March 8, 1960 W. ZEUCH ET AL 2,927,737

FUEL INJECTION VALVES

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FIG. 1

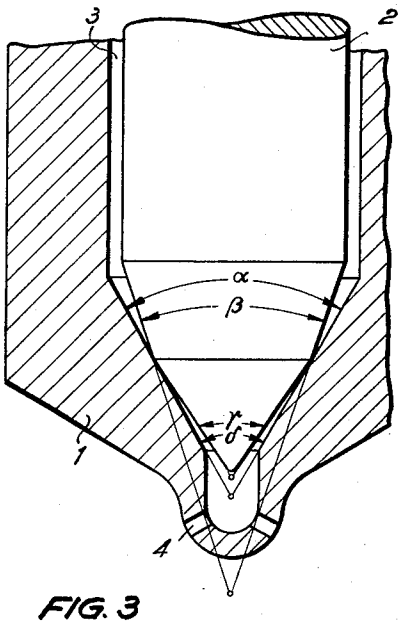

FIG. 2

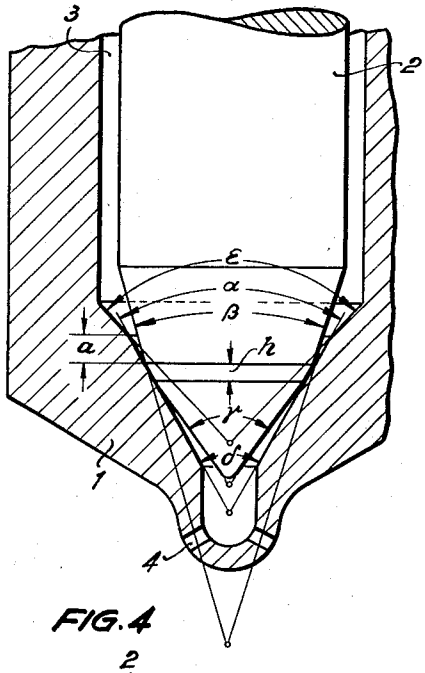

FIG. 3

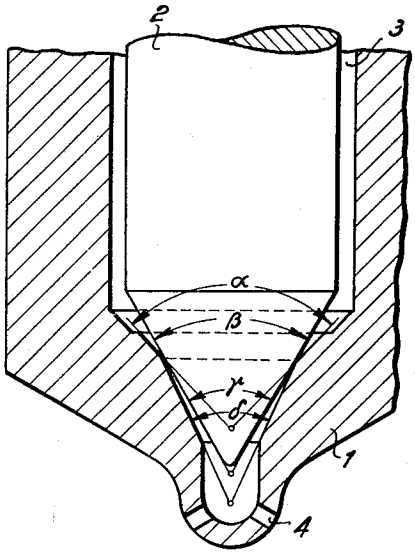

FIG. 4

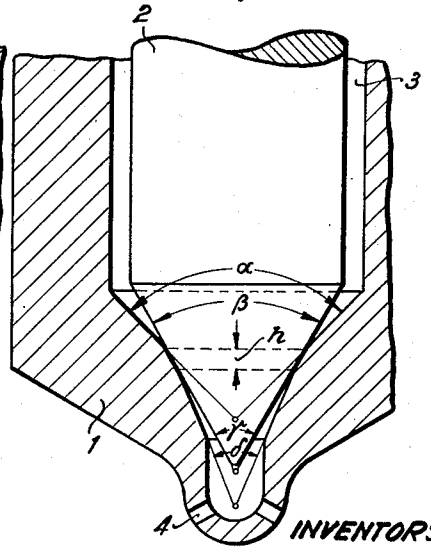

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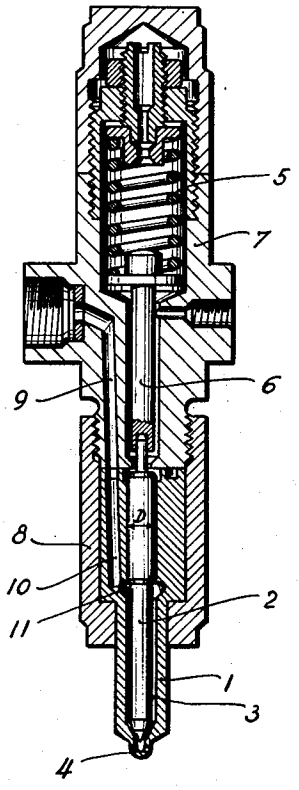
Fig. 5



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FUEL INJECTION VALVES

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Claims priority, application Germany April 12, 1952

7 Claims. (Cl. 239—533)

This invention relates to improvements in fuel injection valves, more particularly suitable for internal combustion engines, with liquid controlled valve needle and having conical surfaces sealing the valve seat in the valve body and on the valve needle.

An object of the invention is to increase the durability of such injection valves by reducing or avoiding corrosion which occurs at the conical sealing surface of the valve needle and frequently limits the life of the injection valve.

This is obtained in accordance with this invention by the feature that the conical angles of these surfaces, so far as they are disposed in front of and behind the valve seat, differ before the valve seat, that is to say on the fuel supply side of the seat, at the most to 20° preferably 10° and behind the valve seat, that is to say on the fuel discharge side of the seat, to at least 0.5°.

In the drawing, four forms of construction are illustrated by way of example.

Figures 1–4 each show a longitudinal section through the part of an injection valve including the valve seat.

Fig. 5 shows a longitudinal section through a fuel injection valve for an internal combustion engine.

In the body **1** of an injection nozzle, a nozzle needle **2** is tightly guided, on which a closing spring **5** acts through a peg **6** in the known manner. The spring **5** is accommodated in a nozzle holder **7** on which the nozzle body **1** is secured by means of a screw cap **8**. The fuel flows through a channel **9** in the nozzle holder and a channel **10** in the nozzle body **1** towards an annular space **11** in the nozzle body and into a circular space **3** between the valve body **1** and the needle **2** and is ejected when the valve is opened through nozzle openings **4**. When the nozzle needle is closed, the fuel pressure engages on an annular shoulder of the nozzle needle, the dimensions of which are determined by the diameter D of the nozzle needle and the diameter of the valve seat. Furthermore, in all the examples the conical angle in the valve body disposed on the fuel supply side of the valve seat is indicated by α and the corresponding conical angle of the valve needle by β. The difference of these two angles (α—β) amounts in all the examples to 10°. The conical angle on the fuel discharge side of the needle is indicated by γ and the corresponding angle in the valve body by δ.

In the example as shown in Fig. 2, there is in the valve body apart from the said angles, another conical surface having an angle ϵ, which intersects the conical angle α at a clearance a from the needle seat. The clearance a is at least half a millimetre in size. The angle ϵ is 3° larger than the angle α.

The needle seat surface in the examples as shown in Fig. 1 and 3, geometrically considered, is only a line which, however, owing to the high specific pressure and

a small remaining change of form at this point, becomes in fact a very narrow annular surface.

In the examples shown in Figs. 2 and 4, the geometrical seating surface amounts to a narrow conical annular surface, the axial height h of which is approximately 0.2–0.3 mm. The angular difference (γ—δ) amounting to 2 to 4° is therefore somewhat larger than the hitherto usual of 0.5 to 1.5°.

In the examples according to Figs. 1 and 2 the angles α and δ are equal, whilst the angles β and γ differ. In the examples as shown in Figs. 3 and 4 the angles α and δ differ while the angles β and γ are equal.

All the examples show injection valves whose injection apertures are at the nozzle holes **4**. The features of the invention may, however, also be used with the same advantage with other types of injection valves, for example those whose injection opening is an annular slit which is formed in known manner by an injection pin on the end of the nozzle needle and an outlet in the valve body into which the injection pin extends.

We claim:

1. A fuel injection valve for an internal combustion engine, comprising a valve body, and a valve needle positioned in the valve body and controlled by the fuel pressure, the valve needle and the valve body having conical surfaces which are convergent in the direction of flow of the fuel and which control the passage of fuel past the needle valve to an outlet in the valve body, said surfaces cooperatively seating together at areas along their lengths, the conical angles of such surfaces differing in front of and also behind the area of seating engagement of the needle in the valve body, by a maximum of no more than 20° on the fuel supply side of the area of seating and by 0.5° to 4° on the fuel discharge side of the area of seating.

2. A fuel injection valve as claimed in claim 1, wherein the conical angles of the valve body on either side of the area of seating are equal.

3. A fuel injection valve as claimed in claim 1, wherein the conical angles of the valve needle on either side of the area of seating are equal.

4. A fuel injection valve as claimed in claim 1, wherein the valve body has a conical angle in front of the area of seating of 3° to 5° larger than the angle of the area of seating and intersects it at a point at least one-half of a millimetre in front of the area of seating measured along the conical axis.

5. A fuel injection valve, including a valve body, and a valve needle controlled by the fuel pressure, the valve body and the valve needle having conical surfaces thereon, these surfaces being convergent in the direction of flow, the conical angles of these surfaces differing in front of and also behind the areas of seating engagement of needle on the valve body by substantially 10° on the fuel supply side of the area of seating, and by 0.5° to 2° on the fuel discharge side of the area of seating.

6. A fuel injection valve as claimed in claim 1, wherein the seating contact of the valve needle with the valve body is over an area of width between 0.2 and 0.3 mm. measured axially of the needle valve.

7. A fuel injection valve as claimed in claim 1, wherein a further conical surface is provided on the valve body and intersects with the first mentioned conical surface on the valve body on the fuel supply side, said further conical surface being located, axially of the valve needle, at least one-half of a mm. from said areas of seating contact and having a conical angle which is 3° to 5° greater

than the conical angle of the first mentioned conical surface on the valve body.

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