Nov. 10, 1964 E. HENRY-BIABAUD 3,156,251

FUEL OUTPUT ADJUSTMENT APPARATUS

Filed May 12, 1960

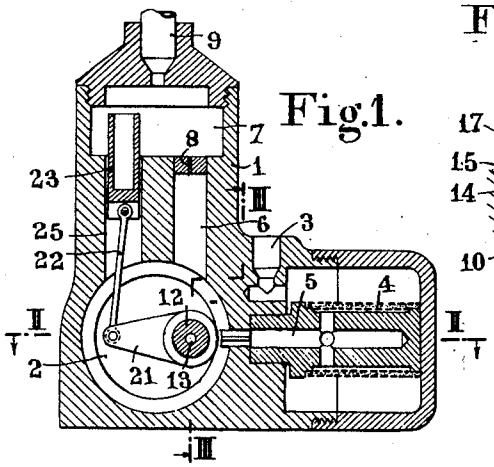


Fig.1.

Fig.4.

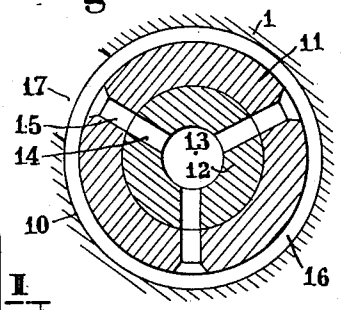


Fig.5.

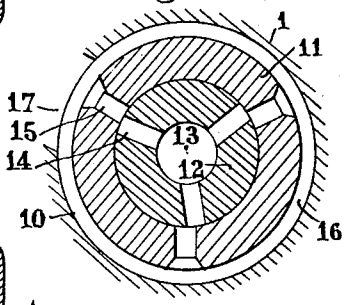


Fig.6.

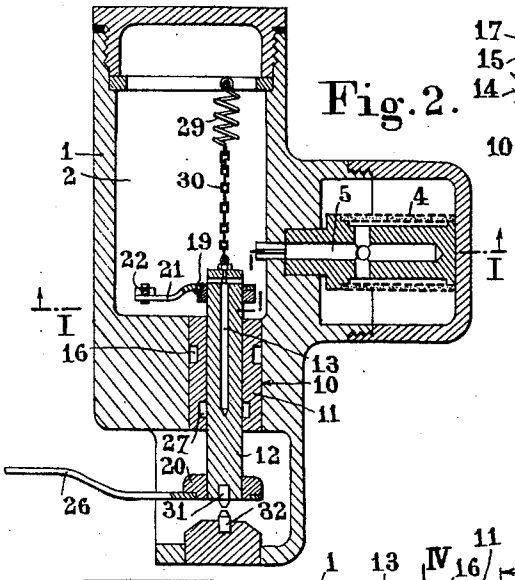
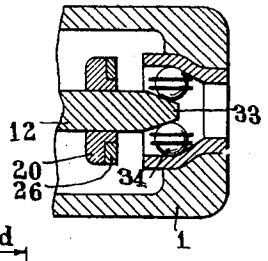


Fig.2.



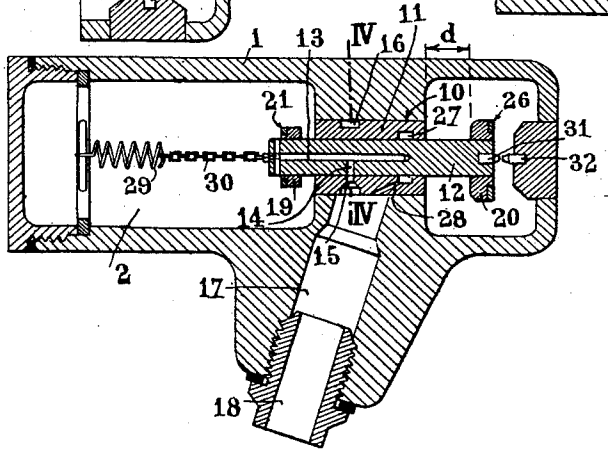


Fig.3.

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3,156,251

FUEL OUTPUT ADJUSTMENT APPARATUS

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4 Claims. (Cl. 137—117)

This invention relates to means for adjusting fuel outputs in fuel feed systems and has specific reference to improvements in fuel output adjustment apparatus wherein the lubrication of the movable components is performed by the fuel itself, and more particularly to apparatus of this character wherein the output adjustment is obtained by the relative rotation or translation of two members.

To prevent, in apparatus of this character, the jamming of parts in relative movement, for example as a consequence of gum deposits or solid impurities contained in the fuel, and according to a first feature of this invention, these parts are so arranged that a relative motion is produced therebetween which differs from that required for the adjustment and produces between these parts a relative scraping action each time the engine is started and stopped.

Thus, notably, when the relative movement between the parts for adjustment purposes is a movement of rotation, the scraping movement is a movement of translation; if, on the contrary, the relative movement between these parts for adjustment purposes is a movement of translation, the scraping movement is a movement of rotation.

This scraping movement may be caused, according to a typical form of embodiment of the invention, by the action of a spring urging one of the moving parts to an inoperative position when the engine is stopped, whereas when the engine is started and during its operation, the fuel pressure acts upon this part in antagonism with the aforesaid spring in order to restore same to its inoperative position in which it is maintained by suitably disposed stops.

It is another feature of this invention to collect by means of a source of vacuum that fraction of the fuel utilized for lubricating the parts in relative motion and to feed this fuel fraction back to the distribution circuit without any loss.

A typical form of embodiment of the invention will be described hereafter with reference to the accompanying drawing forming part of this specification and illustrating diagrammatically by way of example a fuel output adjustment apparatus of the type disclosed in a prior French Patent No. 981,945.

In this apparatus a small orifice provided at a suitable location in the fuel feed duct creates a pressure drop. A piston having one face responsive to the pressure upstream of this pressure drop and the other face responsive to the pressure downstream of said pressure drop acts upon the fuel output by opening more or less a leakage whereby, upstream of the throttling, a variable fraction of the output is branched off. This piston is balanced by the output-adjustment action, that is, an air vacuum, the latter being a function of the engine air output.

In the drawing:

FIGURE 1 is a vertical section of the device which is taken upon the line I—I of FIG. 2;

FIGURE 2 is a section taken upon the line II—II of FIG. 1;

FIGURE 3 is a section taken upon the line III—III of FIG. 1;

FIGURES 4 and 5 are fragmentary sectional views taken upon the line IV—IV of FIG. 3; and

FIGURE 6 is a detail view showing an alternate embodiment.

The body 1 of the device comprises an inner chamber 2 fed through a duct 3, a filter 4 and another duct 5, with fuel from the high pressure pump. Another duct 6 opening into the chamber 2 supplies metered fuel to another chamber 7 formed in the upper portion of the body 1 after this fuel has flowed through a restricted passage or orifice 8. A pipe line 9 connects this chamber 7 to the fuel distributor leading to the engine cylinders.

A bore 10 formed in the body 1 contains a socket 11 having rotatably mounted therein a cylindrical member 12 projecting from said socket at one end into the chamber 2 and at the opposite end from the body 1. This cylindrical member 12 is formed with a blind hole 13 communicating with a number of radial ports 14 (the arrangement comprising three ports in this example) adapted, in a given angular position of the cylindrical body 12, to register with ports 15 formed in the socket 11. These ports 15 are interconnected by a collector groove 16 communicating with a duct 17 ending into a return line connected by means of a fitting 18 to the body 1.

As shown in FIGS. 4 and 5 of the drawings, the communication between the ports 14 and 15 may be more or less throttled according to the angular position of the cylindrical member 12; under these conditions, the fuel leakage output may be adjusted by acting upon the angular position of said element 12. As a result, the output of the fuel discharged through the duct 6 is a function of this angular position.

The cylindrical member 12 carries at either ends collars 19, 20 having secured thereon corresponding control levers 21 and 26. The lever 21 is pivoted on the rod 22 of a piston 23 slidably mounted in a cylinder 25 formed in the body 1. This piston 23 has its upper face responsive to the pressure of the fuel contained in the chamber 2 and its lower face responsive to the pressure prevailing in the chamber 7 downstream of the pressure drop created by the restricted orifice 8.

The lever 26 is connected to the output adjustment member, that is, the diaphragm of a vacuum-forming member (not shown) responsive in turn to the vacuum generated by the flow of air to the engine and taken from the engine choke.

The lubrication between the cylindrical member 12 and its socket 11 is effected by the fuel itself which will fill the clearance left between these two members. This fuel is collected by the collector groove 27 and discharged through a hole 28 to the return duct 17 for the controlled leakage, so that the fuel output circulating in the duct 17 will create a certain suction in the hole 28. With this arrangement any risk of fuel leakage along the cylindrical member 12 and beyond the groove 27 is definitely avoided.

When the engine is operating, the cylindrical member 12 receives on its inner face the fuel pressure prevailing in the chamber 2 and on its outer face the atmospheric pressure, the latter having a negligible value in comparison with the former. Therefore, this member 12 is urged outwards by a force equal to the product of its cross-sectional area by the fuel pressure. Moreover, it is attracted in the opposite direction by a spring 29 to which it is attached by a chain 30. The spring tension is such that its action is inferior to that of the pressure forces irrespective of the rate at which the device may operate. Under these conditions, the stop 31 carried by the cylindrical member 12 is constantly engaging a fixed stop 32.

An adequate adjustment of this fixed stop 32 permits the axial registration between the ports 14 and 15. The two stops are made from a material having a relatively high resistance to wear and tear, such as sintered metallic carbides.

According to another form of embodiment illustrated in FIG. 6, the cylindrical member 12 has an external tapered extension 33 abutting against the balls 34 of a thrust bearing. With this arrangement the mechanism is free from the risk of flaking off the carbide stops as a consequence of the repeated shocks occurring each time the engine is started.

When the engine is stopped, the fuel pressure in chamber 2 becomes zero and the cylinder 12 is returned to its left-hand position (FIG. 3) by the spring 29. Therefore, the cylinder 12 will move to the left through a distance *d* (FIG. 3) until the collar 20 rigid therewith engages the body 1. These reciprocating movements of amplitude *d* which occur each time the engine is started and stopped, produces a scraping action preventing the accumulation of gums and impurities in the clearance between the cylinder 12 and its socket 11.

Of course, the two forms of embodiment of the invention which have been described hereinabove with reference to the drawing should not be construed as limiting the invention as many modifications and alterations may be brought thereto without departing from the spirit and scope of the invention as set forth in the appended claims. Thus, alternate embodiments may be resorted to according to the type of fuel output adjustment apparatus to be equipped in accordance with the teachings of this invention, as the latter is applicable to any apparatus for metering a liquid likely to dissolve lubricating oils or to build up deposits of gums or other solid impurities.

What I claim is:

1. An apparatus for adjusting the output of a liquid fuel delivered under pressure, which comprises a fixed outer member formed with a cylindrical bore and with at least one radial port through which the liquid under pressure may escape, an inner cylindrical member slidably mounted in said bore and in sealing engagement therewith, said inner cylindrical member being formed with at least one radial port through which the fuel under pressure is delivered, a chamber fed with the fuel under pressure, said inner cylindrical member having an end emerging into said chamber and another end protruding outside said chamber, a duct formed in said inner member connecting said chamber with said port of said inner member, another duct for discharging from the apparatus the fuel circulated through said ports, a stop limiting the sliding movement of said inner member under the influence of the fluid pressure prevailing in said chamber when the apparatus is fed with fuel under pressure, in a position wherein said ports lie in a common radial plane, a spring resiliently urging said inner member for sliding in a direction opposite to that resulting from the action of said fuel pressure when the delivery of fuel under pressure to the apparatus has ceased, the traction exerted by said spring being inferior to the force exerted by said fuel pressure, another stop limiting the sliding movement of said inner member under the influence of said spring, and means for causing said inner member to revolve in said outer member and therefore cause said ports to register more or less with each other for increasing or reducing the fuel output through said ports.

2. An apparatus as set forth in claim 1, wherein said fixed outer member is provided with a circular collector groove axially spaced in relation to said radial port in the direction of said other end of said cylindrical inner member, said circular collector groove surrounding said cylindrical inner member and being connected to said other duct.

3. In a device for adjusting the output of liquid fuel under pressure which comprises a body formed with two chambers, means for introducing the liquid fuel into one of said chambers and discharging the liquid fuel from the other chamber, a gaged orifice interconnecting said two chambers, a cylindrical channel between the two chambers, a piston mounted in said cylindrical channel and slidably movable under the action of the difference in pressure between the two chambers, a cylindrical shutter mounted with two motions, one of rotation and the other of axial translation, in sealing engagement in said body, means actuated by the piston and putting said cylindrical shutter in a movement according to one of said two motions and causing a liquid output, taken from said first chamber and proportional to the amplitude of said movement, to be discharged by leak passages, said cylindrical shutter being actuated, at the beginning and at the end of an operative time period and under the action of the pressure built up and of the pressure drop in said first chamber, with a movement according to the other of said two motions and unsticking said cylindrical shutter.

4. In a device for adjusting the output of liquid fuel under pressure which comprises a body formed with two chambers, means for introducing the liquid fuel into one of said chambers and discharging the liquid fuel from the other chamber, a gaged orifice interconnecting said two chambers, a cylindrical channel between the two chambers, a piston mounted in said cylindrical channel and slidably movable under the action of the difference in pressure between the two chambers, a sleeve rigidly mounted through a wall of said body, a cylindrical shutter mounted in sealing engagement in said sleeve, means actuated by said piston and causing said cylindrical shutter to rotate in said sleeve, means enabling said cylindrical shutter to discharge by leak passages a liquid output taken from said first chamber, said liquid output varying with the angular position of said shutter, said discharge means consisting of a cylindrical cavity opening into said first chamber and communicating with said leakage means, and lubrication means for lubricating said cylindrical shutter by the action of said liquid fuel, which becomes operative at the beginning and at the end of an operative time period, said lubrication means consisting of a circular collector groove machined in the inner wall of the sleeve, of a discharge port connecting said groove with said leakage means, of a spring acting upon said cylindrical shutter for imparting thereto a movement of translation when the pressure drops in the first chamber at the end of an operative time period, and of a shoulder limiting said movement of translation.

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