

Jan. 23, 1940.

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2,188,248

VALVE FOR COMBUSTION MOTORS

Filed Dec. 28, 1938

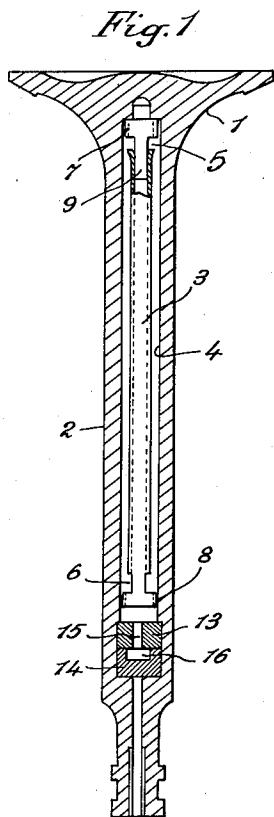


Fig. 2

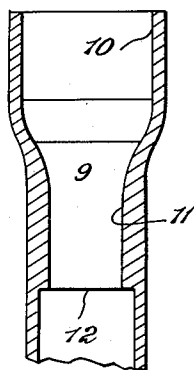
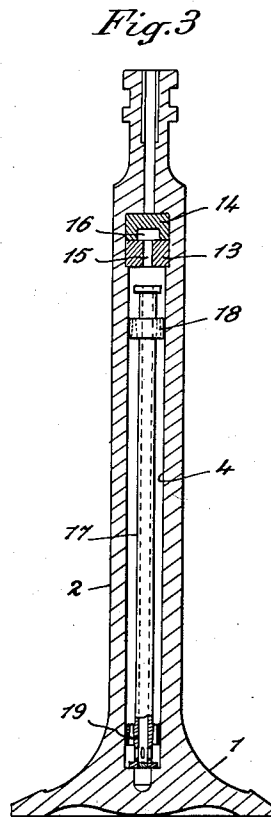
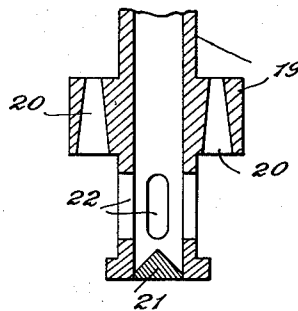


Fig. 4



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2,188,248

VALVE FOR COMBUSTION MOTORS

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Application December 28, 1938, Serial No. 248,098
In Italy February 23, 1938

6 Claims. (Cl. 123—177)

The present invention relates to a mushroom-like valve for combustion motors with cooling device by forced liquid sodium circulation.

The continual increase of speed of the vehicles with combustion motors necessarily requires a corresponding increase of the specific efficiency of said motors which in turn requires an increase of the number of revolutions and of the compression ratio, and consequently of the temperature in the explosion chamber of the cylinder. It was thus indispensable to examine again the functioning of some vital parts or members of the motor in order to modify them according to the new exigencies of the work.

The mushroom-like member of the exhaust valve of present motors is subjected to very high temperatures, consequently the problem of its cooling has presented itself. Types of improved valves are already known in which cooling is obtained by a thermosyphon liquid sodium circulation in the interior of the stem. But even leaving out of account the fact that said prior cooling system can only be effected with valves having the mushroom directed downwards and the stem extending upwardly therefrom, that is, the valves mounted on the head of the cylinder, the proper sodium circulation is not always secured and may be insufficient.

According to the present invention a cooling device is provided by means of which all these difficulties are removed. My improved valve contains metallic sodium or other metallic alloy with a low melting point and a high ebullition point passing to the liquid state, when the valve's mushroom surpasses a certain temperature, and a forced variable circulation begins with the variation of the temperature of the mushroom. Said circulation is obtained by means of a moveable member put in motion by the reciprocatory motion of the valve.

According to one of the modifications of the invention, said moveable member comprises a small pumping tube, completely immersed in the metal and so shaped that when being reciprocated owing to inertia in consequence of the reciprocation of the valve, a circulation of the metal is produced in proximity of the mushroom of the valve. Of course, as the fluidity of the metal increases with the increasing temperature, the efficiency of the pump device is consequently greater, and a valve is provided which automatically controls the delivery of heat from the mushroom head of the valve.

A form of realization of the invention is illus-

trated in the accompanying drawing in which:

Fig. 1 is a vertical section of a type of valve according to the present invention with the pump device partially sectioned;

Fig. 2 is a detail of the device according to Fig. 1;

Fig. 3 is a vertical section of another type of valve according to the present invention with the pump device partially sectioned;

Fig. 4 is a detail of the device according to Fig. 3.

In all the figures the same reference numbers indicate the corresponding parts of the valve.

With reference to the drawing the valve comprises a mushroom 1 and a hollow stem 2, within which, as shown in Fig. 1, may slide a tube 3 with a length a little smaller than the cavity 4 provided within the stem 2. This tube 3 is provided at the ends with two small windows or openings 5—6, and two guiding rings 7—8, these rings allowing the tube to reciprocate within the cavity 4. At the upper end of the tube, adjacent the small opening 5, there is a connecting piece 9 illustrated in detail in Fig. 2. This piece is so shaped that the internal diameter 10 of its upper part, is greater than the internal diameter 11 of its lower part, so that between the body of the tube 3 and the connecting piece, a step or annular shoulder 12 is formed. The cavity 4 is filled with sodium or other convenient metal, so that the tube 3 may be completely immersed therein, and such cavity is closed at the bottom by means of two plugs 13—14, said plugs being then sealed for instance by throttling the end of the stem as illustrated in the figure, that is, by forging or rolling in a lathe with special tools. The plug 13 has a hole 15 in its middle part in order to permit the dilatation of the sodium, while the plug 14 is provided with a cavity 16 designed to receive a part of the sodium when the latter surpasses the temperature of 500° C.

The forced circulation of the metal, when the latter is in the liquid state, is due to the fact that when the valve, for instance, is pushed upwards, the tube 3, owing to inertia, follows the valve, the liquid being compressed at the upper end of the tube 3 by the connecting piece 9, flows through the valve, and runs downwards through the tube 3, flowing out through the openings 6, these openings being on purpose larger than the openings 5 provided at the upper end of the tube 3.

During the downward movement of the tube, on the other hand, the liquid is sucked by the connecting piece 9, and it ascends again within

the space between the tube 3 and the cavity 4, and returns into the tube 3 through the openings 5. In this way by means of the reciprocatory motion of the tube 3, a continual circulation of the liquid metal within the stem of the valve is realized, a circulation which is the more intense the more the liquid is fluid, that is when the temperature of the valve is greater.

A modification of the device according to the present invention is illustrated in Figures 3 and 4, in which the tube 17 is immersed, as in the form of realization already illustrated, in the metal contained in a chamber 4 provided within the stem 2 of the valve, and closed by the plugs 13 and 14. This tube 17 is provided near its ends with two guiding rings 18 and 19 in which there are provided, on the outside of the tube 17 some holes 20, as shown in detail in Fig. 4, with cross section of a trapezoidal shape, with the larger side downwards. The end of the tube 17 nearest to ring 19, is closed by means of a suitable member or plug 21, and is provided with holes 22.

When the tube 17 moves upwards the liquid metal is obliged to descend in the interior of the tube, to flow out through the holes 22 and run upwards again through the holes 20, which in this direction offer a smaller resistance in the interval existing between the cavity 4 and the tube 17. When this tube moves downwards the liquid flows through the holes from below upwards (this being the direction of smaller resistance), and descends as at first in the interior of said tube 17. In such a way as according to the preceding form of realization illustrated, the reciprocating motion of tube 17 produces a continual circulation of the liquid metal, circulation which is the more intense the greater is the temperature of the valve.

In other words, the cooling means which fills up the cavity of the valve stem 2, when converted into a liquid state, has all of its molecules in movement, due to the difference of caloric potentials. The molecular movement is convective. The small internal tube 17, the characteristics of which are indicated above, serves, when the valve is reciprocating for orientating the molecules which are in convective movement towards the axis of the valve and to augment the velocity of these molecules which are in movement by means of an aspiration.

The present invention has been illustrated and specified according to a preferred form of realization, but of course it is understood that constructive changes may be made therein without departing from the spirit of the invention as expressed in the claims.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:

1. A valve of the character described, adapted to operate back and forth rapidly while having the valve head subjected to high temperatures, said valve having a closed chamber therein containing a cooling medium having a low melting point and a high ebullition point, and a movable member in said chamber adapted to reciprocate with said valve for circulating the cooling medium in a liquid state from one end of said chamber to the other, said circulation being more intense as the temperature of the valve heat increases.

2. A valve as claimed in claim 1 in which the movable member comprises a tube completely immersed in the cooling medium and provided with apertures at its opposite ends.

3. A valve of the character described adapted to operate back and forth rapidly while having the valve head subjected to high temperatures, said valve having a closed chamber therein containing a cooling medium having a low melting point and a high ebullition point, a tube completely immersed in the cooling medium in said chamber and adapted to reciprocate with said valve, said tube being provided with openings at its opposite ends communicating with said chamber, a connecting piece at one end of said tube offering a small resistance to the passage of liquid in one direction and a higher resistance to the passage of liquid in the opposite direction, said tube being adapted to reciprocate with said valve for circulating the cooling medium in the liquid state from one end of said chamber through said tube to the other end of said chamber, said circulation being more intense as the temperature of the valve heat increases.

4. A valve as claimed in claim 3 in which the tube is provided with guiding rings at opposite ends thereof for guiding the tube in said chamber during the reciprocatory motion, and the apertures in said tube are arranged in proximity to said rings.

5. A valve as claimed in claim 3 in which the tube is provided at opposite ends with guiding rings, said rings being provided with bores having trapezoidal shape in cross section offering limited resistance to the passage of the liquid in one direction and greater resistance of the passage of liquid in the opposite direction.

6. A valve as claimed in claim 1 in which the chamber in said valve is closed by means of two plugs, the first of which is provided with a central bore to permit the passage of cooling medium therethrough and the second being provided with an expansion chamber to receive said cooling medium when the temperature of said cooling medium reaches a predetermined limit.

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