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LIQUID COOLED VALVE FOR INTERNAL COMBUSTION ENGINES

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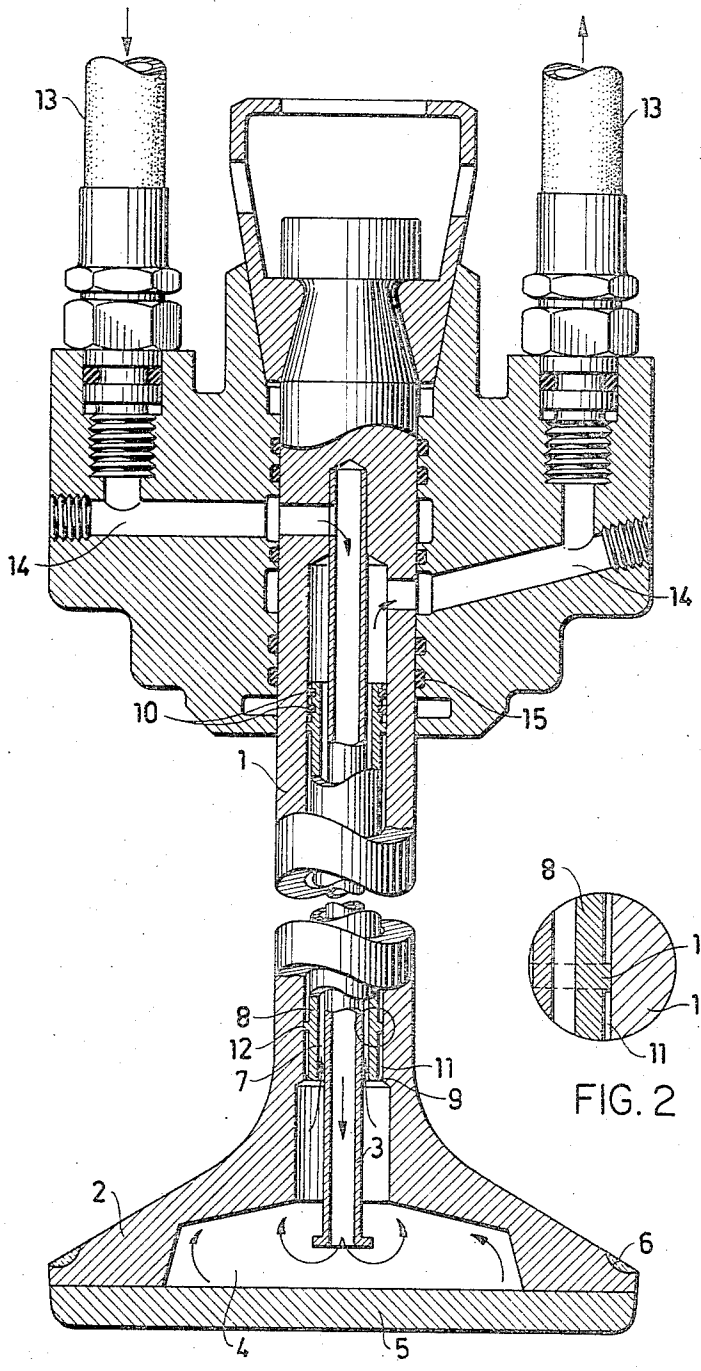


FIG. 1

FIG. 2

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LIQUID COOLED VALVE FOR INTERNAL COMBUSTION ENGINES

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In different types of combustion engines, the need arises to limit the temperature in highly stressed components, particularly at the sealing surfaces of the exhaust gas valves. This is particularly important in Diesel engines and is accentuated if the engine is operating on high-viscosity fuel which is desirable in view of the fact that this type of fuel is considerably cheaper than the more refined qualities. As a matter of fact, the price difference is so great that it has been open-mindedly accepted that the use of the cruder fuel is cheaper, even though it will entail an increase in the service and maintenance costs of the engine, because the useful life of the exhaust gas valves is considerably shortened.

Beyond the conventional reasons for limiting the temperature at the exhaust gas valves, i.e. to attain a lesser reduction of the mechanical strength arising due to the high exhaust gas temperature at high power outputs—there exists in Diesel engines of the type referred to still another reason to have the valves efficiently cooled, viz. the chemical and mechanical attacks on their sealing surfaces which occur because of the comparatively high contents of certain contaminations in this particular type of fuel. The most important contamination is vanadium forming vanadium pentoxide, V_2O_5. This compound has a heavily corroding influence on the valve sealing surfaces if the temperature is too high. Hitherto the problems mentioned above have been approached in substantially four different methods.

The first method involves the use of more resistant materials in the valve proper and for its sealing surfaces. Coatings of hard metal such as stellite have been used; however, this approach has not been very successful.

According to another method, chemical additives are used in the fuel. Apart from not being economical this solution has proved to be of very questionable value.

The third method involves cooling the valves with sodium. It has, however, turned out that the cooling action is quite insufficient for Diesel engines operating on high-viscosity fuel.

The fourth approach involves a circulating cooling agent, in most cases water, introduced into the valve proper. For that purpose the valve stem is provided with an axial bore into which is inserted a tube, the outer diameter of which is considerably smaller than the bore. The cooling agent is introduced through the tube and returns through a passage of annular cross-section formed around the tube. While such an arrangement yields most satisfactory results as far as the cooling of the valve seats is concerned it has the considerable disadvantage of greatly increasing the wear of the valve stem. This wear, or rather corrosion, arises because the cooling of the valve stem permits sulphuric compounds to condense thereon.

The object of the present invention is to provide a device permitting the use of a water-cooled valve, which in turn yields the necessary lowering of the temperature at the valve seat without causing such an extensive cooling of the valve stem that the disturbing condensation phenomenon just referred to can arise. This has been achieved by the use of a heat-insulating layer surrounding said annular cross-section passage.

The invention will now be described in greater detail,

reference being made to the accompanying diagrammatic drawing:

FIGURE 1 is an axial section through a valve illustrating one embodiment of the invention. FIGURE 2 is an enlargement of one portion of the axial section.

Reference numeral **1** designates the stem and numeral **2** the head of a disk valve, e.g. an exhaust gas valve for a Diesel engine. Inside the stem there is, in a manner known per se, mounted an insert tube **3** extending into the head portion **2** and opening into chamber **4**. The latter is covered by a lid **5** welded to the rim of valve head **2**. Numeral **6** refers to a coating of stellite or some similar material.

The cooling agent, such as water, is accordingly supplied to the central tube **3** and flows from there to the chamber **4**. Thence it returns through the annular cross-section passage **7** formed between the tube **3** and the surrounding portion of the stem. However, according to the present invention the outer wall of the return flow passage **7** is not defined by the stem proper because between the latter and tube **3** there is arranged a jacket **8** extending along the greater portion of tube **3**. At its inner end, jacket **8** is welded to the valve as shown at **9** whereas the outer end is journalled in sealing rings **10** contacting the wall of the bore. In this manner disturbances caused by possible differences in the heat expansion properties of the various materials concerned are eliminated.

As appears most clearly from the drawing jacket **8** is provided with a number of axially spaced flanges **12**. In that way there is formed along the major portion of the stem air chambers **11** of annular cross-section. They serve as heat-insulating layers preventing the surface temperature of the valve stem from being reduced to such a low value that the unfavorable condensation phenomenon above referred to could take place.

The cooling agent is supplied to and derived from the valve through flexible hoses **13** communicating with bores **14** arranged in the stem guiding member. Sealing between that member and the stem may be attained by the use of O-rings **15**.

The invention may in several respects be modified within the scope of the appended claims. According to the simplest embodiment the heat-insulating layer is constituted by air but, in principle, any suitable material can be used. If the outer diameter of the valve stem is e.g. 24 mm., then the diameter of the bore may amount to 12 mm. and the outer diameter of the insert tube equal 8 mm. The latter tube as well as the jacket could suitably have a wall thickness of the order of magnitude of 1 mm. The width of the air chamber is very small, generally between 0.2 and 0.4 mm. The spacing between the rings **12** could be approximately 100 mm.

We claim:

1. A liquid cooled disk valve for an internal combustion engine comprising in combination:

(a) a hollow valve stem,

(b) a valve head mounted on said stem, the inner walls of said valve head defining a cooling chamber,

(c) an annular insulating jacket coaxially mounted within said valve stem, said jacket having at least one annular ridge mounted on the exterior wall of said jacket and adjacent to the inner walls of said valve stem,

(d) an insulating layer lying between the inner wall of said valve stem and the exterior wall of said insulating jacket, and

(e) a coolant supply tube coaxially mounted within said insulating jacket to supply a coolant to said valve head, the exterior wall of said supply tube and the interior wall of said insulating jacket defining an annular return passage for a coolant from said valve head,

whereby the coolant is thermally separated from said valve stem by said insulating layer.

2. A liquid cooled disk valve for an internal combustion engine as set forth in claim 1, wherein the insulating layer is air.

3. A liquid cooled disk valve for an internal combustion engine as set forth in claim 1 wherein:

(a) the annular insulating jacket is rigidly connected to said valve stem at the valve head end of said stem, and comprising

(b) at least one sealing ring coaxially mounted within said valve stem at the opposite end from said valve head, said ring surrounding said insulating jacket to define a sealed annular chamber between said insulating jacket and said valve stem.

4. A liquid cooled disk valve for an internal combustion engine as set forth in claim 1 wherein there are several annular rings mounted between said insulating jacket and said valve stem to define several insulating annular chambers.

5. A liquid cooled disk like valve for an internal combustion engine comprising in combination:

(a) A hollow valve stem,

(b) a valve head mounted on said stem, the inner walls of said valve defining a cooling chamber,

(c) an annular insulating jacket coaxially mounted within said valve stem and adjacent to the inner walls of said valve stem, and

(d) a coolant supply tube coaxially mounted within said insulating jacket to supply a coolant to said valve head, the exterior wall of said supply tube and the interior wall of said insulating jacket defining an annular return passage for a coolant from said valve head,

whereby the coolant is thermally separated from said valve stem by said insulating layer.

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