Oct. 6, 1931. R. HERVIG ET AL 1,826,543

COMPOSITE METAL ARTICLE AND PROCESS OF MAKING THE SAME

Original Filed July 9, 1924

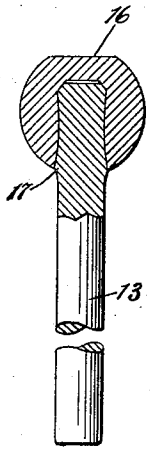


Fig. 2.

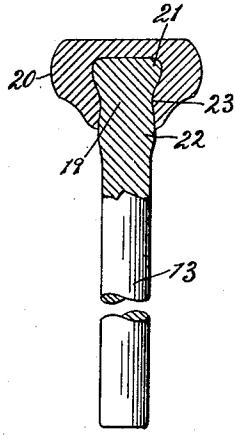


Fig. 3.

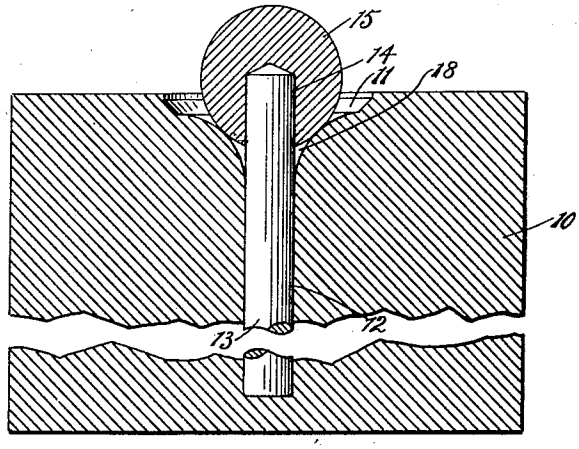


Fig. 1.

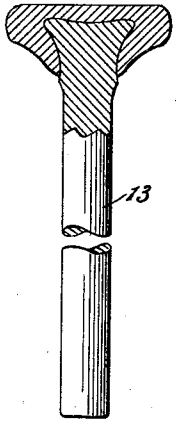


Fig. 4.

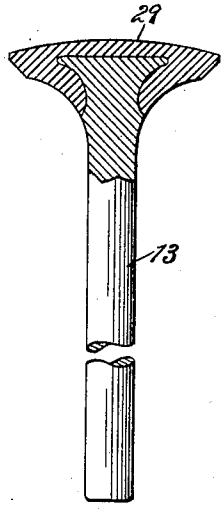


Fig. 6.

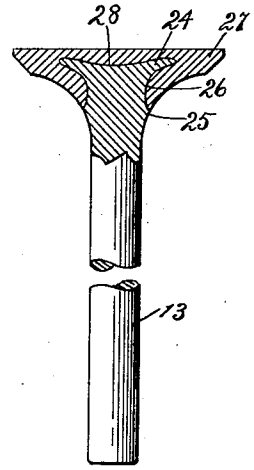


Fig. 5.

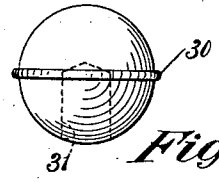


Fig. 7.

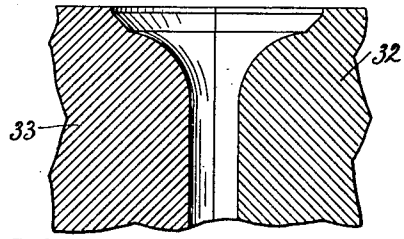


Fig. 8.

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UNITED STATES PATENT OFFICE

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COMPOSITE METAL ARTICLE AND PROCESS OF MAKING THE SAME

Application filed July 9, 1924. Serial No. 725,023.

This invention relates to composite metal articles such as poppet valves, valve tappets and the like and has for its principal object to eliminate difficulties in manufacturing and to improve the product. In the interest of brevity the invention will be disclosed in a manner particularly suited to poppet valves by way of illustration, but this illustration will be sufficient to make the substance of the invention available for other uses.

According to this invention one end of a stem rod is inserted into a pocket in a blank of head metal and the pieces are forged together between dies to form an enlarged or distorted portion on the rod interlocked with, and enveloped by, a casing forming the outer portion of the valve head, the most important result of which is the practically indestructible mechanical bond between the two parts, wherein the contacting surfaces are in uniformly intimate relation without pressure and without strain, the presence of which would produce warping in service. However, unless the head blank contains almost exactly the correct quantity of metal, the valve will either be so incompletely formed as to necessitate rejection, or it will be formed with a "flash" that will require removal by an expensive special operation; while if the correct quantity of metal is in the head blank the valve heads will be ready to grind in.

This difficulty is readily overcome by using globular blanks of head metal and drawing on the art of anti-friction ball making for processes and machines by which they can be produced with great uniformity at low cost.

The globular shape, moreover, places the head metal in the most suitable position for the forging operation, permitting a desirable enlargement of the stem rod about the juncture of the head and stem, disposing a large proportion of the metal contained in the head blank near the periphery of the head, and preventing the formation of any sharp corners in the rod metal where stresses might localize.

Rough balls are made in many ways. A very common practice is to pass a bar through a "Bradley" hammer which converts it into a string of ball shaped blanks connected by short wires of small diameter that are readily severed to free the blanks. Another cheaper method, much used, is to cut bars into short lengths and upset them with cup shaped dies. Perhaps the cheapest way is to pass rods between suitable rollers from which they are delivered in a form similar to the strings produced by the Bradley hammer.

The rough balls, however produced, are passed through a machine which consists chiefly of a disc provided with a circular groove or grooves and rotating in suitable spaced relation to another disc presenting a grinding surface of emery, or the like.

The use of globular head blanks has a further advantage when they are made from some of the most desirable materials, for the bars or other shapes received from the mill frequently contain defects in the form of surface cracks that have heretofore been removed only by machining which is excessively expensive, both in material wasted and in the labor; whereas ball forging operations can be so performed as to close these cracks, or at least not to increase their depth, and the rough grinding usually removes the cracks altogther with a very small loss of metal, and at an almost negligible labor cost.

With most materials, however, the grinding operation will not be necessary and the blanks may, if desired, be only roughly globular as distinguished, for example, from cylindrical, but it will be obvious that the use of substantially spherical blanks makes it easy to maintain symmetry with respect to the axis of the pocket in which the stem is received.

The accompanying drawings illustrate the forging operations by which the two blanks are joined together and reduced to a valve.

Fig. 1 is a fragmentary sectional view illustrating one form of lower die with the stem rod and head blank assembled and placed therein ready to receive the pressure from the upper die;

Figs. 2, 3 and 4 represent successive stages through which the parts may pass during the forging operation;

Fig. 5 represents a valve produced by using

a flat upper die in connection with the blanks and lower die shown in Fig. 1;

Fig. 6 illustrates a similar valve that may be produced by using a concave upper die with the blanks and lower die shown in Fig. 1;

Fig. 7 illustrates a head blank in one form that may be produced by forging, and

Fig. 8 is a fragmentary sectional view of a modified form of the lower die.

In Fig. 1 there is shown a lower die member 10 having a die cavity consisting of a head portion 11 and a stem portion 12 adapted to cooperate with a selected upper die. A stem rod 13 which may be a mere length of round bar stock, or may be a finished stem, so far as the lower portion is concerned, has its upper end seated in a pocket 14, extending radially into a spherical head blank 15.

When a flat upper die is used the initial pressure on the head blank 15 will flatten it, as indicated at 16 in Fig. 2, and cause the stem rod to expand radially, as shown at 17 in that figure, the metal of the stem being free to flow out into that portion of the die cavity indicated by 18 in Fig. 1. Upon further pressure the parts assume the form shown in Fig. 3 in which substantially the entire upper end portion of the stem expands radially, as indicated at 19, and the head blank expands radially, as indicated at 20. It will also be noted that the stem enlarges more adjacent to the extreme end, as at 21, and at about its juncture with the bottom of the head blank at 22, than it does at the intermediate part 23, thereby assuming a gradually curved waist like form. In Fig. 4 the parts are shown in a further stage of the development that finally results in the construction shown in Fig. 5, where the stem rod has been expanded quite widely at 24, less widely at 25, and still less widely at 26, preserving the waist like curvature between a distinct head or shoulder at the end of the rod and the fillet like enlargement at the juncture of the rod with the bottom portion 31 of the head blank metal. The extent of the expansion of the stem rod will depend somewhat on the over-all length and it is not necessary that the head blank be in contact with the die in the initial operation, as shown in Fig. 1, but it may be held in spaced relation by an added length of the stem rod.

Interlocked with the upper portion of the stem is an envelope, or jacket 27 of the head blank metal presenting the desired mushroom exterior and interlocking with the stem in uniformly intimate contact. The enlargement or distortion of the stem rod and the formation of the jacket having been accomplished by the flowing of the metal of the two parts together under the pressure of the die, the fit is of the most exact nicety, but there is no pressure between the parts and therefore no strain that would cause the head to warp in service.

The exact formation of the stem within the envelope will always depend somewhat on the shape of the die cavities as well as the proportions of metal and the form of the two blanks. For example, it does not invariably occur that the stem has the depression 28, as shown in Fig. 5. The use of a concave upper die will, in many instances, eliminate that concavity, as indicated in Fig. 6, at 29, and might permit a convexity. It may also be eliminated by slightly flattening the head blank opposite to the pocket before the forging operation. The configuration may thus be varied, but so long as the stem is permitted to expand in the initial forging operation, the finished product will present no stem metal of less diameter than the rod blank, nor any sharp corner at which localization of stresses might occur.

The configuration shown in Figs. 5 and 6, including the evenly curved waist like portion affords resistance to movement in both directions with strength that will endure severe service without loosening, and without straining either the stem metal or the head metal by localization. In other words, insofar as the transmission of force is concerned the two parts are, in effect, integral. But when there is no actual union between the contacting surfaces, the transmission of sound is so poor as to be practically negligible. This eliminates a great deal of motor noises that are ordinarily attributed to valve tappets but are in part, at least, due to the sounds produced by the valve head striking its seat.

The silence of the valve may be increased by using a metal for the envelope or jacket that rings with a low pitched note characteristic of nickel steels.

The head blank shown in Fig. 7 may be produced by upsetting short lengths of rod between a pair of cup shaped dies, which process usually results in a fin 30 circumscribing the blank about the center. By arranging the axis of the pocket 31 at right angles to the plane of this fin, such blanks may be used in the place of blank 15 without any difficulty because the fin will flow outwards into the periphery of the head and disappear as such.

There is some economy in forging the rod and head blank assembly in an ordinary upsetter with the rod gripped between a pair of clamping dies 32 and 33, substantially as illustrated in Fig. 8. Valves made in this way will have a fin on the underside of the head, but the saving in cost will more than offset that objection.

Various modifications may be made within the scope of the invention, and while the foregoing disclosure includes specific description and illustration, it is not intended that anything therein should unnecessarily limit the claims or require an interpretation of them

that would permit the substance of the invention to be appropriated without infringment.

The valve as an article of manufacture is claimed in my copending application filed of even date herewith.

We claim as our invention:

1. The process of making composite metal articles which includes forming a globular blank of head metal with a pocket therein, inserting one end of a rod into the pocket and radially expanding the inserted portion of the rod and the blank to form a head.

2. The process of making composite metal articles which includes forming a globular blank of head metal with a pocket therein, inserting one end of a rod into the pocket and radially expanding the inserted portion of the rod and the blank to form a head by forcing them into a die having a flattened mold cavity.

3. The process of making composite metal articles which includes forging a ball shaped blank, penetrating the blank radially, inserting one end of a rod into the blank and hot forging the assembly to distort the rod and form the blank into a head interlocked with the distorted portion of the rod.

4. The process of making composite metal articles which includes forging a ball shaped blank, surfacing the blank by grinding, penetrating the blank radially, inserting one end of a rod into the blank and hot forging the assembly to distort the rod and form the blank into a head interlocked with the distorted portion of the rod.

5. The process of making metal articles which includes forming a ball shaped blank of head metal, surfacing the blank by grinding, forming a radial pocket in the blank, inserting one end of a rod into the blank and forging the assembly to distort the rod and form the blank into a head interlocked with the distorted portion of the rod.

6. A composite metal article of the class described consisting of a stem having a distorted portion adjacent to one end and a head interlocked with said distorted portion, the interlocked surfaces being in the condition of having been formed by inserting one end of the stem into a pocket in a globular blank and hot forging the blank and a portion of the stem to form a head.

7. A composite metal article of the class described consisting of a stem having a knob adjacent to one end and a head interlocked with said knob in the condition of having been formed by inserting one end of a rod into a radial hole in a spherical blank and hot forging the assembly to form a head on the rod.

RICHARD HERVIG.
ROBERT JARDINE.

CERTIFICATE OF CORRECTION.

Patent No. 1,826,543. Granted October 6, 1931, to

RICHARD HERVIG ET AL.

It is hereby certified that the above numbered patent was erroneously issued to "Rich Tool Company, of Chicago, Illinois, a corporation of Illinois", whereas said patent should have been issued to Rich Tool Company, of Portland, Maine, a corporation of Maine, as assignee by mesne assignments of the entire interest in said invention, as shown by the records of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 16th day of February, A. D. 1932.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.