

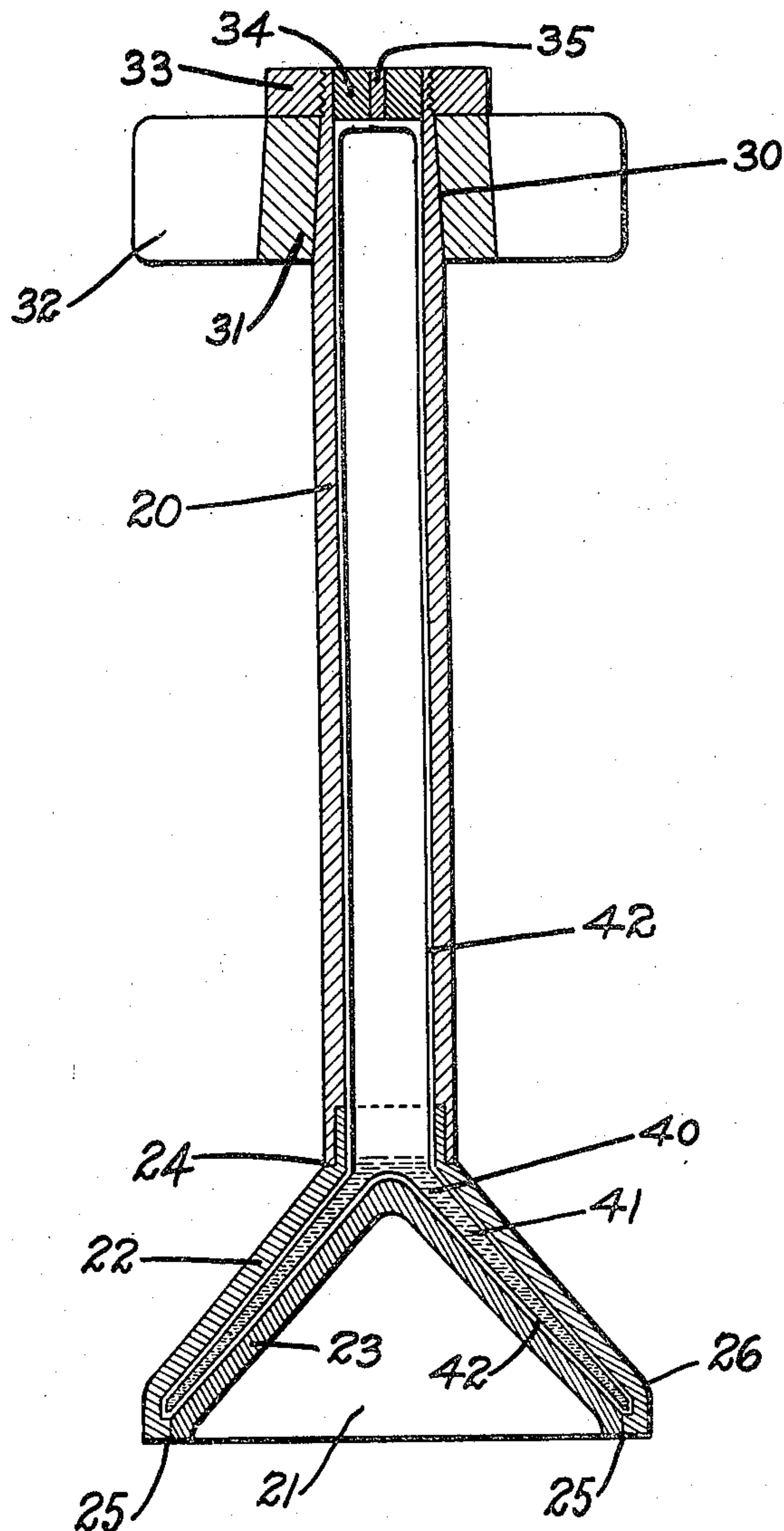
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COOLING DEVICE FOR VALVES AND THE LIKE

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Witnesses

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COOLING DEVICE FOR VALVES AND THE LIKE.

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The present invention relates to improvements in the manufacture of parts of cooling devices in which the transfer of heat from one metallic body to another is relied upon to produce the desired cooling effect.

As an instance of one particular form of application of such invention, the present description relates to valves of internal combustion engines. By utilizing my improvements, these valves are adapted to be cooled by the transfer of heat by a body of mercury, referred to herein as the working medium or working mercury, which vaporizes or boils in contact with the heated surface, and the vapor is brought into contact with a heat absorbing or cooling surface.

A device of this character may consist of a valve or other engine part having a hollow body which is subjected to the heat caused by the engine operation. This valve contains a small quantity of working mercury, portions of which, when vaporized by the heat, pass up the hollow stem of the valve into a cooling portion thereof, (preferably provided with cooling ribs), and the cooled or condensed vapor falls back to the working mercury, which process of vaporization and cooling dissipates the heat and materially reduces the temperature around the valve head.

It will be understood that the devices referred to are applicable not only to valves, but also to other parts of the engine, or to other devices, which in operation are subjected to considerable heat and which it is desired to cool. However, as a specific embodiment of my improvements, the description which follows will be directed more particularly to valves of engines of the character described.

Among the objects of the present invention are to provide devices of the above character with improved means for facilitating the transfer of heat from the part to be maintained at a desired temperature or cooled; to increase the efficiency of valves of the kind above referred to, and to insure that the cooling action shall take place before the valve becomes too highly heated.

In accordance with my present invention, I provide devices of the character described with heat dissipating or transferring bodies, as a result of which the valve or the like will be maintained in a cooled condition in an ex-

tremely effective manner. These heat transferring bodies may be a metallic or amalgam coating or veneer on the interior of the hollow valve, and this heat transferring body appears to have the effect of facilitating the transfer of the heat from the metal of the valve to the working mercury, and vice versa. In other words, it possesses the quality of providing good thermal contact, so that heat readily flows from it to the mercury and vice versa, and also from the metal of the valve to it, and vice versa. As the result, the mercury is raised to a boiling point more rapidly than would be the case without any such amalgam coating, and begins its function to cool the valve at a relatively early stage in its operation, and before the valve reaches an extremely high temperature. Moreover, when the working mercury is functioning to cool the valve, this veneer or coating of amalgam or heat transferring medium appears to act as an effective intermediary to transfer the heat from the vaporized mercury to the metal of the cooling part of the valve, thereby cooling or condensing the vaporized mercury and aiding still further in dissipating the heat.

In order that my invention may be more readily comprehended, I have described a preferred embodiment thereof herein with reference to the accompanying drawing, which shows a valve in accordance with my invention in sectional elevation. For the sake of clearness the stem of the valve is shown greatly enlarged.

Referring to the drawing, the valve consists of the hollow stem 20 and the head 21, this head consisting of the parts 22 and 23, the part 22 being welded to the stem 20 at the joint 24, and the part 23 being welded to the part 22 at the joints 25. The seat of the valve is approximately around the periphery of the head 21 at the point 26.

The top of the valve stem is tapered at 30, and this stem may serve to receive the annular member 31, which carries the heat-radiating ribs 32. The annular member 31 is maintained in position because the opening therein is tapered and slips over the tapered end of the valve stem 20, and may be locked in place by means of a locking ring 33, which is threaded to the tapered end of the valve. A plug 34 closes the upper end

of the valve, and is welded thereto at its edges. A central opening 35, closed by a plug 36, may be provided for a purpose hereinafter described.

It is to be noted that the conical head of the valve encloses a chamber 40 of relatively narrow cross-section, and this chamber is provided in order to form a receptacle for the working mercury 41, the arrangement being such that when the valve is heated, this mercury will boil and the mercury vapor will pass up towards the upper end of the valve stem, where it will be cooled and will then drop back to the valve head, as described in the aforementioned co-pending application.

It is to be noted that the interior walls of the valve stem and the head are provided with a coating 42 of amalgam or heat-transferring medium. This coating is, for the sake of clearness, shown on an exaggerated scale in the drawing; but in practice it is generally relatively thin, the purpose of the coating being to facilitate the transmission of heat from the metal head of the valve to the working mercury in the interior of the valve, in order to initiate the boiling of the mercury before the walls of the valve become too hot, and also to facilitate the transmission of heat from the mercury vapor to the walls of the valve while the cooling takes place.

I find that the best results are obtained by the use of amalgam coating, that is, an alloy of mercury and some other metal, and I find that if this amalgam be introduced into the valve, it will, in the course of the operation of the valve, become deposited upon the interior of the valve in the form of the coating 42.

The coating may consist of an amalgam of brass, which may be introduced either in the form of brass, or in the form of an amalgam, into the interior of the valve in any suitable manner. For instance, it can be introduced at the time of brazing the joints of the valve by the use of brass as a brazing medium, an excess of brass being employed which passes into the interior of the valve and forms an amalgam with the mercury, which, in the operation of the valve, is transferred to the walls of the valve to form the coating 42. Or I may introduce a small quantity of an amalgam, through the opening 35 at the top of the valve, which is thereafter plugged up and sealed hermetically as shown, and this amalgam is deposited upon the walls of the valve to form the coating 42 as herein described.

Instead of introducing an amalgam through the opening 35, a metal or metal compound may be introduced, which will form an amalgam with the working mercury. Various methods of amalgamating such valves and otherwise treating them are

described in the co-pending application of Thomas Midgley, Jr., Serial No. 211,224, filed January 10, 1918.

In the operation of my improved device, I find that I obtain markedly improved results from the introduction of another metal or amalgam as described herein. This I ascribe to the fact that the metal or amalgam forms a coating on the interior of the wall of the valve which can be "wetted" by the working mercury and which facilitates the passage of heat from the metal of the valve to the interior metal and vice versa in a manner which appears to be absent in valves not having such a coating. As a result, I find that the valve in accordance with the present invention will be considerably cooler in operation than a valve which contains the working mercury alone. I believe that I am correct in describing the metallic coating as an amalgam or alloy of mercury, but it will be understood that I use this term generally to indicate the alloy or mixture of metals which is formed as a result of this invention.

It will, of course, be understood that portions of the working mercury are continuously vaporized when the mercury reaches its boiling point; these portions pass up towards the upper part of the stem, and are there cooled and give up heat. The condensed mercury, thus transformed again into liquid form, falls by gravity back to the chamber in the valve head, thereby bringing about a continuous and automatic cooling operation; and the device forming a self-contained cooling system.

While I have referred herein to certain metals and amalgams which may be employed for the purpose of forming a coating or veneer herein, I wish it to be understood that other metals may be found to be suitable for the purposes of my invention, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In a device of the kind described including a hollow portion, a body of working mercury within said hollow portion, and a heat transferring body upon the interior walls of said hollow portion.

2. In a device of the kind described, including a hollow portion, a body of working mercury within said hollow portion, and a metallic coating upon the interior walls of said hollow portion.

3. In a device of the kind described including a hollow portion, a body of working mercury within said hollow portion, and an amalgam coating upon the interior walls of said hollow portion.

4. In a device of the kind described including a hollow portion adapted to be exposed to high temperature conditions, cooling means including a body of working mer-

cury and another metal contained within the interior of said hollow portion.

5 5. In a device of the kind described, including a hollow portion adapted to be exposed to high temperature conditions, cooling means including a body of working mercury and an amalgam contained within the interior of said hollow portion.

10 6. An engine valve formed with a hollow stem containing a small portion of mercury, adapted to be vaporized by the heating of the valve, and to condense within the hollow stem, the inner wall of said hollow stem being formed with a coating of mercury amalgam.

15 7. In a device of the kind described, including a hollow portion, a body of fluid metal within said hollow portion, and a heat transferring body upon the interior walls of said hollow portion.

20 8. In a device of the kind described, including a hollow portion, a fluid chemical element within said hollow portion, and a heat transferring body upon the interior walls of said hollow portion.

25 9. The method of facilitating the transfer of heat between mercury vapor and a metal body, which consists in causing the heat to traverse an intermediate metal.

30 10. The method of facilitating the transfer of heat between mercury vapor and a metal body, which consists in causing the heat to traverse an intermediate amalgam.

35 11. The method of facilitating the transfer of heat between a body of working mercury and another metal body, which consists in causing the heat to traverse an interme-

diate metal in passing from one of said bodies to the other.

12. The method of facilitating the transfer of heat between a body of working mercury and another metal body, which consists in causing the heat to traverse an alloy of one of said bodies in passing from one body to the other.

45 13. In a device of the kind described, including a hollow portion, a body of working mercury within said hollow portion, and a metallic coating upon the interior walls of said hollow portion, said metallic coating having the property of being wetted by the working mercury.

14. An engine valve of the character described, comprising a hollow stem having a flared end portion, and means adapted to cooperate with said flared end portion to form a valve head, said flared end portion and said means being welded together about their circumferential edges, and said means comprising a cupped plate nested in said flared end portion.

15. An engine valve of the character described having a stem, and an enlarged head, said head including a pair of plate members spaced apart to provide therebetween a hollow head, the one plate member being centrally secured to said stem and the other plate member being supported wholly by said first plate member and secured thereto by welding about its peripheral edge, said plates being cupped and nesting with one another.

In testimony whereof I affix my signature.

CHARLES F. KETTERING.