June 13, 1961 E. SCIORE 2,988,346

FUEL REGULATOR

Filed March 23, 1959

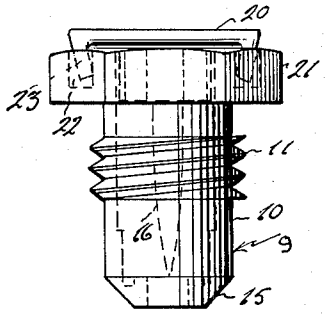


Fig. 1

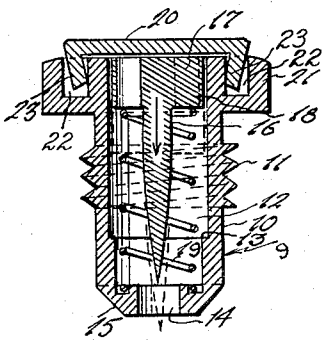


Fig. 3

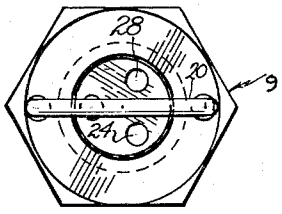


Fig. 2

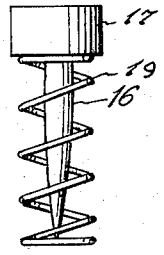


Fig. 4

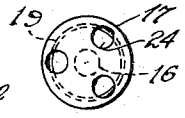


Fig. 5

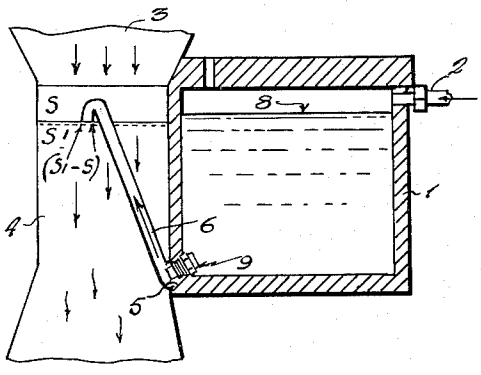


Fig. 6

Inventor
Evelino Sciore
By Fletcher Yeiser Yaugh & Kent
PATENT ATTORNEYS

United States Patent Office

2,988,346
Patented June 13, 1961

2,988,346

FUEL REGULATOR

Evelino Sciore, 222 6a St., NE., Calgary, Alberta, Canada

Filed Mar. 23, 1959, Ser. No. 801,326
1 Claim. (Cl. 261—66)

My invention relates to new an useful improvements in fuel regulators adapted to be used in conventional carburettors.

It is well known that as the speed of an engine increases, the ratio of the gasoline to air increases so that a rich mixture occurs which is uneconomical and undesirable.

I have overcome this disadvantage by providing a fuel regulator adapted to regulate the flowing of gasoline from the float chamber to the main spray nozzle located inside the venturi tube of the carburettor at any speed above the normal idling speed.

A further object of my invention is to provide a device of the character herewithin described which maintains the correct proportion between air and gasoline at any number of revolutions per minute of the engine, thereby providing greater efficiency and greater economy.

Another object flowing from the foregoing object is to provide a device of the character herewithin described which gives an improved ratio of miles per gallon for the same atmospheric conditions, at any speed travelled.

With the foregoing objects in view, and such other subjects and advantages as will become apparent to those skilled in the art to which this invention relates as this specification proceeds, my invention consists essentially in the arrangement and construction of parts all as hereinafter more particularly described, reference being had to the accompanying drawings in which:

FIGURE 1 is a side elevation of my device.

FIGURE 2 is a top plan view of FIGURE 1.

FIGURE 3 is a vertical section of FIGURE 1.

FIGURE 4 is a side elevation of the tapered needle valve and piston head per se together with the spring.

FIGURE 5 is a top plan of FIGURE 4.

FIGURE 6 is a schematic view of part of a carburettor showing the location of my device therein.

In the drawings like characters of reference indicate corresponding parts in the different figures.

The mathematical theory upon which the fuel regulator operates is as follows:

The realization of the fuel regulator has been based on the following considerations, taken from the effective volumetric efficiency of the engine at the various conditions of operation.

It is known that the speed of any fluid going through any given section S is dependent from the relation

$$V=\frac{Q}{S} \tag{1}$$

where V is the speed of the fluid, Q the quantity or volume per second and S the section through which the fluid is going.

It is also known that if a fluid is falling by gravity its speed will be

$$V=\sqrt{2gh} \tag{2}$$

where V is the speed of the fluid, g the acceleration of gravity and h the height from which it is falling or piezometric height. In this case when the piston of an engine is forced to move downward, it is creating a vacuum thus letting the air fall by gravity and in taking the amount Q, equivalent to the cylinder displacement,

through the section S; therefore the Equations 1 and 2 become

$$\frac{Q}{S}=\sqrt{2gh} \tag{3}$$

and from the Equation 3 we resolve h thusly

$$h=\frac{Q^2}{2gS^2} \tag{4}$$

Multiplying both sides of Equation 4 by y which is the specific weight of the fluid, air in this case, a unit pressure, or the total pressure exerted upon one unit of section S (refer now to FIG. 6), will be obtained

$$hy=\frac{Q^2y}{2gS^2} \tag{5}$$

To determine the total pressure exerted upon the total section S, multiply both members of Equation 5 by S thus giving

$$hyS=\frac{Q^2y}{2gS} \text{ or } P_{TS}=\frac{Q^2y}{2gS} \tag{6}$$

P_{TS} standing for total pressure upon section S.

Referring to FIG. 6 it is noticed that immediately below the section S containing the spray nozzle, there occurs a new section S_1 therefore the air going through the Venturi tube is submitted to a negative variation of unit pressure (being S_1S). This negative variation of unit pressure can be obtained by dividing both sides of Equation 6 by S_1

$$\frac{P_{TS}}{S_1}=\frac{Q^2y}{2gSS_1} \tag{7}$$

This Equation 7 will express the unit pressure exerted negatively upon section S_1 of which the spray nozzle section is $(S_1—S)$; therefore multiplying again both sides of Equation 7 by the spray nozzle's area $(S_1—S)$, the total negative pressure or depression du exerted upon the spray nozzle's area can be obtained thus

$$du=\frac{(S_1-S)Q^2y}{2gSS_1} \tag{8}$$

Equation 8 can be written, expressing the depression du in function of the weight of the air, considering that

$$Q=\frac{W}{yt}$$

(Q being volume of air per second, y specific weight of air, t time in seconds, W weight of air)

$$du=\frac{(S_1-S)W^2}{2gy^2SS_1} \tag{9}$$

Considering Formula No. 9 it is noticed that the depression du exerted upon the spray nozzle area, which can also be assumed as the weight of gasoline required by the engine, is proportional to the square of that weight, flowing from the other factors, namely

$$\frac{S_1-S}{SS_1}$$

ratio between difference of the areas of the Venturi tube containing the spray nozzle and their product, g acceleration of gravity, y specific weight of the air intaken and eventually the volumetric efficiency of the engine at various r.p.m. (revolutions per minute).

As a result, with the increasing r.p.m. of the engine the mixture of air-gasoline, has the tendency to become richer. To correct this tendency the fuel regulator with its sliding needle, provides the means by which the section of the jet, through which the gasoline is delivered to the spray

nozzle and thence to the cylinders, can be varied accordingly to the engine's requirements. As it has been stated *du* is the depression created by the intake in the Venturi tube; this depression can be transformed in the corresponding hydrostatic pressure exerted upon the area of the section Φ of the sliding needle, thus

$$H=\frac{W^2\Phi}{2gy t^2 S S_1} \qquad (10)$$

This force H, being proportional to the square of the weight of the air intaken by the engine causes deformations of the spring and consequent motion of the sliding needle. These deformations are not equal to each other depending upon W^2, therefore it is necessary to determine previously, considering equal intervals of r.p.m., the corresponding gasoline requirements of the engine knowing its cubic displacement and using the ratio in weights 1:15 or other (1:15 or 1:18) for gasoline-air mixture. The same operation, using the same intervals of r.p.m. has to be performed using Formula 9. Comparing the results, a different gasoline weight will be obtained for each corresponding r.p.m. considered.

The difference between the weights of gasoline calculated by the Formula 9 and the weights of gasoline determined by using ratio 1:15 or others, as above specified, effectively required by the engine, taken for the same r.p.m. can be transformed into obstructing areas of the sliding needle using the formula

$$s_1=\frac{(w_1-w)s}{w_1}$$

Where "s_1" is the obstructing area of the sliding needle for that particular number of r.p.m., "s" is the area of the section of the normal jet, "w_1" is the weight of gasoline determined by using Formula 9 and "w" is the weight of gasoline effectively required by the engine.

The calculated obstructing areas of the sliding needle have to be placed at suitable distances from each other according to the calculated deformations of the spring and to the space at disposal.

Structurally, and referring to the drawings, reference should first be made to FIGURE 6 which shows schematically a conventional float chamber **1** of a carburettor having a gasoline intake **2** and part of the conventional air intake **3** together with the venturi restriction **4** normally encountered in carburettors and which is conventional.

An outlet **5** is provided adjacent the base **6'** of the float chamber and a tube or fuel passage **6** communicates this outlet with a jet or spray nozzle **7** situated within the venturi **4** and it will be appreciated that the conventional float mechanism (not illustrated) normally maintains the float level indicated by the dotted line **8**.

In place of the usual jet normally situated within the outlet **5**, I have provided my fuel flow regulating device collectively designated **9**. It comprises a cylinder or tubular body **10** screw threaded as at **11** on the outer surface thereof, to permit engagement with the outlet **5** in the base of the float chamber **1**. The inner bore **12** of the cylinder is reduced in size part way down the length thereof, as at **13** thus forming a shoulder at this point and then continues down to terminate in a metering orifice **14** defined by an inturned annular shoulder at the base **15** of the cylinder.

A tapered needle valve **16** is located within the cylinder **10** centralized by the provision of a piston **17** formed on the upper end thereof which is adapted to reciprocate within the upper or inlet end **18** of the cylinder so that the needle valve **16** is adapted to enter into or retract from the metering orifice **14** thus changing the effected cross sectional area of this orifice and thus the amount of gasoline passing therethrough.

This needle valve is normally maintained in the uppermost position by means of a compression spring **19** surrounding the needle valve and reacting between the base **15** of the cylinder and underside of the piston **17**.

The needle valve is prevented from displacement upwardly from the cylinder by means of a retaining bar **20** spanning the upper open end of the cylinder. In this connection an annular flange **21** is formed integrally around the upper end of the cylinder and is provided with a pair of recesses **22**. The ends **23** of the retaining bar are bent downwardly and inwardly to engage within the recesses **22** thus preventing displacement of the needle valve.

Communication between the float chamber **1** and the interior of the cylinder is provided by the provision of a plurality of passages or apertures **24** in the piston thus allowing gasoline to pass freely into the cylinder then through the metering orifice **14** into the tube **6**.

In operation, the needle valve slides into engagement with the metering orifice **14** relative to the vacuum created in the venturi tube **4** by the operation of the engine (not illustrated). By this means, the section of the metering orifice **14** through which the gasoline is delivered to the spray nozzle **7** and then to the engine cylinders, can be varied in accordance with engine requirements. The hydrostatic pressure of the gasoline exerted on the top aera of the piston head **17** will deform the spring **19** by an amount variably corresponding with the particular revolutions per minute during a specific period of time. As an example for a stated r.p.m., I have devised the formula

$$s_1-s=\frac{(w_1-w)w}{s}$$

where s_1 is the obstructing area of the needle **16** and s is the area of the section of the normal jet aperture, and w_1 is the weight of gasoline and w is the weight of gasoline effectively required by the engine.

Summary.—The calculated obstructing areas of the sliding needle **16** and the aperture **14** are so related to be in accordance with the calculated deformations of spring **19**, which areas are arrived at in a definite manner by the use of formulae hereinbefore described.

In conclusion, I should state that I have tested the device manufactured according to the foregoing and that it has performed satisfactorily.

Since various modifications can be made in my invention as hereinabove described, and many apparently widely different embodiments of same made within the spirit and scope of the claim without departing from such spirit and scope, it is intended that all matter contained in the accompanying specification shall be contained in the accompanying specification shall be interpreted as illustrative only and not in a limiting sense.

What I claim as my invention is:

In a carburetor including an air conducting throat, a fuel jet disposed in said throat, a constant level liquid fuel chamber, a fuel passage extending from said chamber to said jet, and an automatic fuel flow regulator provided in said passage, said regulator being a self-contained entity capable of unitary installation and removal in and from the carburetor and comprising a tubular body having fuel inlet and outlet ends, an inturned annular shoulder provided at the outlet end of said body and defining a restricted fuel metering orifice, a piston reciprocable in the inlet end portion of said body and provided with passage means for entry of fuel into the body, a needle carried by said piston within said body and having a tapered end portion cooperating with said metering orifice to respectively increase and decrease the rate of fuel flow therethrough when said piston is slid away from and toward the outlet end of the body, a compression spring positioned in said body in surrounding relation to said needle, one end of said spring bearing against said inturned shoulder and its other end bearing against said piston, and means provided at the inlet end of the body for retaining said piston therein against the resiliency of

said spring, said last mentioned means comprising an outturned annular shoulder provided at the inlet end of the body, said shoulder having a face provided at diametrically opposite points with respect to said body with a pair of recesses, a keeper bar extending transversely of the inlet of the body for engagement by said piston, and a pair of angulated end portions provided on said keeper bar, said angulated end portions being frictionally received in said recesses.

References Cited in the file of this patent

UNITED STATES PATENTS

2,621,909 Stearns ---------- Dec. 16, 1952