Sept. 21, 1937. A. T. COLWELL 2,093,776

METHOD OF MAKING VALVES

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Fig. 1.

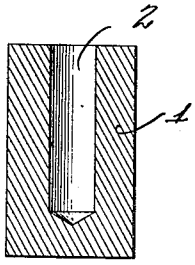


Fig. 2.

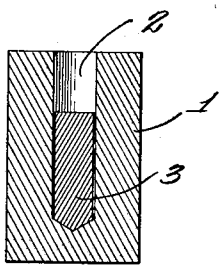


Fig. 3.

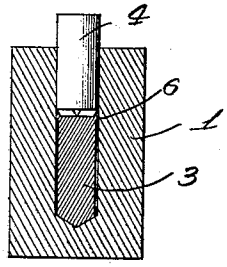


Fig. 5.

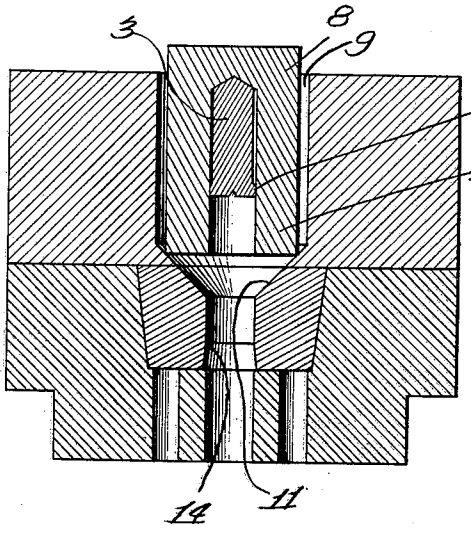


Fig. 6.

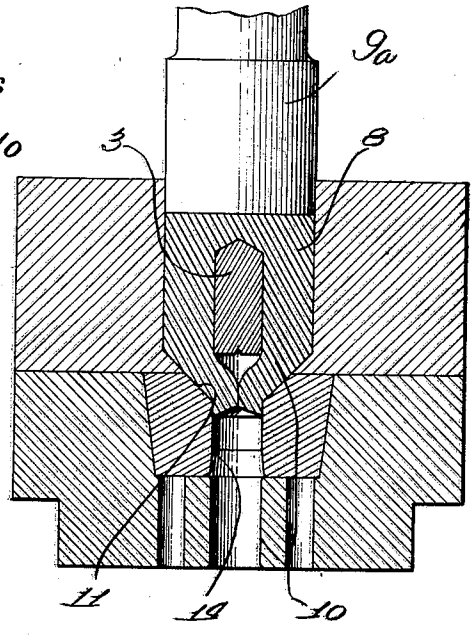
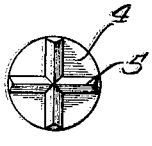


Fig. 4.



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METHOD OF MAKING VALVES

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Fig. 7.

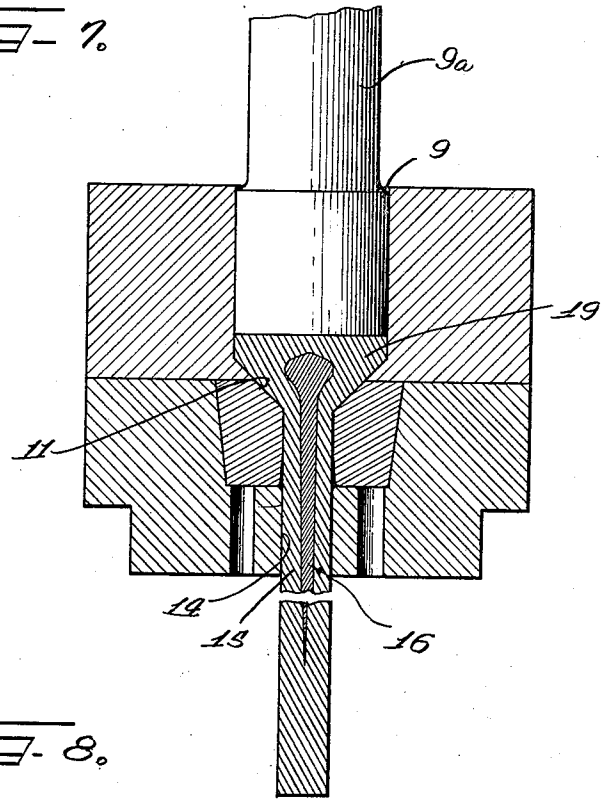


Fig. 8.

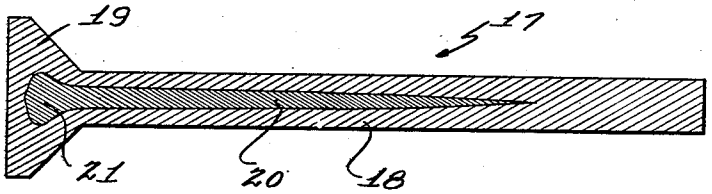
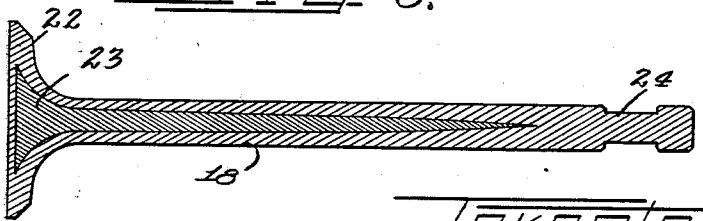


Fig. 9.



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UNITED STATES PATENT OFFICE

2,093,776

METHOD OF MAKING VALVES

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Application December 12, 1931, Serial No. 580,649

12 Claims. (Cl. 29—156.7)

This invention relates to a method of making poppet valves for internal combustion engines and in particular to a method of making metallic cooled exhaust valves.

Temperatures attained in the combustion chambers of automotive engines closely approximate the temperatures to which the metals used in the manufacture of valves are heated in such manufacture. The gases which pass through the exhaust valves maintain the exhaust passageway at a temperature of around 1600° F. for ordinary engine speeds. These gases have a very destructive effect on the valves, causing corrosion and warping and producing a destructive change in the metal of the valves. Since these gases are directed against a portion of the valves which includes the upper portion of its stem and the lower portion of its head, it has been a problem for valve manufacturers to devise a means of cooling this portion of the valve.

This cooling has been accomplished in several ways, as by providing a shield around this portion of the valve and by filling the interior of the valve with a cooling or high heat conducting means.

This invention relates to the latter type of cooled valve and it is an object of this invention to produce a valve of this type by a method which is inexpensive, expedient and adapted for use in large scale production.

It is a further object of this invention to produce a metallic cooled valve by a method in which the cooling metal is imbedded in the valve in one major forging operation.

It is a particular object of this invention to provide a method of making metallic cooled valves in which a blank containing the metal is extruded so as to form the valve about the insert.

Other and further important objects of this invention will be apparent from the following description and appended claims.

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

On the drawings:

Figure 1 is a sectional view of a metallic blank with a recess drilled therein, used for forming the valve of this invention.

Figure 2 is a sectional view of the blank with an insert therein.

Figure 3 is a sectional view of the blank showing the use of a plug for affixing the insert metal in the recess.

Figure 4 is a bottom plan view of the plug.

Figure 5 is a sectional view showing the blank in the die, before extruding.

Figure 6 is a sectional view showing the initial step of the extruding process.

Figure 7 is a sectional view of the extruding die showing the extruding valve therein.

Figure 8 is a sectional view of the valve formed after extrusion.

Figure 9 is a sectional view of a completed valve.

As shown on the drawings:

In carrying out this invention a blank 1 is formed as by casting or cutting a slug from a bar of rolled stock. A suitable recess 2 is drilled in the blank 1. The recess 2 is preferably cylindrical and concentric with the blank 1 extending through one end of the blank and for a considerable distance within the blank. An insert 3 of a metal having a relatively high heat conductivity is placed in the blank. The insert metal does not completely fill the blank and a plug 4 having an embossed cross 5 on one end thereof is hammered into the recess against the plug to spread the end thereof as shown at 6 to firmly secure the plug within the recess.

The valve 1 may be formed of any suitable valve material, such as tungsten steel or nickel chromium steel. The insert or slug 3 is formed of a suitable metal which has a high rate of heat conductivity relative to that of the metal of the blank. In practice, copper and aluminum have been found to be suitable metal from which to form the insert 3.

The composite metal blank 8 thus formed is heated to a forging temperature and placed in the end 9 of the extrusion die. The blank is placed in the die so that the open end of the recess 2 faces downwardly. Pressure is then applied to the upper end of the blank by means of the hammer 9^a which forces the wall 10 of the blank extending below the insert 2 to close in beneath the insert by reason of the restricting wall 11 of the die.

The end 11 of the blank is contracted and forced through the lower throat 14 of the die to form a stem 15. The insert 2 is extended into the stem as shown at 16 of Figure 7.

The valve formed after extrusion is shown at 17 of Figure 8. The valve thus formed comprises a stem 18 and a head 19 with a core of copper 20 extending through the stem and enlarged as at 21 in the head portion. The copper insert 19 is firmly welded to the outer wall of the valve through its extent.

The valve or valve blank thus formed is again forged to shape the head portion to final shape as shown at 22 this process enlarging the head insert 21 to form the enlarged insert 23. The free end of the stem is machined to finished form as shown at 24.

It will be seen that the method of this invention provides a simple and expedient process for forming a metal cooled valve which firmly bonds the insert metal to the metal of the valve in one major forming operation. This process eliminates the steps of welding ordinarily en-

countered in the making of valves of this type. Further, by this process a valve having an insert contacting the outer metal throughout its total extent is formed.

It is contemplated that the exact procedure set forth in this specification need not be followed in detail. For example when using Silcrome steel or other steels having high forging temperatures, it is preferable to heat the blank, quickly place the insert in the recess and secure it by a quick blow from the punch. The blank is then extruded as set out.

Many changes may be made in the design and proportion of the parts and the arrangement of the steps carrying out this 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 making a copper cooled valve which comprises drilling a recess in a metallic blank, placing a copper insert of smaller size than the recess in the recess against the bottom thereof, heating the blank to forging temperature and extruding the blank, with the recessed end toward the extrusion die, to cause the metal of the blank to enclose the copper insert and to form a valve with the metal of the insert drawn down into the stem.

2. The method of making a copper cooled valve, which comprises drilling a recess in a metallic blank, placing a copper insert of smaller size than the recess in said recess, securing the insert in said recess against the bottom thereof, heating the blank to forging temperature, and extruding the blank, with the recessed end toward the extrusion die, to cause the metal of the blank to enclose the copper insert and to form a valve with the metal of the insert drawn down into the stem.

3. The method of making a copper cooled valve which comprises extruding a metallic blank having a recess therein partly filled by a copper insert, the extrusion being carried out with the recessed end toward the extrusion die so as to form the metal of the blank about the insert and completely enclose said insert.

4. The method of making valves which comprises partially filling a short recessed cylindrical blank with an insert of desired characteristics different from those of said blank shaping the closed end of said blank to the approximate shape of the finished valve head and drawing out the remainder of the blank to form the stem while simultaneously causing the metal of the blank to completely enclose the insert.

5. The method of making valves which comprises placing a slug of metal having a high rate of heat conductivity in a recessed metal blank, the slug being of such size as to leave a portion of the recess unfilled, shaping the closed end of the blank to the approximate shape of the valve head and drawing out the remainder of the blank and a portion of the slug to form a stem thereby causing the metal of the blank to completely enclose the insert metal.

6. The method of making valves which comprises placing a slug of metal having a relatively high rate of heat conductivity in a recessed metal blank, the slug being of such size as to leave a portion of the recess unfilled, simultaneously shaping the closed end of the blank to the approximate shape of the valve head and drawing out the remainder of the blank to form a long seamless stem thereby causing the metal of the blank to completely enclose the insert metal.

7. The method of making a poppet valve having a filler of metal of relatively high heat conductivity therein which comprises forming a short cylindrical blank of the valve metal with a recess extending axially substantially therethrough, inserting a slug of the metal of relatively high heat conductivity in the recess to the bottom thereof to partially fill the recess, shaping the closed end of the blank to the approximate form of the valve head and drawing out the remainder of the blank to form the valve stem thereby causing the metal of the blank to completely enclose the insert metal.

8. The method of making a poppet valve having a filler of metal of relatively high heat conductivity therein which comprises forming a short cylindrical blank of the valve metal with a recess extending axially substantially therethrough, inserting a slug of the metal of relatively high heat conductivity in the recess to the bottom thereof to partially fill the recess and simultaneously shaping the closed end of the blank to the approximate form of the valve head and drawing out the remainder of the blank to form a stem, the operation causing the metal of the stem to completely enclose the insert metal.

9. The method of making an internal combustion engine poppet valve of the type having an inner core of heat conducting metal, which comprises providing a recessed blank of a suitable ferrous alloy, partially filling the recess with an insert of metal having a high rate of heat conductivity and extruding the blank with the recessed end toward the extrusion die to draw the metal of the blank about said insert and form a valve with the metal of the insert entirely enclosed within the metal of the blank.

10. The method of making an internal combustion engine poppet valve of the type having an inner core of heat conducting metal which comprises boring a recess in the blank made of a suitable ferrous alloy, partially filling the recess with an insert of metal having a high rate of heat conductivity, securing the insert in the recess and extruding the blank with the recessed end toward the extrusion die to draw the metal of the blank about said insert and form a valve with the metal of the insert entirely enclosed within the metal of the blank.

11. The method of making valves which comprises placing a slug of material having a high heat conductivity into a recessed metal blank and extruding the blank in a die with the recessed end toward the extrusion die to cause the metal of the blank to enclose the insert material and form a valve with the insert material drawn into the stem.

12. The method of making valves which comprises providing a metal blank having the recess axially therein extending from one end thereof into spaced relation from the other end, inserting a slug of high heat conductivity metal of smaller peripheral size than the size of the recess, expanding one end of the slug into frictional engagement with the walls of the recess, shaping the closed end of the blank to the approximate shape of a valve head and shaping the remaining portion of the blank and a portion of the slug to form a valve stem with the slug metal extending into the stem and spread out into the head.

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