

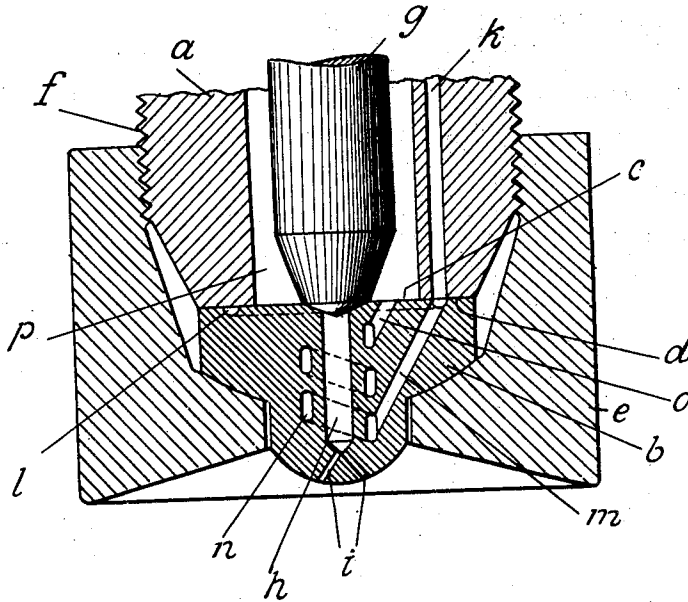
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COOLING DEVICE FOR INJECTION NOZZLES OF INTERNAL COMBUSTION ENGINES

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COOLING DEVICE FOR INJECTION NOZZLES OF INTERNAL COMBUSTION ENGINES

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This invention relates to a device for cooling the injection nozzle of an internal combustion engine of the kind working with solid injection and in which cooling spaces are arranged in or around the nozzle. In this type of internal combustion engines difficulties may arise at the injection of certain kinds of fuel oil, especially oils having a high degree of viscosity. The difficulties are caused in such devices due to the fuel oil becoming partly coked during injection, and forms considerable deposits of coke at the surface of the fuel injection nozzle, so that the atomization of the fuel is disturbed with the result that the combustion in the cylinder becomes less complete. The coking is supposed to be due to the fact that the viscous oil has a tendency to cling with a considerable force to the edge of the atomizing passages. It has been attempted to overcome the said defect by providing the injection nozzle with cavities through which cooling water is circulated, and a considerable reduction in the deposit of coke has been obtained thereby, but these known devices have several deficiencies. Firstly the fuel valve is complicated owing to the arrangement of water passages with tube connectings and the like, and secondly leakage between the fuel oil compartments and water compartments may cause the oil to be mixed with water, which mixture is thus introduced into the cylinder, or this leakage may cause the water to pass directly into the cylinder, which is objectionable. On the other hand the water may become contaminated by oil, which is also objectionable. The said deficiencies of the known devices are avoided by this invention, according to which fuel oil is employed for the cooling of the injection nozzle, i. e. the same oil which is used for the combustion. In other words, the invention may be characterized thereby that the cooling chambers are provided in or around the nozzle, and communicate with inlet and outlet means for the circulation of fuel oil, and that the piping system for the fuel oil serving the cooling purpose is connected with the fuel injection means of the engine so that the fuel oil is employed both for cooling purposes and for injection into the

engine cylinder. According to the invention the fuel oil used for cooling is caused to pass with great velocity through the cooling spaces in or around the nozzle thereby that the cooling spaces have a suitable small passage area relative to the pressure with which the oil is pressed through the cooling spaces and relative to the passing quantity of oil.

The arrangement according to the invention is so that the cooling oil is pumped in by the fuel injection pump of the engine through the cooling passages of the injection nozzle during the injection period, whereby it exerts its cooling effect upon the nozzle and is immediately thereafter injected into the engine cylinder. To this end the cooling passages of the nozzle communicate at one extremity with a supply pipe for fuel oil from the fuel injection pump of the engine and at the other end with the compartment of the fuel valve from which the injection into the engine cylinder takes place.

In the accompanying drawing the invention is illustrated.

The drawing shows a constructional form, seen in section through a part of the fuel valve.

In the drawing *a* is the lower part of the fuel valve housing, *b* a fuel injection nozzle having a plane surface *c*, which lies close to a corresponding plane surface *d* of the valve housing *a*. *e* is a screw cap holding the nozzle when it is screwed on to a threaded portion *f* of the valve housing *a*. *g* is the lower portion of a valve spindle terminating at its lower end in a cone which coacts with the conical valve seat of the nozzle *b*, which is provided with a central fuel passage *h* communicating with the engine cylinder (not shown) through atomizing passages *i*. The valve housing has a fuel oil supply passage *k* opening into its end surface *d* and communicating through an annular recess *l* in the surface *c* of the nozzle with a passage *m*, the other end of which communicates with a helical cooling passage *n* formed in the nozzle surrounding the passage *h*. At the top this cooling passage *n* communicates with the annular space *p* around the lower part of the valve spindle *g*. The device acts as follows: During the

pressure stroke of the fuel injection pump fuel oil is supplied through the passages *k*, *m* and passes with great velocity through the cooling passages *n*. Hereby the injection nozzle is cooled considerably, although the cooling takes place only during the comparatively short time corresponding to the injection period, because the great velocity of the fuel oil renders the transmission coefficient between metal and oil very great. While the fuel oil exerts its cooling effect upon the nozzle it is heated, so that it becomes less viscous whereby its tendency to cling at the edges of the atomizing passages is reduced. Having passed the cooling chambers *n* the fuel oil passes through the passage *o* to the space *p*, where its pressure causes the spindle to lift, so that the oil is allowed to pass further on through the central fuel passage *h* and the atomizing passages *i* into the combustion chamber of the engine cylinder.

The invention may be performed in many other ways than shown and specified above only by way of examples.

I claim:

1. A device of the class described comprising a housing for connection with an internal combustion engine cylinder, a fuel ejecting nozzle fitted to the housing, said nozzle having a central fuel discharge passage and a helical fuel passage surrounding the former and discharging into the housing, said central passage having a seat at its upper end, a valve spindle in the housing cooperatively associated with the seat, said nozzle having atomizing passages therein affording communication between the central passage and engine cylinder, means for conducting fuel oil to the nozzle, and a passage in the nozzle connecting the fuel oil conducting means and the fuel passage as and for the purpose set forth.

2. A device of the class described comprising a housing for connection with an internal combustion engine cylinder, an injection nozzle fitted to the housing and having a central fuel passage therein, a seat at one end of the passage, a valve spindle cooperatively associated with the seat, said nozzle having atomizing passages therein affording communication between the central passage and engine cylinder and having a helical passage therein surrounding the central passage, means for injecting fuel oil into the spiral passage for discharging into the housing, said valve spindle when unseated permitting discharge of fuel oil into the central passage and into the atomizing passages.

3. As a new article of manufacture, a fuel injection nozzle having a central fuel passage and atomizing passages communicating with its lower end, said nozzle having a helical passage surrounding the central passage for conducting fuel oil to the upper end of the central passage.

4. A device of the class described comprising a housing for connection with an internal combustion engine cylinder, an injection nozzle fitted to the housing and having a central fuel passage therein, a seat at one end of the passage, a valve member cooperatively associated with the seat, said nozzle having atomizing passages therein affording communication between the central passage and engine cylinder and having a cooling passage therein surrounding the central passage, means for conducting fuel oil for cooling purposes to the said cooling passage and to said central passage for injection into the engine cylinder.

5. A device of the class described comprising a housing for connection with an internal combustion engine cylinder, an injection nozzle fitted to the housing and having a central fuel passage therein, a seat at one end of the passage, a valve member cooperatively associated with the seat, said nozzle having atomizing passages therein affording communication between the central passage and engine cylinder and having a cooling passage therein surrounding the central passage, means for injecting fuel oil into the cooling passage for cooling purposes and further for discharging from said passage into the space of the housing above the valve seat, the valve member when being thereby unseated permitting discharge of fuel oil into the central passage and into the atomizing passages for injection into the engine cylinder.

6. A device as claimed in claim 5 wherein the cooling passage is helical.

In testimony whereof I affix my signature.

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