. The usual gasoline supply and float chamber is indicated conventionally at 5. 6 is a float therein for controlling the level of the liquid. 7 is the passageway for the fuel which communicates with the opening 8 in which the needle valve 9 is located.

This needle valve is designed for varying the flow of the liquid fuel through the smaller opening 10 in the usual manner. For the purpose of assembling the structure one of the ends of the casing 1 may be considered the cover plate and made removable, as indicated at 1′.

Referring now to the detail construction of the control member 2; the flattened surfaces 11 and 13 are arranged at an angle to each other and are connected by the curved surface 12. It will be noticed from a comparison of Figs. 1 and 4 where the control member 2 is shown open or adjusted in different positions that some part of the curved surface 12 is always located directly above or coincides with the gasoline opening 10.

14 designates the nozzle plate in which the opening 10 is located and 10′ designates the usual packing nut. 15 designates the passage way between the curved surface 12 and the nozzle plate 14. The flattened surfaces 11 and 13 which are connected by the curved surface 12 forms with the nozzle plate 14 a Venturi passage 16 or outlet opening whose throat or narrow part 15 is in all of the positions of the control member 2 over or coincident with the gasoline outlet nozzle 10 at which point the mixture of air and gasoline takes place. The current of air which passes the nozzle 10 at a very high velocity thoroughly breaks up the liquid gasoline into a very fine spray which commingles with the air and is thus prepared for complete combustion in the cylinder of the engine.

When the control member 2 is turned or operated by means of the shaft 4 the size of the discharge opening 16 is either increased or diminished in order to admit the passage of a greater or less quantity of air and gasoline mixture into the cylinders of the engine; it also increases or diminishes the area of the throat opening 15 of the Venturi passage 16 which will permit the flow of a greater or less quantity or volume of air and necessarily varies the velocity of the air current therethrough, and consequently the quantity of gasoline which would be carried along or taken up by the current of air as it passes through the throat opening 15.

The outlet passage 17 for the mixture is circular in cross section and the edge 18 of the portion 3 of the movable control member 2 is straight, therefore the area of the Venturi passage 16 is small at first but increases rapidly as the control member 2 is rotated. During the initial or first movements of the control member the areas of the passage 16 and throat 15 of the Venturi passage 16 is properly proportioned so as to make or produce a comparatively rich mixture of air and gasoline which will readily ignite when drawn into the cylinders of the engine.

The area of the Venturi passage 16 increases faster than the area of the throat 15 as the control member 2 is rotated, therefore the mixture of air and gasoline would continue to grow richer and the engine would not operate properly. In order to balance or offset this condition the auxiliary inlet air port 19 and the outlet passage 20 are provided in the movable semi-cylindrical portion 3, of the control member 2. The auxiliary air inlet port 19 is so located that it commences to open at the time when the area of the throat 15 is not large enough to pass the proper volume of air in order to produce an economical mixture. The additional air thus admitted through the auxiliary air inlet port 19 and outlet passage 20 not only supplies the extra air needed but by reason of its joining or uniting with the mixture of air and gasoline between the nozzle 10 and the Venturi passageway 16 dilutes the rich mixture making it suitable for combustion in the cylinders of the engine.

As the control member 2 is rotated to increase the area of the Venturi passage 16 the opening leading to the Venturi passage is closed. If the Venturi passage 16 is open one half of its distance the air inlet passage 21 is closed one half plus the area of the auxiliary air inlet opening 19. Further rotation of the control member 2 increases the area of the Venturi passage 16 and lessens the area of the inlet 21; thus cutting off part of the air supply producing a somewhat richer mixture of air and gasoline which is desirable for maximum power at extreme high speeds.

It is obvious that the position of the control member 2 and the proportional areas of the air passages 21 and 15 and Venturi passage 16 are not in any way dependent on the suction or operation of the engine, and that these proportional areas are constant for a given position of control member 2. Therefore the mixture of air and gasoline supplied to the engine cylinder at any

position of control member 2 is positively and automatically controlled in quality and quantity and the speed and power of the engine is governed accordingly.

Referring to the construction shown in Figs. 5 and 6, the control member 22 is here shown as a single solid piece that is secured to the operating shaft 4 and turns in the casing 1 as before. 22′ designates a passageway through the member 22; its forward lower edge completely closes the outlet passage 17 in the position shown. 23 designates a thin flat spring which will readily bend. It is preferably formed from a single piece of float material and is attached at its upper end to the control member 22 by means of the screws 24; its lower or free end 25 rests against the lower inclined surface 26 of the control member 22. Its intermediate or center portion 27 is formed with a curve. When the control member 22 is operated some portion of the curved surface 27 will always be located above or will coincide with the fuel outlet 10. By using the thin flat spring 23 the action of the incoming air at 21, on the outer surface of the spring 23 will cause the same to bend or yield and assume a new position which will have the effect of increasing the area of the throat 28 and consequently changing the quantity of the mixture as well as the quality as already described.

The incoming air at 21 will cause the spring to bend or yield inward and increase the throat area 28, thus decreasing the richness and increasing the quantity. As the control member 22 is further turned to increase the area of the outlet opening 29 the mixture is not as rich but its volume or quantity is increased. The spring therefore automatically controls the area of the Venturi passage 16. The spring will be partially flattened throughout its entire length by the incoming air.

In Figs. 7 and 8 the control member 30 is also formed as a solid piece. The plane surfaces 31 and 32 are connected by the curved surface 33 and in this surface is formed a vertically arranged recess 34 which receives the fuel supply stand pipe 35 that is formed with outlet openings 36. This pipe is located in an opening in the throat plate 14. 37 is a chamber which communicates with the passageway 7. It is closed by the plug 38. As shown in Fig. 7 the control member is closed. When it is turned a larger or smaller number of the openings 35 are uncovered permitting the incoming air to take up and carry along a greater or less quantity of the liquid fuel. The action of the plane surfaces 31 and 32 is the same as already described in connection with Figs. 1 to 4.

The single control member 22 shown in Figs. 5 and 6 or the single control member 30 shown in Figs. 7 and 8 are provided with auxiliary air passages 22′ and 30′ respectively, as shown. These passages are for the same purpose as the auxiliary inlet air port 19 and the outlet passage 20 shown in Figs. 1 to 4.

It will be noted that the curved part 12 of the controlling member 2 is always located directly over the fixed delivering opening 10 of the gasoline supply nozzle in all positions of the control member or, in other words, the throat or the narrowest part of the Venturi passageway is always located over the gasoline supply and that the space 16 increases in area as the throat area 15 increases.

What I claim is:

1. In a carbureter, the combination, of an enclosing casing, a mixture controlling member therein formed with surfaces at an angle to each other, an outlet passage for the liquid fuel, the delivery end of which is located in substantially a plane surface, the said surfaces of the control member and the plane surface of the outlet passage coöpating with each other to form a passageway with a contracted throat through the casing, in all positions of the mixture controlling member, and the operation of said member operating to bring about a definite or fixed variation in the cross sectional area of the throat portion of the passageway.

2. In a carburetor, the combination with an enclosing casing, of a single control member therein for varying the quantity and quality of the mixture and which member is formed with two plane surfaces that are arranged at an angle to each other and are connected by a curved surface, a plate in which the delivery end of an outlet opening for the liquid fuel is located and said opening terminating opposite the curved surface of the control member in all postions of said control member.

3. In a carburetor, the combination with an enclosing casing, of a single control member therein which is formed with two flat plane surfaces that are arranged at an angle to each other and are connected by a curved surface, a plate in which the outlet opening for the liquid fuel is located and said opening always terminating at the narrowest point of the throat of the passageway in all positions of the control member.

4. In a carburetor, the combination with an enclosing casing, of a single control member therein, said member having an auxiliary air passage through the same, the location of the control member and air passage being such that when the control member is slightly opened the air passage is closed and when the position of the control member is such that too rich a mixture is produced the auxiliary air passage will open, a plate in which

the delivery end of the gasoline outlet opening is located, said control member and plate being so formed as to cooperate and produce a passage having a contracted throat through the casing in all positions of the control member.

5. In a carburetor, the combination with an enclosing casing, of a mixture controlling member therein which is formed with flat surfaces that are arranged at an angle to each other and are connected by a curved surface which merges into the flat surfaces, a plate in which the delivery end of the liquid fuel nozzle is located and said end always terminating opposite the curved surface of the control member in all of its positions to form the smallest passageway or throat opening through the casing, the throat or smallest portion of which passageway is in all positions of the controlling member coincident with the center of the gasoline opening.

6. A carburetor having in combination with an enclosing casing, a control member therein, a throat plate in which the gasoline opening is located, the control member having a curved and a plane surface which forms an angle with the plate for providing a passageway having a contracted throat, said passage and throat being increased in sectional area when the control member is opened and decreased when the control member is partly closed and the contracted throat being always coincident with the gasoline outlet opening in all positions of the control member.

FREDERICK H. BULLARD.