Nov. 6, 1956 R. L'ORANGE 2,769,669

NEEDLE NOZZLE FOR INTERNAL COMBUSTION ENGINES

Original Filed Oct. 29, 1951

FIG.1.

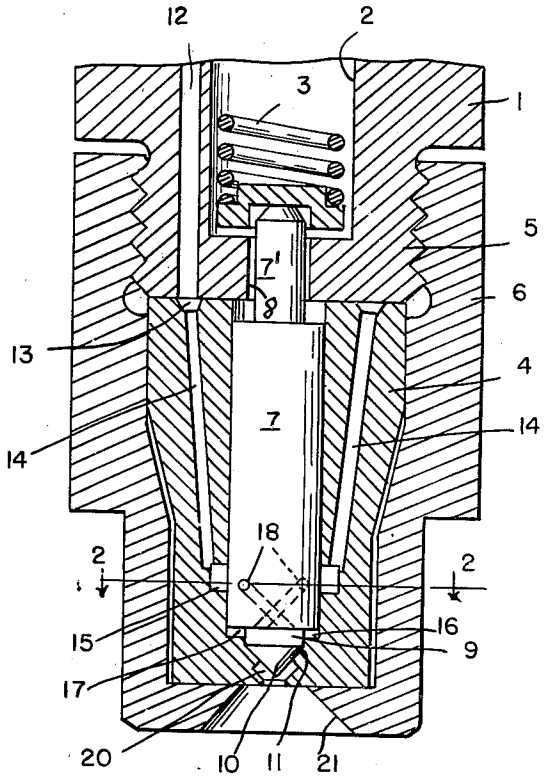
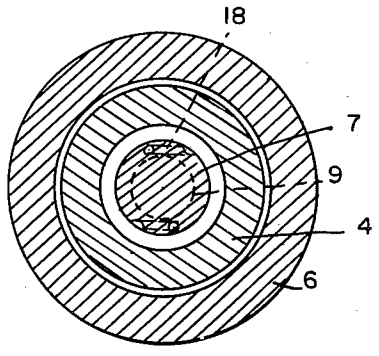


FIG.2.



INVENTOR.

RUDOLF L'ORANGE

BY

Whittemore, Hulbert & Belknap

ATTORNEYS

United States Patent Office 2,769,669 Patented Nov. 6, 1956

2,769,669

NEEDLE NOZZLE FOR INTERNAL COMBUSTION ENGINES

Rudolf L'Orange, Glatten, near Freundenstadt, Germany

Original application October 29, 1951, Serial No. 253,656, now Patent No. 2,743,961, dated May 1, 1956. Divided and this application July 5, 1955, Serial No. 520,010

3 Claims. (Cl. 299—107.6)

This invention relates to internal combustion engines, and refers more particularly to improvements in fuel injection means for such engines.

This application is a division of my copending application Serial No. 253,656, filed October 29, 1951, now Patent No. 2,743,961.

The combustion chamber of internal combustion engines, especially diesel engines having precombustion or postcombustion chambers, frequently requires the injection of fuel in a jet which widens into a relatively oblique conical surface. For this purpose there have been provided on the nozzle needles small pins which extend into the atomization bore and form, possible in cooperation with recesses, edges or the like provided in the nozzle bore, an annular gap through which the injected jet is expanded to a certain conical angle. This construction, however, affords difficulty in manufacture; especially due to the necessity of an absolutely accurate centering of the small pin with the seat. Furthermore the annular gap, which must have a width of a few hundredths of a millimeter, is exposed to the danger of contamination, especially upon the stopping of the engine. These contaminations are mostly flushed away during the operation of the motor; but in the meantime, however, they encumber the starting of the engine by poor atomization.

The object of the present invention accordingly is to create a needle injection nozzle of the same manner of operation for various cone angles, which is not subject to these difficulties. The solution of the problem is effected in accordance with the present invention whereby the entrance of the fuel coming from the injection pump into the annular space which is arranged directly in front of the seat of the needle takes place over cross sections which are tangentially directed in such a manner that a rotational motion is produced in this annular space below the shoulder of the needle in front of the needle seat. Depending on the intensity of this rotary motion, in combination with the selection of the diameter of the atomization opening, the length of the atomization opening and the stroke of the needle, there is then produced a wider or narrower atomization cone. In this connection there can also be produced nozzles of the same size atomization cone angle, in connection with which however the penetrating power varies, depending on the influence of the said factors. The admission cross sections which bring out the rotation in the annular space below the needle shoulder can be arranged in the needle guide itself, penetrating inwards to the needle guide bore from the outside. Such constructions can be realized in a particularly good manner in connection with needle seats which are separated from the cylindrical needle guides. From the point of manufacture, particularly practicable solutions result if these admission cross sections are hollowed out of the needle. In this case the annular space, which is ordinarily arranged around the needle, must be removed somewhat from the needle seat. The connection of this annular space to the annular space existing under the needle shoulder is then formed by the channels, the discharge of which into the annular space in front of the needle seat produces the rotation. These connecting channels can be hollowed out in the form of helical grooves to the corresponding lower inlet amount. A particularly advantageous solution, both for manufacture and operation, results if these connections consist of bores which lead, outside of the axis of the needle and at an inclination to same, from the annular space in the needle guide to the space below the needle shoulder. The invention can therefore be applied to needle nozzles, the seat of which is developed in the customary manner as a conical valve, as well as to the known shapes of plane, flat or annular seats in the valves; in which connection, of course, in the latter case, the influence of the passage of the fuel through the needle seat must be counted with greater weight among the factors determining the atomization shapes than in the former case.

Although the present invention is primarily intended for the injection shapes described in the preamble in a jet or cone lying in the needle axis; and therefore with an atomization bore lying in the needle axis, it is particularly applicable in special cases when the atomization bore is inclined to the needle axis; or when several atomization bores are present. The influence of the measures in accordance with the present invention will, in such case, primarily act to impart to the corresponding nozzle jets a strong breaking-up and lesser penetrating force. In addition to this one improvement which the present invention can impart to all such nozzle needle valves, is an improved protection of the needle seat from dirt particles, inasmuch as such particles are flushed away in a somewhat better manner; as well as, in those designs in which tangential cross sections are recessed out of the needle, an improvement of the life of the needle seat due to a continuous rotation of the needle seat.

Other objects will become apparent as the following description proceeds, especially when taken in conjunction with the accompanying drawing wherein:

Figure 1 is a longitudinal cross sectional view of a needle nozzle constructed in accordance with the present invention and;

Figure 2 is a cross sectional view taken along the line 2—2 on Figure 1.

Referring now more particularly to the drawing there can be seen the lower end of the nozzle holder 1 which has a central recess 2 for receiving a coil spring 3. A needle guide 4 is clamped against the lower threaded reduced portion 5 of nozzle holder 1 by a screw coupling 6. The screw coupling is generally cup-shaped having the needle guide disposed therein and having the bottom wall of the coupling bearing against the lower end of the needle guide and pressing the upper end of the latter against the reduced portion 5 of the nozzle holder 1.

The needle guide 4 has a vertically extending bore which is of uniform cross-section throughout the major portion of its length and has received therein a nozzle needle 7, also of uniform cross-section closely but slidably received in the portion of said bore of uniform cross-section. A pin 7' of reduced cross-section projects upwardly from the upper end of the nozzle needle and through a passage 8 in the nozzle holder which is aligned with the bore of the needle guide and which opens into the recess of the nozzle holder. The coil spring 3 produces a downward resilient force upon the nozzle needle as will be apparent from the drawing.

The lower end of the nozzle needle has a reduced downward projection 9 which terminates in a conical valve portion 10 having a tight seating engagement with a valve seat 11 having a frusto-conical configuration.

The nozzle holder 1 has a fuel pressure passage 12 therein which communicates with the annular distribution groove 13 in the top surface of the needle guide which

surrounds the needle bore in the guide. From the annular distribution groove, the fuel is fed via one or more fuel channels **14**, to the upper annular space **15**. The space **15** is in direct communication with the bore of the needle guide throughout its annular extent and is spaced above the lower end of the uniform cylindrical portion of the bore by a substantial distance.

The fuel can now only pass from the upper annular space **15** into the lower annular space **16** which is defined by the lower end of the cylindrical portion of the bore in cooperation with the shoulder **17** of the nozzle needle through two tangential bores **18** which conduct the fuel into the lower annular space **16**. These bores **18** have ports at the upper end opening through the side wall of the nozzle needle in communication with the annular space **15** and have ports at the lower end opening through the shoulder portion **17** of the nozzle needle in communication with the lower annular space **16**. These bores **18** are arranged in off-center relation to the axis of the needle and are inclined with respect to the axis thereof obliquely from their upper to their lower ports.

This construction has the advantage that the cylindrical surface of the needle, with the exception of the small ports at the upper ends of the bores **18**, is not interrupted, which is of particular advantage for obtaining the best possible fit of the needle in the needle guide bore, particularly between the upper annular space **15** and the lower annular space **13**.

Fuel is discharged beyond the valve seat **11** through bores **20** and **21** in the needle guide and screw coupling.

What I claim as my invention is:

1. A fuel injection nozzle for internal combustion engines, comprising a guide having a cylindrical bore communicating at one end with a fuel atomizing port and having a fuel intake port in the form of an annular groove in and surrounding said bore in spaced relationship to the atomizing port axially of said bore, a needle having a sliding fit in said bore, a reduced part on said needle

engageable with an annular seat surrounding the atomizing port and forming an annular chamber between said seat and annular groove, said needle having a cylindrical portion closely and sealingly fitting the bore between said annular groove and fuel atomizing port, and fuel passages in the form of circumferentially spaced open-ended bores through the cylindrical portion of said needle extending obliquely from said annular groove to said annular chamber.

2. The fuel injection nozzle defined in claim 1 in which a frusto-conical seat surrounds the fuel atomizing port for engagement with a frusto-conical surface on the reduced part of said needle, said seat being formed as an integral part of said guide.

3. A fuel injection nozzle for internal combustion engines, comprising a guide having cylindrical bore communicating at one end with a fuel atomizing port and having a fuel intake port in said bore in spaced relationship to the atomizing port axially of said bore, a needle having a sliding fit in said bore, a reduced part on said needle engageable with an annular seat surrounding the atomizing port and forming an annular chamber between said seat and said intake port, said needle having a cylindrical portion closely and sealingly fitting the bore between said intake port and said fuel atomizing port, and fuel passages in the form of circumferentially spaced open-ended bores through the cylindrical portion of said needle extending obliquely from said intake port to said annular chamber.

References Cited in the file of this patent

UNITED STATES PATENTS

1,525,156	Teufl	Feb. 3, 1925
1,952,816	Mock	Mar. 27, 1934
2,110,365	Imfeld	Mar. 8, 1938

FOREIGN PATENTS

562,033	Great Britain	June 15, 1944