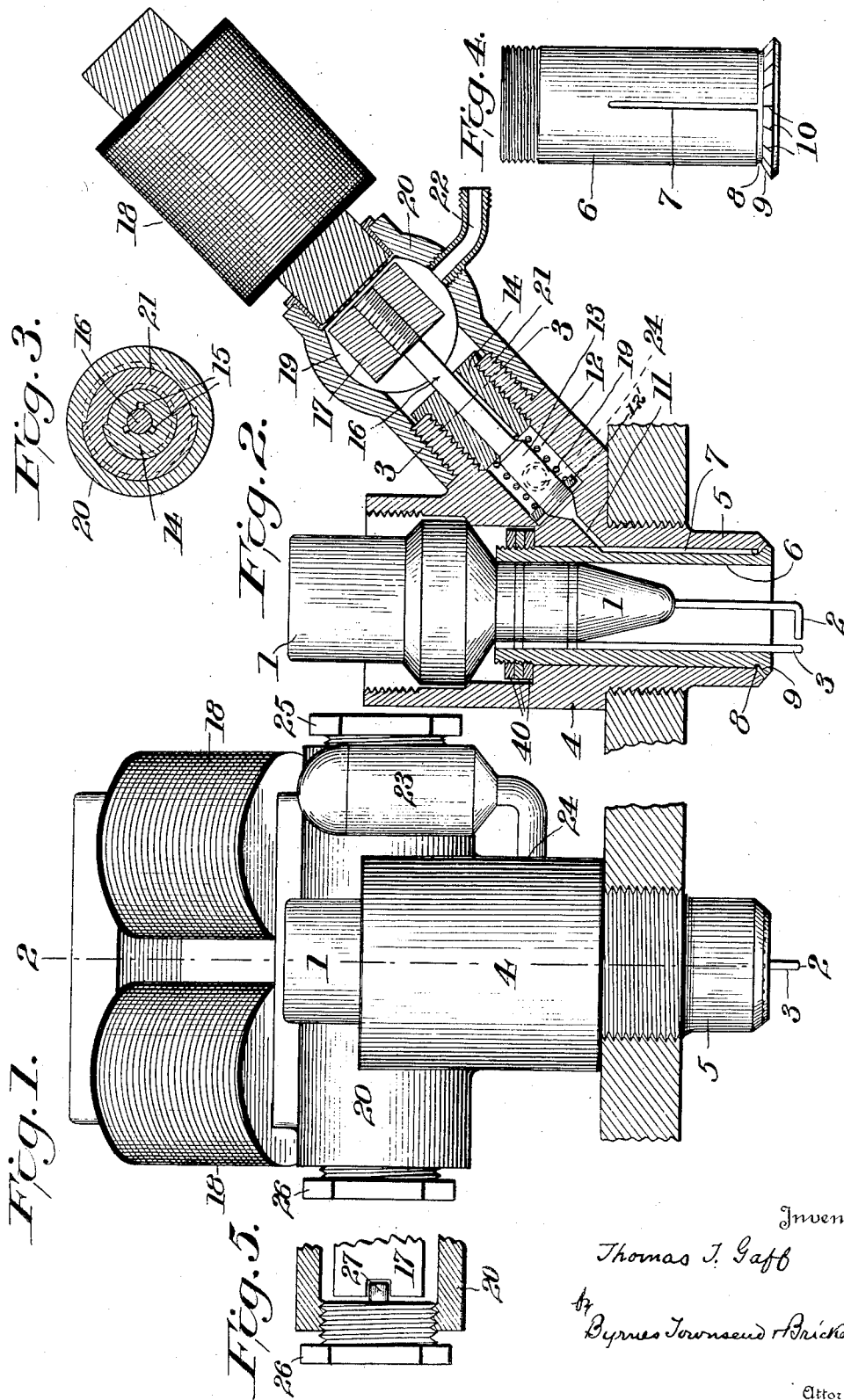


T. T. GAFF.
LIQUID FUEL FEEDING DEVICE.
APPLICATION FILED JULY 13, 1917.

1,373,498.

Patented Apr. 5, 1921.



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LIQUID-FUEL-FEEDING DEVICE.

1,373,498.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, THOMAS TRUEMAN GAFF, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Liquid-Fuel-Feeding Devices, of which the following is a specification.

This invention relates to a device for delivering charges of gasoline directly into the cylinder of an explosive engine of the type described in my U. S. Patent No. 1,059,604, patented April 22, 1913. In that patent is shown and described a means for delivering gasoline under pressure from an accumulator into the cylinder by means of an automatically controlled valve.

My present invention relates to improvements in the valve construction, whereby, because of its double action, no more than a measured maximum of fuel can be delivered into a cylinder at any one time and the possibility of flooding is precluded; and also relates to improvements in the means for introducing the gasoline from the valve chamber into the cylinder, a series of exceedingly small openings being provided, so that the gasoline is ejected in such a fine state of subdivision that an explosive mixture is readily and certainly produced.

My invention further comprises means for electromagnetically operating said valve, the armature to which the valve stem is connected being movably mounted within the fuel conduit, in proximity to the pole-pieces of an electromagnet, these pole-pieces extending through the walls of the conduit.

In the drawings, Figure 1 is an elevation; Fig. 2 is a section on plane 2—2 of Fig. 1; Fig. 3 is a transverse section on plane 3—3 of Fig. 2;

Fig. 4 is a detail view of the sleeve surrounding the spark-plug; and

Fig. 5 is a detail on a plane passing through the axis of the valve.

Referring particularly to Fig. 2, the spark-plug 1, having the usual terminals 2, 3, is mounted in a special fitting 4, screwed into the head of the engine cylinder. Surrounding the spark-plug and fitting snugly within an extension 5, of the fitting 4 is a sleeve 6 shown in detail in Fig. 4. This sleeve 6 has in its outer-wall a narrow groove 7, which in practice is about one-sixty-

fourth of an inch in width, and communicates at its lower end with a peripheral groove 8, beneath which is a flange 9 having on its upper inclined surface a series of fine or capillary grooves 10, in practice as small as from 0.004 to 0.006 of an inch in width. The extension 5 is formed at its lower end with a surface having an inclination corresponding to the inclination of the surface 9, so that when the sleeve 6 is secured in place by drawing up the nuts 40, 40, there are formed between the two inclined surfaces a series of fine capillary openings extending around the lower end of the extension 5, and adapted to deliver a fine spray of fuel in proximity to the terminals of the spark-plug. The flange on the end of the sleeve can, of course, be left plain and the capillary grooves cut in the lower end of the extension 5. The liquid fuel is delivered to the groove 7 from an opening 11, which in turn communicates with a chamber 12, (which may be called a measuring chamber) through an opening controlled by the lower end of the double-ended valve 13, whose upper end engages a valve seat in the annular plug 14, having a flanged head, this plug being screwed into an extension 21 of the fitting 4, and enabling an adjustment of the lift of the valve. This measuring chamber 12 is so limited in size—proportioned to the engine to which the device is attached—that the expulsion of its contents cannot cause a flooding of the engine by the injection thereof of an amount of liquid fuel greatly exceeding the maximum normal feed. As shown in Fig. 3, a series of grooves 15 are made in the central opening of the plug 14, to provide fuel passages around the stem 16, of the valve, this stem being threaded into the armature 17 of the electromagnet 18 and provided at its upper end with a slot enabling an adjustment of the air gap between armature and magnet poles without disturbance of the valve adjustment. A retracting spring 19 is located between the upper wall of the chamber 12 and a threaded nut 12', on the valve 13 through which the tension of the spring may be adjusted. The armature 17 is located within a laterally extending chamber 19, formed in a T-shaped fitting 20, which is screwed on to the extension 21. The cores

of the magnet coils also extend, through pressure tight closures, into the chamber 19, and their ends are located in close proximity to the armature.

5 The lift of the valve 13 and the capacity of the chamber 12 is adjusted by screwing in or out, the plug 14.

A tube 22 serves to deliver liquid fuel, under pressure into the chamber 19. A
10 closed pressure-chamber 23 is connected at its lower end through opening 24 to the chamber 12. The outer ends of the T-shaped fitting 20 are closed by screw-threaded plugs 25, 26, and may be provided with inwardly-
15 extending pins 27 which engage guide-grooves in the ends of the armature.

The operation of the device is as follows:—The liquid fuel is delivered, under sufficiently high pressure (*e. g.* 100 lbs. per
20 sq. in.), through the pipe 22 into the chamber 19, whence it flows through passages 15 into the chamber 12, assuming the valve 13 to be in its lowermost position and the magnet deenergized. This fuel is maintained under
25 this pressure in the chamber 13, by the tension from an accumulator, as provided in my prior Patent 1,059,604, which delivers the fuel under maintained pressure to the conduit 22. At the proper time, as by the
30 mechanism described in my prior patent, the circuit of the magnet is closed, thereby shutting off the supply of fuel, and opening the exit from chamber 12 to the passages 11 and 7, through which the fuel is forced, under
35 pressure from the pressure-chamber 23 into the groove 8 and through the capillary passages 10 into the engine cylinder, in the form of a fine liquid or vapor spray. The finely divided or atomized fuel is thus
40 injected into the heated air in the cylinder, in the quantity requisite to produce an explosive mixture. As soon as the timing device breaks the magnet circuit, the injection ceases and the valve is again operated by the
45 spring 19, to close the exit and open the inlet to the chamber 12. By this double valve action, there is thus injected for each engine stroke, a definite quantity of fuel, determined by the length of time the magnet
50 is energized through the timing device shown in my Patent 1,059,604. Should, however, the timing device, for any reason, fail to break the circuit and deenergize the magnet 18; thus preventing the closing of
55 passage 11 by valve 13, it will simultaneously stop the flow of liquid through passages 15, and no other liquid than that then contained in chamber 12 can pass into the engine cylinder. This prevents the flood-
60 ing of the cylinder from the accumulator, which might otherwise take place. Further, this small quantity of fuel is preheated in passing through the passages 11, 7 and 8 which are necessarily, when the engine is in
65 operation, at relatively high temperature,

so that the fuel is or may be, by the time it is delivered through the passages 10, already converted into vapor form. Any suitable timing mechanism, such as that described in my prior patent, may be used to cause the
70 operation of the electromagnet.

While I have described in detail the construction and arrangement of the various parts of the device, my invention is not limited to these particular constructions and
75 arrangements, as other means of accomplishing the same results will suggest themselves to those familiar with the art.

I claim:

1. In a fuel-feeding device for explosion
80 engines, a measuring-chamber arranged to contain a definite amount of fuel, means for supplying fuel thereto under pressure, means for delivering under pressure the fuel contained in said chamber to the engine
85 cylinder, said means comprising a double-acting valve and a pressure-chamber connected to said measuring-chamber.

2. In a fuel-feeding device for explosion
90 engines, a measuring-chamber arranged to contain a definite amount of fuel, means for supplying fuel thereto under pressure, means for delivering under pressure the fuel contained in said chamber to the engine
95 cylinder, said means comprising a valve mechanism arranged to automatically close the fuel supply to said measuring-chamber when the delivery therefrom is open and vice versa, and a pressure-chamber connected to said measuring-chamber. 100

3. In a fuel-feeding device for explosion engines, a measuring-chamber, means for adjusting the capacity of said chamber, conduits connecting said chamber to a pressure fuel supply and to the engine cylinder, a
105 valve arranged to alternately open and close said conduits, means for operating said valve and means for adjusting the lift of said valve.

4. In a fuel-feeding device for operating
110 explosion engines, a measuring-chamber, conduits connecting said chamber to a pressure fuel supply and to the engine cylinder, a pressure-chamber in open communication with said measuring-chamber, a valve ar-
115 ranged to alternately open and close said conduits and means for operating said valve.

5. In a fuel-feeding device for explosion engines, a cylinder member having a longitudinal groove thereon, a connecting pe-
120 ripheral groove, and a flange, in combination with a sleeve having inner surfaces fitting the outer surfaces of the cylindrical member and its flange and capillary openings formed between the flange and the inner surfaces
125 of the sleeve.

6. In a fuel-feeding device for explosion engines, a measuring-chamber having an exit opening in one end, an adjustable plug closing the other end of said chamber and
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having an inlet opening therethrough, a valve arranged to alternately open and close said openings, and means for operating said valve.

5 7. In a fuel-feeding device for explosion engines, a measuring-chamber having exit and inlet openings, a valve for controlling said openings, a fuel conduit connected to said chamber, an armature connected to said
10 valve and within said conduit, and an electromagnet mounted on said conduit and having a pole-piece extending therethrough into proximity to said armature.

8. In a fuel-feeding device for explosion

engines, a measuring-chamber having exit 15 and inlet openings, a valve for controlling said openings, a fuel conduit connected to said chamber, an armature connected to said valve and within said conduit, an electro-
20 magnet mounted on said conduit and having a pole-piece extending therethrough into proximity to said armature, and means for adjusting the air gap between the armature and poles of the magnet without disturbance
25 of the valve adjustment.

In testimony whereof I affix my signature.

THOMAS T. GAFF.