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FUEL INJECTION NOZZLE FOR HIGH-SPEED
INTERNAL-COMBUSTION ENGINES
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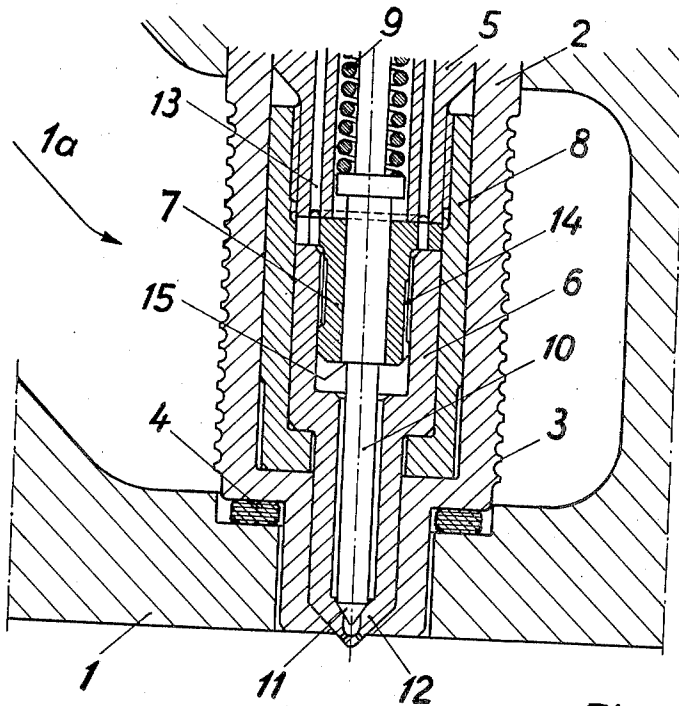


Fig. 1

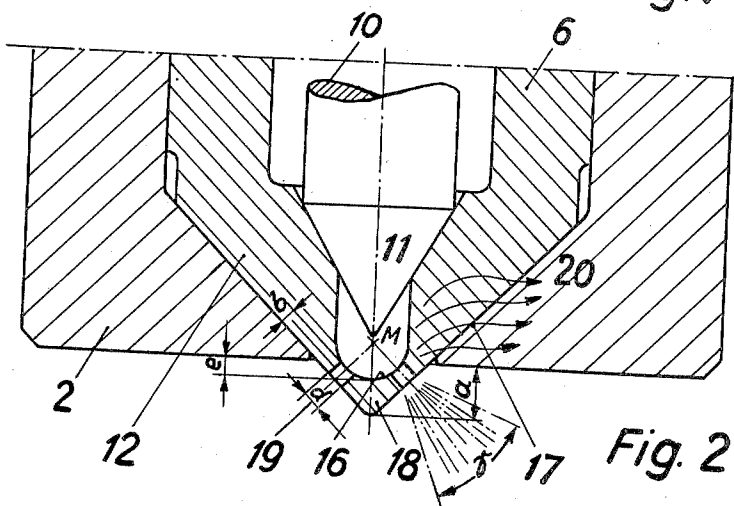


Fig. 2

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FUEL INJECTION NOZZLE FOR HIGH-SPEED INTERNAL-COMBUSTION ENGINES

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1 Claim. (Cl. 299—107.6)

Fuel injection nozzles for direct-injection internal combustion engines are known in which the nozzle head is shaped spherically concave on the inside and is of conical shape on the outside and in which moreover the axes of the injection holes pass through the centre of the hemispherical space and are perpendicular to the external conical surface.

Known nozzles of this type fail to satisfy in high-speed engines because the atomization of the fuel in the short injection time available is inadequate. By the present invention a material improvement is achieved by reducing the minimum distance between the surface of the internal spherical concavity and the external conical surface of the nozzle head to such a dimension that the length of the nozzle holes arranged circularly at these points is not more than twice their respective diameters. By forming the nozzle head with this locally thin wall, the nozzle holes are made so short that the fuel emerges from the nozzle in substantially wider-angle cones of spray. The core of the jet is reduced in proportion to the entire mass of the jet, and the wider-angle cone of spray can now seize and entrain a larger quantity of air.

A further advantage of this arrangement of the nozzle head resides in the fact that the cones of fuel spray emerging from the nozzle holes are relatively short and are therefore unable to impinge on the walls of the combustion chamber, where they would otherwise form incrustations.

Since with the thickness of the shell of the nozzle head reduced in this way the removal of heat is somewhat impaired, it is of advantage for the nozzle head to be encompassed by a cooled nozzle-holder at that portion of its conical section which is located immediately above the nozzle-hole outlets, because in this case the portion of the nozzle head which still projects into the combustion chamber will, owing to the reduction of the exposed surface, absorb less heat from the combustion chamber, whilst such heat as does penetrate into the nose of the nozzle will be conducted away directly into the cooled nozzle-holder.

The drawing illustrates a typical embodiment of the invention.

Fig. 1 shows the lower part of an injector in longitudinal section, and

Fig. 2 shows the head of the injector on an enlarged scale, likewise in longitudinal section.

The injector is part of an air-cooled internal combustion engine and is, to enable it to be cooled by the stream of combustion air entering the engine, located in the air intake port 1a of the cylinder head 1. The internal parts of the injector are accommodated in a cooling jacket 2, made of material of high coefficient of heat-conductivity, which in turn is provided with cooling fins or ribs 3 and is sealed at the bottom of the cylinder head by means of a heat-insulating packing-seal 4.

The nozzle-holder 5 secured in the upper portion of the cylinder head carries at its lower end the nozzle body 6 which is connected to it, with the needle guide sleeve 7 inserted therebetween, by the cap nut 8. The hydraulically controlled nozzle needle 10 urged by the spring 9 bears with its lower end 11 against the inner wall of the nozzle head 12.

The fuel oil delivered by a fuel pump is supplied to the nozzle head through ports 13 and slit filters 14 and, when the injection pressure is reached, lifts the nozzle

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needle 10 by the shoulder 15 against the pressure of the spring 9.

As is shown on an enlarged scale in Fig. 2, the tip 11 of the nozzle valve needle projects into a cylindrical bore with a hemispherically-shaped lower limiting surface 16, the tip of the needle being located approximately in the centre M of the hemisphere. On the outside the nozzle head is of conical shape, its angle of conicity being about 90° both in the seating 17 and at the point 18. The axes of the nozzle holes 19 pass exactly through the centre M of the hemisphere 16 and are exactly perpendicular to the line of the shell of the nozzle head cone. The spherical concavity extends extremely close to the external conical surface, so that the minimum distance b between the internal spherical concavity limiting surface 16 and the external conical surface of the nozzle head 12 is very small. The length b of the nozzle holes does not exceed twice their diameter d. As a result of this arrangement, the fuels emerge from the nozzle in spray cones of wide angle δ.

In order to render as favourable as possible the conditions of cooling of the nozzle head 12, the conical seating 17 of the cooling sleeve or jacket 2 is extended into the immediate vicinity of the outlets of the nozzle holes 19, so that the distance e is not more than twice the diameter d of the holes. Accordingly, the nose 18 of the nozzle projects only by the amount "a" into the combustion chamber and exposes a correspondingly small heat-absorbing surface to the hot gases. Such quantity of heat as still does penetrate into said nozzle nose 18 can then be readily conducted away by the nozzle wall, which rapidly thickens as it distances itself from the nozzle holes, and be transferred, in the taper seating 17, directly into the cooling jacket 2 (see arrows 20).

It can thus be seen that in accordance with the present invention there has been provided a fuel-injector device for high-speed and air-cooled combustion engines having a combustion chamber into which extends a cylinder head having a bore; said device further including a cooling jacket made of a material of great heat conductivity and having a cylindrical hollow forward end portion with an inner seating surface, a needle-operated fuel nozzle terminating in a head disposed within said forward end portion of said cooling jacket, said nozzle head being provided with a conically shaped inner seating surface and with a continuous and conically shaped outer surface, said outer surface of said nozzle head including a forward pointed end portion forming a hollow tip provided with nozzle openings passing through said tip and directed toward said combustion chamber, the remainder of said outer surface of said nozzle head being positioned rearwardly of said tip and forming a seat cooperable with said inner seating surface of said cooling jacket, the forward end of said needle being disposed rearwardly of said nozzle tip and engageable with said inner seating surface in said nozzle head, so that, when said tip and said openings extend beyond said inner seating surface of said forward end portion of said cooling jacket into said combustion chamber, said needle end is located remote from said nozzle tip, said end portion of said cooling jacket extending through said bore of said cylinder head and providing a space therebetween, said cylinder head and said cooling jacket being provided with shoulders, and heat-insulating packing means seated intermediate said shoulders and in communication with said space.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent, is:

In a fuel-injector device for high-speed and air-cooled combustion engines having a combustion chamber into which extends a cylinder head having a bore; a cooling jacket made of a material of great heat conductivity and having a cylindrical hollow forward end portion with an inner seating surface, a needle-operated fuel nozzle terminating in a head disposed within said forward end portion of said cooling jacket, said nozzle head being provided with a conically shaped inner seating surface and with a continuous and conically shaped outer surface, said outer surface of said nozzle head including a forward pointed end portion forming a hollow tip pro-

vided with nozzle openings passing through said tip and directed toward said combustion chamber, the remainder of said outer surface of said nozzle head being positioned rearwardly of said tip and forming a seat cooperating with said inner seating surface of said cooling jacket, the forward end of said needle being disposed rearwardly of said nozzle tip and engageable with said inner seating surface in said nozzle head, so that, when said tip and said openings extend beyond said inner seating surface of said forward end portion of said cooling jacket into said combustion chamber, said needle end is located remote from said nozzle tip, said end portion of said cooling jacket extending through said bore of said cylinder head and providing a space therebetween, said cylinder head and said cooling jacket being provided with shoulders, and heat-insulating packing means seated intermediate said shoulders and in communication with said space.

References Cited in the file of this patent

UNITED STATES PATENTS

	1,761,122	Groff	June 3, 1930
	1,850,227	Dinner	Mar. 22, 1932
5	1,990,875	Mock	Feb. 12, 1935
	2,144,861	Truxell	Jan. 24, 1939
	2,175,450	Thege	Oct. 10, 1939
	2,231,937	Meyer et al.	Feb. 18, 1941
10	2,250,364	Fiedler	July 22, 1941
	2,322,606	Ward	June 22, 1943

FOREIGN PATENTS

767,717	France	May 7, 1934
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