Sept. 21, 1937. A. T. COLWELL 2,093,772

METHOD OF MAKING VALVES

Filed May 16, 1931

Fig. 1

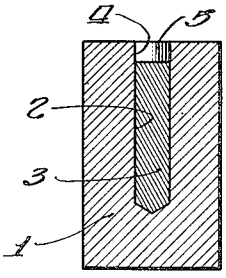


Fig. 3

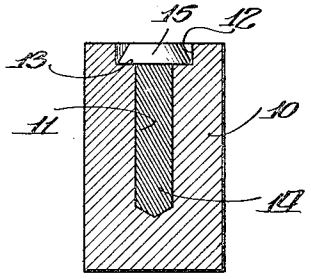


Fig. 2

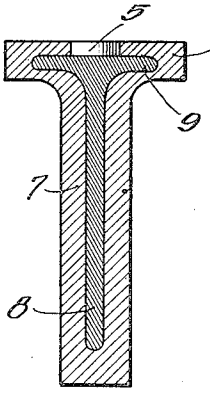


Fig. 4

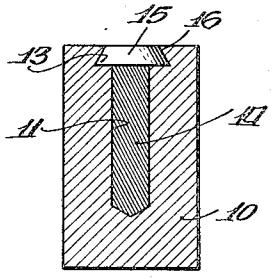


Fig. 5

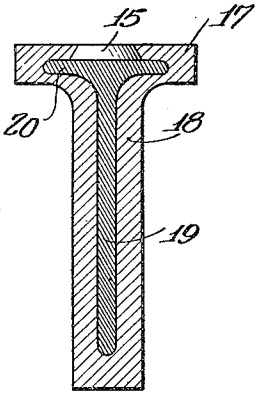
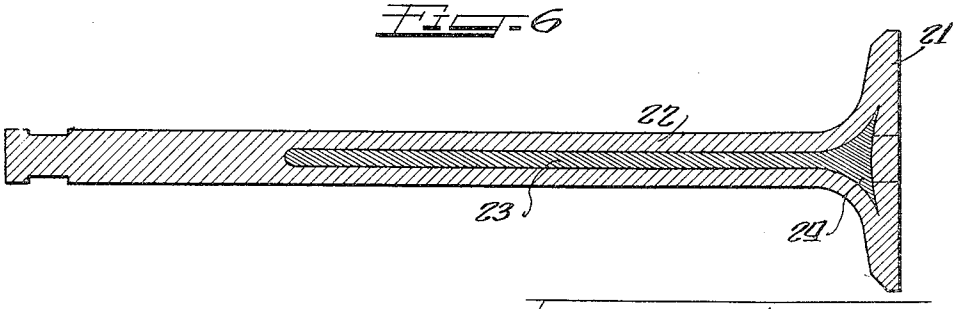


Fig. 6



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METHOD OF MAKING VALVES

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Application May 16, 1931, Serial No. 537,828

6 Claims. (Cl. 29—156.7)

The present invention relates to a method of making composite metal articles and in particular to a method of fabricating metal cooled valves for internal combustion engines.

It is an object of this invention to provide a method of sealing the chambers of metal cooled valves.

It is a further object of this invention to provide a method for completely enclosing a metal insert in a valve to enable the latter to satisfactorily conduct heat from the head of the valve.

It is a particular object of this invention to provide a method for completely enclosing a metal insert in a valve to enable the latter to satisfactorily conduct heat from the head of the valve.

It is a particular object of this invention to provide a method of inserting a metal member into a recess formed in a valve to provide the valve with a cooling metal.

These and other objects of this invention will be apparent from the following description and appended claims.

This invention (in a preferred form) is illustrated in the drawing and hereinafter more fully described.

On the drawing:

Figure 1 is a sectional view of a blank having a recess filled with a cooling metal and showing a plug inserted in the end of the recess.

Figure 2 is a sectional view of a partially completed valve formed from the blank of Fig. 1.

Figure 3 is a sectional view of a blank similar to Fig. 1 used in making a valve according to a modified form of my invention.

Figures 4 and 5 illustrate two steps in carrying out the modified form of my invention.

Figure 6 is a sectional view of a completed valve.

In carrying out this invention, a suitable blank 1 is provided. The blank is preferably formed from a suitable valve material such as tungsten steel or chromium steel by forging or cutting a slug from rolled stock. A recess 2 is drilled into the blank 1 longitudinally thereof. The recess 2 is preferably cylindrical and concentric with the blank 1, extending thru one end thereof and for a considerable distance within the blank.

The recess 2 is then partially filled with a suitable metal insert 3. The insert 3 may be inserted as a solid metal or melted and poured into the recess. The metal 3 does not completely fill the recess, an opening 4 being left above the metal.

The blank 1 containing the insert 3 is heated to forging temperature, and a plug 5 of suitable metal is inserted in the top portion 4 of the recess 2. The plug 5 is of sufficient size to fill the expanded recess and in the subsequent cooling of the metal is firmly embedded in the article formed from the blank. The preheating of the blank 1 and insert 3 prevents the formation of internal pressure in the completed valve when it becomes heated during operation. If the plug 5 were forced into a cold blank on top of a cold insert the insert metal may be expanded greater than the blank metal when the valve is heated during use to develop an internal pressure in the valve tending to warp the same. If the insert and blank are first heated to expand the metals before inserting the plug, a subsequent heating of the completed valve will not expand the insert to a greater size than when the plug was inserted and no internal pressure will result.

This method of sealing a recess is particularly adapted for valve making. In this connection, it is preferable to use a suitable steel such as tungsten steel for the metal of the blank and a metal having a relatively high rate of heat conductivity for the filler metal 3. Copper and aluminum have given good results as a filler metal. The plug 5 may be of any metal but is preferably formed of the same metal as the blank 1.

The heated blank 1 containing the insert 3 and plug 5 is worked to form the completed article. In valve making, the blank 1 is extruded through a suitable die which forms a head 6 and stem 7 on the blank. The insert metal 3 is drawn into the stem, by this operation, to form the core 8, while a part thereof is spread out into the head 6, as shown at 9.

The plug 5 is heated from contact with the hot metal of the blank and is securely united to the head 6. The valve thus formed is allowed to cool, to thereby shrink the metal of the head 6 about the plug 5 to secure a firmer bond between the metals.

In a modified form of the invention as shown in Figures 3, 4, and 5, a suitable blank 10 is recessed at 11 in the manner previously described. The recess 11 is counterbored to provide the enlarged opening 12 and a shoulder 13. The recess 11 is filled as in the preceding case with a suitable metallic filler 14 and the blank 10 and filler 14 are heated to forging temperature.

A metal plug 15 is fitted in the bore 12. The plug 15 is preferably frusto-conical in shape and may be of the same material as the blank 10. The metal of the blank 1 is peened over the plug as shown at 16.

The blank 10 is extruded to form a head 17 and stem 18 thereon. The insert or filler 14 is drawn out in the stem to form the core 19, a portion of which is spread out in the head 17 as shown at 20.

The plug 15 is heated from contact with hot metal of the blank 1 and due to the pressure exerted thereon is securely united to the head 17. The subsequent cooling of the valve shrinks the metal of the head 17 about the plug 15 to secure a firm bond between the metals.

The headed articles thus formed are forged to form the completed valve shown in Figure 6. The valve comprises a head 21 and stem 22 and a core 23 of heat conducting metal in the stem having a portion 24 thereof in the head of the valve.

Many changes may be made in the steps of my process and I do not wish to be limited otherwise than is necessary by the prior art and the scope of the appended claims.

I claim as my invention:

1. The method of sealing a metal cooled valve, which comprises heating a valve blank having a recess therein partially filled with a metal of relatively high heat conductivity to forging temperature, inserting a cold metal plug in the end of the recess, forging the blank and shrinking the metal of the blank about the plug.

2. The method of forming a metal cooled valve, which comprises drilling a recess in a valve blank, partially filling the recess with a metal of relatively high heat conductivity, heating the blank to forging temperature, filling the recess with a cold metal plug, forging the blank to form a valve, and shrinking the metal of the valve about the plug.

3. The method of forming a metal cooled valve, which comprises drilling a recess in a metal blank, counterboring said recess, partially filling said recess with a metal of relatively high heat conductivity, heating the blank to a forging temperature, inserting a cold metal plug in said recess, forging the blank to form a valve, and shrinking the metal of the valve about the plug.

4. The method of forming a composite metal valve to prevent excessive internal pressures from being developed in the valve under working conditions which comprises heating a recessed metal blank having an insert metal in the recess thereof to expand the blank and insert, inserting a relatively cool metal plug in the end of the recess to encase the insert and working the blank to form a valve.

5. The method of making metal articles having a material encased therein to prevent internal pressures being developed in the article when the same is heated which comprises forming a metal blank with a blind bore therein, inserting a material having relatively high heat conductivity in the bore, heating the blank and insert to expand the same, disposing a cold metal plug in the end of the bore to encase the material therein and forging the blank to incorporate the plug therein.

6. The method of forming a metal cooled valve which comprises forming a blind bore in a metal blank, counterboring the end of the bore to provide an enlarged opening thereto, filling the bore with a metal of relatively high heat conductivity, heating the blank and insert metal to expand the same, inserting a cold metal plug having a tapered periphery into the counterbored opening with the small end of the plug at the top thereof, peening the blank metal over the plug to securely seat the plug in the counterbore and working the blank to form a valve.

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