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HOLLOW VALVE STRUCTURE

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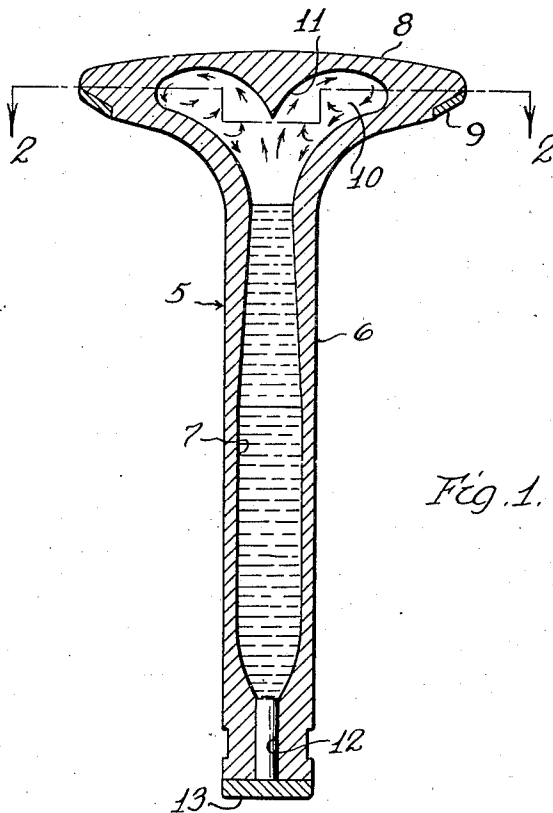


Fig. 1.

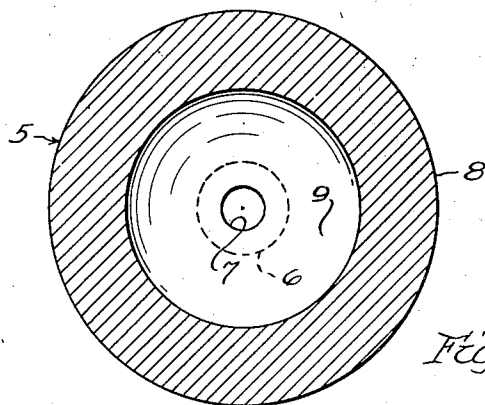


Fig. 2.

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HOLLOW VALVE STRUCTURE

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1 Claim. (Cl. 123—177)

This invention relates to hollow valves in general, and, more particularly, concerns the internal shape of the hollow head of a sodium cooled poppet valve as used in internal combustion engines and the like.

A hollow valve generally of the type shown herein and provided with a coolant medium in the cavity thereof is shown in Patent No. 1,670,965 issued to S. D. Heron for "Cooling of exhaust valves for internal combustion engines" and under which applicant's assignee has an exclusive license. The characteristic and distinguishing feature of the present invention thereover resides in the outline of the cavity in the hollow valve head. As is well known, and disclosed in the above patent to Heron, the coolant is preferably a mixture of sodium and potassium nitrate which liquefies readily above 428° F., which is well below the normal operating temperature of the valve, and thereafter is caused by the rapid valve reciprocation to wash the walls of the hollow valve cavity and wipe the heat off from the hotter hollow head and seating portions to lower the temperature thereof and conduct the heat through the liquid down to the lower stem regions and out the valve guide concentrically surrounding the valve stem. It has been determined by experimentation with a transparent hollow glass valve filled with a colored liquid, so the movement thereof could be readily followed, and caused to reciprocate in a motion simulating valve action that improvement could be made in the circulation and flow of the liquid coolant sealed therein. From observation it was determined that the liquid coolant striking the generally flat cavity in the end of the head of the Heron valve was deflected partially outward toward the inner face of the valve seating surface and partially directly downward where it interfered with coolant in the flow returning to the stem regions, and hence an objectionable surging and turbulence was produced which interfered with the smooth and efficient flow of coolant which might be expected, and is desirable. Accordingly, it was suggested that the contour of the outline of the cavity in the end of the valve head be shaped according to the teaching of the present invention and such objectionable eddying or surging of the liquid coolant would be obviated.

The primary object of the present invention is the provision of a valve having a hollow head and stem cavity therein for reception of a coolant liquid at valve operating temperatures in which the outline of the cavity in the end of the

valve head is contoured so as to produce the most efficient circulation of the liquid coolant therein during valve operation; the provision of a hollow valve as above described in which the outline of the cavity in the valve head assumes a depending conical form having an apex in line with the axis of the communicating stem cavity whereby liquid coolant is caused to be directed equally radially outward therefrom toward the outer regions of the cavity to the inner face of the valve seat and return downward along the inner wall of the valve throat to the lower stem regions.

Another object of the invention is the provision of a structurally improved hollow valve of the character described without necessitating any increase in manufacturing costs and which provides a valve of increased operating efficiency.

Further and other objects and advantages of the invention reside in the novel combination and arrangement of parts as will be apparent from the accompanying drawing, forming a part of this specification and about to be described, and pointed out with particularity in the appended claim.

In the drawing like reference characters denote corresponding parts in the different views, and in which:

Fig. 1 is a vertical sectional view through a hollow valve with a hollow cavity partially filled by a coolant and illustrating the teaching of this invention; and

Fig. 2 is a sectional plan view taken on the line 2—2 of Fig. 1.

Now having reference to the drawing there is illustrated a valve generally designated 5, having a hollow cavity therein for reception of a coolant. The valve 5, has a stem 6 with an axial cavity 7 therein, and an integral head portion 8, having an external annular seating surface 9, and generally circular interior cavity 10 extended to adjacent the seating surface 9. Within the head cavity 10, which is in communication with the axial stem cavity 7, a conical shaped projection 11 is formed integral with the head end of the wall of the cavity and centrally disposed with its apex directed toward the longitudinal axis of the stem cavity. Since the method of constructing this valve forms no part of this invention, and only the improved structure thereof producing a more efficient circulation of the coolant to be contained therein is claimed, it will be sufficient to state that such a valve may be made according to the method disclosed in Patent No. 1,950,953 issued to W. Scrimgeour for "Hollow forged valve and method of making same." In

the patent just mentioned the valve is initially formed from a cylindrical billet or blank that is bored out to leave an end wall having a boss therein, and thereafter the blank may be operated upon by die-shaping and related operations on the closed end of the blank to form the head and shape a conical apex therein. After formation of the head the elongated valve stem is produced by swaging or rolling. To close the end of a valve such as shown herein a tapered plug is driven into a reduced opening 12 in the foot end of the stem after a quantity of coolant has been introduced into the stem cavity 7 to fill about 60% of the total capacity of the stem and head cavity; and thereafter to provide further insurance against fluid leakage during severe operating conditions and to afford a suitable life to the cam or tappet contacting end of the valve a hardened wear-resisting disc 13 is butt-welded thereto. For more detailed information as to the construction of such a valve reference may be made to the above mentioned Scrimgeour patent.

The operation of this improved valve structure as regards more efficient flow and circulation of the liquid coolant therein and to reduce turbulence or surging is as follows: During valve operation the valve is reciprocated rapidly up and down and the liquid coolant therein free to move relative thereto is caused to be agitated by inertia force toward the head end of the valve. When the coolant strikes the apex of the central conical projection 11 axially opposite the upper end of the stem cavity the body of the liquid coolant is split up and deflected radially outward in all directions to the outer regions of the circular cavity in the head end of the valve toward the inner face of the valve seating surface and then reversed in direction again so as to flow back along the inner depending wall of the cavity forming the valve throat. Due to the regulated flow the coolant returning to the stem cavity hugs the outer wall thereof and transfers its heat content therethrough to the cooler concentric valve guide external thereto. This is to be distinguished from the unregulated movement of the coolant in the Heron valve wherein he produces only violent turbulence during

valve action which causes surging or eddying and interference of fluid flow to and from the head cavity and hence something less than the regulated improved circulation of coolant as disclosed in this invention.

From the foregoing disclosures it will be apparent there has been described an improved hollow valve structure for more efficient flow and circulation of a coolant contained therein which accomplishes, among other things, the objects and advantages of the invention first enumerated. It is not intended, however, to be limited to the specific structure illustrated which is merely for purposes of illustration but to include other internal combustion engine parts having liquid cooled cavities therein and subjected to similar operating conditions, as will be apparent to those skilled in the art to which this invention relates, therefore, formal changes may be made in the illustrated structure without departing from the spirit and substance of the invention as defined by the scope of the following claim.

What I claim is:

25 A valve having a head and integral stem portion with communicating cavities therein, the stem cavity being axially disposed and extended substantially to the lower end of the stem and the head cavity extended transversely thereacross, said cavities being adapted to receive a coolant medium partially filling the same and which is liquid at the normal working temperature of the valve to permit circulation thereof under operating conditions, said head cavity in 35 said valve having an end wall with a central depending conical portion with its apex in line with axis of the stem cavity, and said stem cavity having an upper end of reduced cross section to localize and direct coolant medium toward said conical apex thereabove, whereby 40 coolant medium in motion during operating conditions of the valve is caused to be deflected outward by said cone toward the upper and outer regions of the head cavity and return flow is 45 urged to adjacent the lower outer cavity walls.

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