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E. R. HEWITT

1,737,155

FUEL INJECTOR

Filed June 28, 1927

Fig. 1.

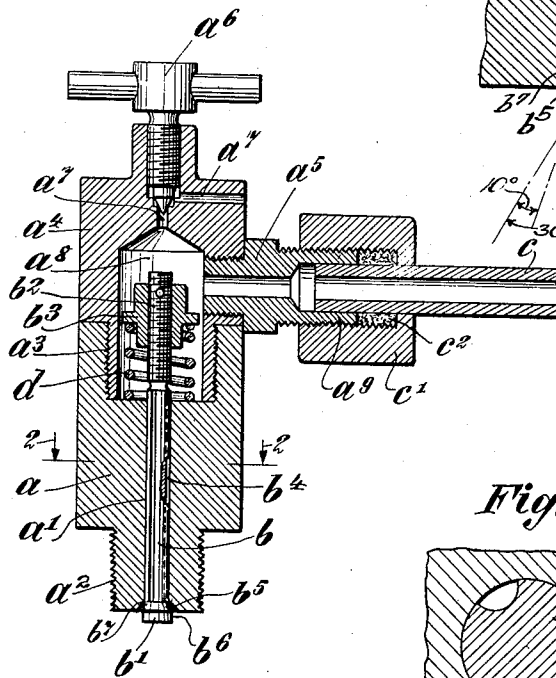


Fig. 4.

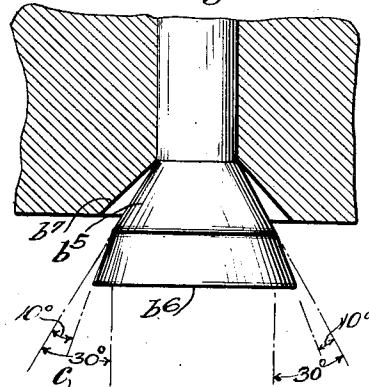


Fig. 2.

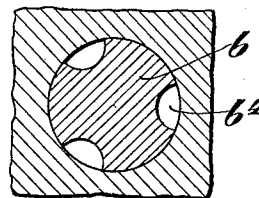
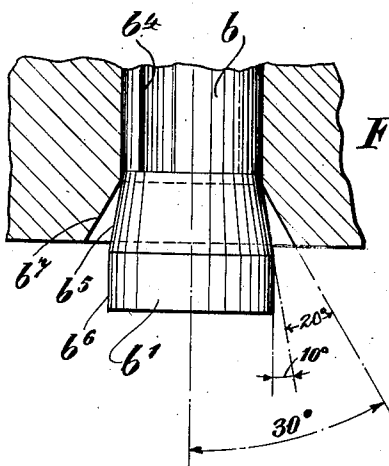


Fig. 3.



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UNITED STATES PATENT OFFICE

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FUEL INJECTOR

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The present invention relates to devices for injecting fuel into a combustion space and includes injectors wherein a plunger is maintained seated by a suitable spring, the pressure of which is overcome by the fuel column to unseat the plunger and inject a quantity of the fuel within the space.

Where fuel is injected in liquid form and mixed within the combustion space to form an explosive charge, it is necessary to provide a means to mix the air and fuel intimately in order that efficient operation will result. In present practice, the problem of bringing about an efficient mixture so that no particles of liquid fuel will collect on the walls of the chamber but, on the contrary, the fuel will be injected in the form of a finely divided volume of vapor, each particle of which is available for complete combustion has, caused considerable attention and resulted in devices which, at best, only partially overcome the above difficulty.

An object of the present invention is to provide an injector for liquid fuel which is able to finely atomize the charge and cause its intimate mixture with the desired volume of air to produce an explosive charge which can be fully burned and thereby approach, as closely as possible, the maximum efficiency obtainable for a given set of conditions. The specific means by which this is accomplished includes an injector resembling, generally, old forms, but which is provided with a nozzle constructed with a tapering plunger seat and providing the plunger with an outer surface or extension forming, preferably an acute angle with the face of the injector.

A further object of the invention is to improve the construction of the injector to render it more rugged and enable it to feed the fuel without becoming clogged by foreign matter which may be present therein. Other objects will appear as the description proceeds and reference will now be had to the accompanying drawings for a more detailed description of the invention wherein:

Figure 1 is an elevation, in section, showing a preferred form of the invention.

Figure 2 is a section taken on line 2—2 of

Figure 1 and looking in the direction of the arrows.

Figure 3 is a view in elevation, partly in section, showing an enlarged plunger and related valve seat as shown in Figure 1.

Figure 4 is a view in elevation, partly in section, showing a modification of Figure 3.

Referring to the drawings, *a* designates the casing of an injector having a hollow cylindrical bearing portion *a'*, an extension *a²* adapted to be secured to a cylindrical head construction in well known manner, and female threads *a³*. At the lower extremity of extension *a²*, a conical seat is provided against which a suitable extension *b'* on plunger *b* may be seated.

Secured at the top of the casing is a fitting *a⁴* which receives a nipple *a⁵* and is provided with a manually operated tap *a⁶*. Channels *a⁷* are provided in the fitting and afford a means of communication between the hollow portion *a⁸* of the fitting and the air. By means of tap *a⁶*, any air collected in the hollow portion *a⁸* may be blown out as will be readily understood from the drawings. The nipple *a⁵* is provided with a threaded extension *a⁹* to which a feed line *c* may be connected by means of a suitable nut *c'* and packing *c²*.

The plunger *b* is provided with a threaded end *b²* which receives a nut *b³*. Between the nut and the upper portion the casing *a*, a spring *d* is secured. This spring serves to seat the extension *b'* of the plunger upon the conical seat at the bottom of the extension *a²* of the casing, and its tension may be varied by means of the nut *b³*. The plunger *b* is formed with longitudinal grooves *b⁴* which permit the flow of fluid from the hollow portion *a⁸* to the end of the extension *a²*.

It will be apparent that a differential pressure exists between spring *d* and the fuel supply from pipe *c*, and when the pressure of the fuel supply in pipe *c* is sufficient, the plunger will be moved downwardly, against the action of spring *d*, to unseat the extension *b'* of the plunger from the conical seat in the extension *a²* of the casing. As long as this excess pressure is sustained, the fuel will be ejected from the casing, and

when removed, the plunger will be seated once more to prevent further flow of the fuel.

In order to atomize, more effectively, the spray of the injector, the extension b' is formed with an outwardly slanting conical surface b^5 which engages the top of the conical nozzle b^7 in the extension a^2 of the casing. Beyond such conical portion, a further extension b^6 is provided in the form of a second truncated cone, Figure 4 or a cylinder, Figure 3 the sides of which preferably lie at angles of 10° with the surface b^5 of the plunger. It has been found that best results are obtained when the lateral slant of the conical nozzle b^7 of the casing a is about 30° with respect to the center line of the plunger, and the sides of the truncated extension b^6 lie at angles of 10° with respect to the surface b^5 . The angle of lateral slant of the portion b^5 may be varied between certain limits and in order to effect better seating of the plunger the sides b^5 should be at an appreciable angle to the surface b^7 of the injector so that a line contact between the two will result. If, as in Figure 4, the angle of the side of b^5 to the length of the plunger is increased, the face b^7 must be flared out accordingly to keep an angle of say 20° between the face b^7 and b^5 to allow room for the spraying of the fuel between the two.

It has been found that making the angle of lateral slant of the truncated or cylindrical section b^6 less than that of b^5 the atomization is improved tremendously, this being the essential feature of the invention. As a further feature, it is to be noted that the bearing portion a' of the casing a serves to constrain, positively, the movements of the plunger b to effect the proper seating of its conical portion b^5 and thus cause a positive cut-off of the spray at the desired point. By providing impulses of sufficient suddenness and pressure through the supply pipe c , the resulting spray into the combustion chamber is of a finely atomized character and in the form of a well defined volume which has been regulated by the proper seating of the plunger b .

Although the invention has been described with reference to the specific embodiment shown in the accompanying drawings, wherein certain dimensions have been given as preferable, it is to be understood that the invention is not to be limited in respect to the dimensions and arrangement of the parts, save as defined in the appended claims.

What I claim is:

1. In a device for spraying fluids, a casing having a nozzle in the shape of a truncated cone of outward lateral slant, a plunger movable in the casing, a truncated conical extension on the plunger, said extension being positioned to seat against the nozzle and being of appreciably less outward lateral slant than said nozzle, whereby a line contact be-

tween these will result when the extension is seated and an outwardly enlarging passage for fluid will exist, and a prolongation on the extension, said prolongation having generally circular cross-section and an upward lateral slant of from zero degrees upwards but less than that of the extension.

2. In a device for spraying fluids, a casing having a nozzle in the shape of a truncated cone of outward lateral slant, a plunger movable in the casing, a truncated conical extension on the plunger, said extension being positioned to seat against the nozzle and being of appreciably less outward lateral slant than said nozzle, whereby a line contact between these will result when the extension is seated and an outwardly enlarging passage for fluid will exist, and a prolongation on the extension, the outer periphery of the extension and the inner periphery of the prolongation coinciding, said prolongation having generally circular cross section and an outward lateral slant of from zero degrees upwards but less by approximately 10° than that of the extension.

This specification signed this 16th day of June, A. D. 1927.

EDWARD R. HEWITT.