June 3, 1941. R. L. WILCOX 2,244,381

MEANS OF PRODUCING SOCKETED ARTICLES

Original Filed Sept. 1, 1938

Fig. 1.

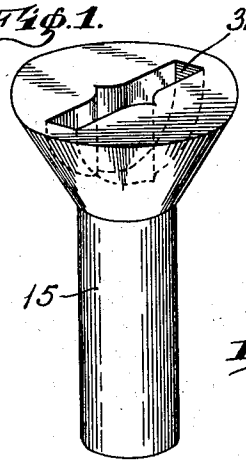


Fig. 2.

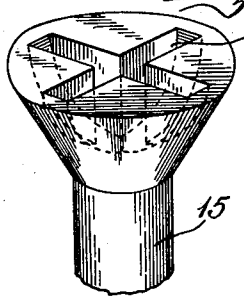


Fig. 3.

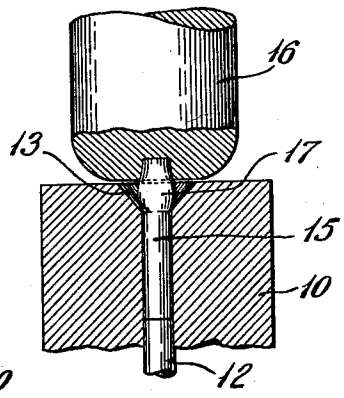


Fig. 4.

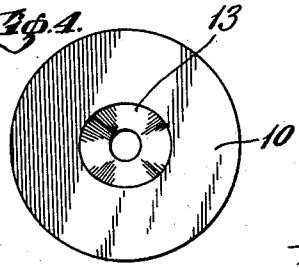


Fig. 5.

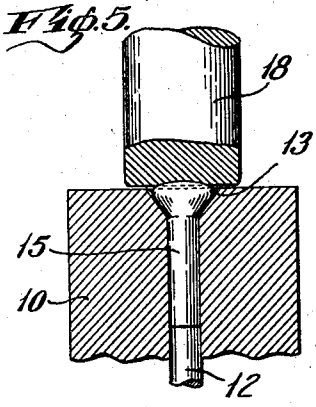


Fig. 11.

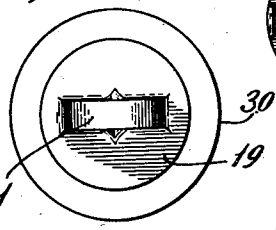


Fig. 12.

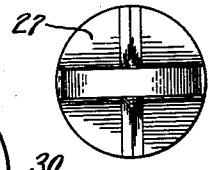
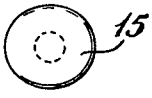


Fig. 14.



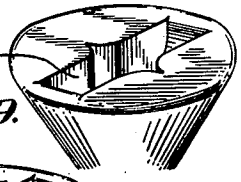


Fig. 9.

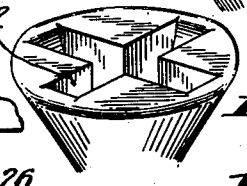


Fig. 10.

Fig. 6.

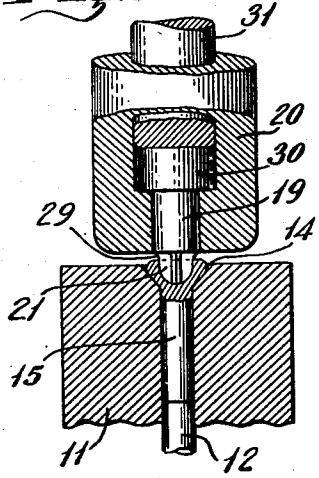


Fig. 7.

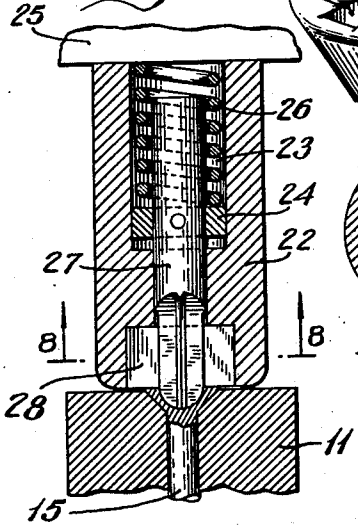


Fig. 13.

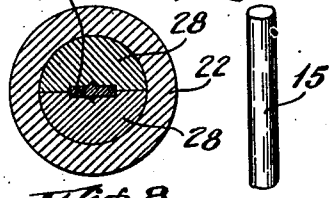


Fig. 8.

INVENTOR
RICHARD LESTER WILCOX
BY George C. Hall
ATTORNEY

Patented June 3, 1941 2,244,381

UNITED STATES PATENT OFFICE

2,244,381

MEANS OF PRODUCING SOCKETED ARTICLES

Richard Lester Wilcox, Waterbury, Conn., assignor to The Waterbury Farrel Foundry and Machine Company, Waterbury, Conn., a corporation of Connecticut

Original application September 1, 1938, Serial No. 227,892. Divided and this application November 29, 1939, Serial No. 306,593

9 Claims. (Cl. 10—7)

This invention relates to means of producing socketed articles, particularly screws, bolts and the like.

This case is a division of Serial No. 227,892, filed Sept. 1, 1938, which has resulted in Patent No. 2,205,507 of June 25, 1940.

Heretofore such articles, of an inferior character, have been made by a method that was especially severe upon the tools, resulting in a frequent breakage and replacement thereof. The defects of such method were increased and accentuated by the necessary use of tougher and harder material, such as high carbon steel and metal having nickel, chrome or other like alloys forming part thereof, now demanded for screws, bolts and the like. In such method the socket is usually formed by a punch, the tip of which is the same height or length as the depth of the socket and the same cross sectional area. This tip is forced into the head of the blank its full height and in displacing the metal therein causes the same to flow outwardly and upwardly. This upward moving metal of the head of the blank engages the working face of the punch adjacent to the tip, whereby pressure is applied thereto. Thus, the socketing tip and punch apply pressures that cause flow of the metal in opposite directions. In brief, different portions of the punch apply pressures that cause a metal flow of the head in opposite directions. The result is, that the tip, being the smaller portion of the tool, cannot withstand the counteracting pressure of the working face of the punch, and is broken off, generally on a line substantially flush with the working face of the punch. This, of course, ruins the tool and the same must be replaced. If the broken punch is not immediately discovered, blanks continue to pass through the machine automatically, incomplete and lacking a socket. When the broken punch is discovered, the machine is stopped, the old punch taken out and a new one installed. If such punch is not ready for immediate installation the machine stands idle until a new punch is made. In either case the time necessary to make these changes is substantial and costly, the machine being out of production.

The means herein described differs in several respects from that heretofore known, in that the socket is made by first forming an oversize socket substantially the same depth as the finished socket and without pressure on the end of the blank, the metal of which flows axially without restraint, then project into this oversize socket a tool which in cross section is the same as the finished socket and then applying pressure to the end of the blank. This causes the metal to flow inwardly and around the tool, reducing the oversize socket to the finished socket of less cross sectional area, shapes the head of the blank and completes the blank.

There are other differences between the means herein shown and that of the prior art, which will become apparent from the following description and the accompanying drawing, disclosing for purposes of illustration a limited number of the several embodiments of the invention.

In the drawing:

Figure 1 is a perspective view of a finished bolt or screw blank with one form of socket therein;

Figure 2 is a similar view with a portion of the shank broken off and having another form of socket therein;

Figure 3 is a fragmentary view of a die and punch, with a blank therein after it has been coned or bulbed thereby;

Figure 4 is a plan view of the die shown in Figures 3 and 5;

Figure 5 is a fragmentary view of the die shown in Figure 3, a punch associated therewith and a blank with its head flattened thereby, and illustrating the operation succeeding the one shown in Figure 3, and the blank shaped thereby;

Figure 6 is a fragmentary view of another die and a socket forming punch with a blank positioned therebetween and illustrating the operation succeeding the one shown in Figure 5;

Figure 7 is a fragmentary view of the die shown in Figure 6, the punch and socket shaping matrix that cooperate therewith, the head of the blank shown therein being in its completed and finished form;

Figure 8 is a transverse sectional view of the punch and associated parts, taken generally upon line 8—8 of Figure 7;

Figures 9 and 10 are views of the head of a blank with the oversize socket therein, as fashioned by the operation of the tools shown in Figure 6;

Figure 11 is an end view of the punch for forming the oversize socket and as illustrated in Figure 6;

Figure 12 is an end view of the matrix as shown in Figure 7;

Figure 13 is a view of the blank before being subjected to any operations by the means and method herein described; and

Figure 14 is a plan view of the head of a blank, illustrating a preferable form thereof, if

the socket to be formed therein requires an unequal distribution of the metal.

In the practice of this invention the means therefor are associated with a header or upsetting machine, preferably of the plural blow type.

As illustrated, two dies are utilized, severally designated 10 and 11, having an aperture therethrough of substantially the same cross section as the blank and the usual knockout pin 12 or the like movable therein.

In the working face of the die 10 is a countersunk recess 13 and a similar recess 14 in the die 11. These recesses both have angular walls, substantially as shown, and the recess 14 is generally annular and the recess 13 may or may not be, as required, or as seems desirable.

For some operations, the included angle of the walls of the recess 13 may be less than those of the recess 14 to facilitate the metal flow and fashioning the finished head. This relative angular inclination of the recess walls may be reversed from that above stated, that is, the included angle of the walls in the recess 14, being less than those in the recess 13.

A blank 15, usually cut from a wire length, is presented to the die 10 in any convenient and well known manner, the inner end being against the knockout pin 12. When so positioned, the projecting end is engaged by the punch 16, and the outer end thereof coned or bulbed as at 17. This operation is the conventional first step in an upsetting operation.

While still in the die 10, the coned portion 17 is subsequently engaged by the punch 18 and upset to the form substantially as shown in Figure 5, wherein the outer edge is rounded and the recess is not completely filled out, particularly at its open end.

From the die 10 the blank is transferred in any convenient manner to the die 11 and there subjected to pressure of the socket forming punch 19, which is mounted in the punch holder 20. This punch 19 has a strong, rugged body portion, with a head 30, within the bore of holder 20 in contact with pressure member 31 and provided with a tip 21 that in cross section approximates the shape of the finished socket but of larger cross sectional area. As this tip is projected into the blank it produces an oversize socket. The lower end of this tip, as shown, is rounded, although it may be of different shape if desired, and is projected into the blank so that the outer end of the tip is spaced the same distance away from the neck of the head, that is, the point where the head and shank join, as in the finished socket. The tip is of greater height than the depth of the socket and does not project its full length into the blank, hence the face of the punch holder 20 is distant from the blank and the face of the die 11, thus providing ample space for free and uninterrupted metal flow.

The article is completed by the mechanism substantially as shown in Figure 7, wherein 22 indicates the punch having a central chamber 23 with a collar 24 therein, between which and the pressure plate 25 is a coil spring 26.

Movably mounted in the punch 22 is a matrix 27, the outer end of which is preferably, although not necessarily rounded, and having a cross section the same size and shape as that of the finished socket.

In the outer end of the punch 22 are two guide sections 28, the inner faces of which are in engagement with each other and are recessed so as to form an opening therebetween the same size and shape as the cross section of the matrix 27, substantially as shown in Figure 8. These guide sections 28 form a split guide for the matrix which moves freely therein.

After the blank has been fabricated by the mechanism shown in Figure 6, the punch 22 approaches the blank, when in the form as shown in Figure 6, and the matrix enters the oversize socket and continues its movement until the rounded end thereof engages the bottom of the socket. The punch 22, however, continues its movement, the spring 26 being compressed thereby as the matrix is stationary and by its engagement and that of the guide therein with the head of the blank, the metal of the latter flows until it both fills the recess 14 and closes around the matrix, which limits its further flow in that direction. This operation not only fashions the head to its finished form but also reduces the oversize socket to its completed shape and size. The punch 22 when withdrawn carries with it the matrix 27 and the finished blank is ejected from the die by the knockout pin 12. Heretofore it has been the practice to form the socket and shape the blank at one and the same operation, the tip of the punch making the finished socket. This necessitates the use of a tool wherein the tip thereof is exactly the same shape in cross section and height as that of the finished socket. After such a tip has been projected into the blank the working face of the punch adjacent to the tip applies pressure to the head of the blank. Thus, a pressure is applied through the tip, which causes the metal to flow outwardly, and a pressure by the punch face on the end of the blank causes the metal to flow inwardly, two diametrically opposite flows of the metal. This results in an imperfect product and is the cause of frequent breakage of the punch, particularly the tip on the juncture line of the tip and the body of the punch. In the means herein shown the socket is first made larger than the finished socket, and no pressure is applied to the head of the blank. By such a method a much more rugged socketing punch is used and the metal is free to flow under the pressure thereof without restriction or counterpressure. Again, the junction point between the tip and the punch body may be rounded as at 29, adding materially to the strength of the tool. Thereafter, this socket is completed by an inward flow of the metal to reduce the oversize socket to its smaller and finished size, at which time there is no socket punch, the matrix merely limiting the inward flow of the metal and pressure is only applied to the outside of the head.

By the means herein shown and described a blank is produced with a perfect socket to the required shape and depth, as well as a finished head that does not require trimming or the like. The blanks are made at high speed with no breakage of tools.

In Figures 1 and 2 are illustrated two of the many shaped sockets commonly used. Other shapes may be produced equally as well by the means herein disclosed. In the producing of various shaped sockets the flow of metal is equal in some and in others unequal. To illustrate, the flow of metal in the shape of socket shown in Figure 1 is unequal, and equal in the shape shown in Figure 2. If unequal, it is desirable to so shape the recess 13 in the die 10 as to facilitate the subsequent flow of metal in fashioning the blank. This is done for unequal flow by forming the recess other than round in shape, one shape being generally elliptical, substantially as

shown in Figure 14, the minor axis of which is coincident with the length of the socket. Projecting the socket forming tip 21 into the blank, causes a greater flow of metal in the direction of the length of the socket than at right angles thereto. Other shapes of recesses may be provided to facilitate forming varying shapes of sockets, the disclosures herein being merely for illustration and not limitation.

In Figure 14 is illustrated the head of a blank, substantially as formed with the tools as shown in Figure 5, and as presented to the tools as shown in Figure 6.

There are minor changes and alterations that may be made within my invention, and I would therefore have it understood that I do not limit myself to the exact means herein disclosed, but claim all that falls fairly within the spirit and scope of the appended claims.

What I claim is:

1. Apparatus for making a socketed head blank, comprising mechanism for upsetting the portion of the blank to be socketed, a socketing mechanism of greater height than the depth of the socket and projected into the upset portion; and means for shaping the head and socket in its finished form, comprising in part a member within the socket to limit inward flow of the metal and a punch therearound, movable relative to said member, which applies endwise pressure to the upset portion of the blank outside of the socket area and while the said member is stationary within the socket.

2. Apparatus for making a socketed head blank, comprising in part dies and punches which cooperate to upset that portion of the blank to be socketed; a punch having a tip thereon of greater height than the depth of the finished socket and having a larger cross section than the finished socket; a matrix having substantially the same shape and size in cross section as the finished socket; and a punch movable relative to the matrix that applies pressure to the end of the upset portion while the matrix is stationary within the said socket and thereby shaping the upset portion into a finished head and completing the socket therein.

3. In apparatus for making a socketed head blank, the combination with a die; of a punch to form a socket in the blank; another punch that applies pressure to the blank outside of the said socket; a matrix movable therein and in one position a portion thereof projecting beyond the working face of the punch, said portion in cross section being smaller than but having substantially the same shape as the said socket; and means within the punch guiding the matrix in its movement, comprising two members having abutting faces and an opening therethrough corresponding in shape with said matrix.

4. In apparatus for making a blank with a socket in the head thereof, the combination with a die; of a punch to form a socket in the blank; another punch that applies pressure to the blank outside of the said socket; a matrix movable endwise therein; a spring to project the matrix outwardly; and a guide member in the punch through which the matrix projects, said matrix at its outer end at that portion passing through the guide member having substantially the same cross sectional shape of but slightly smaller than the said socket.

5. Apparatus for making a socketed head blank, comprising in part dies and punches, each of said dies having a recess in its working face, the cross sectional shape of the recess in one die being substantially the same as that of the head of the blank in its finished form and the recess in the other die having a shape elliptical in cross section.

6. Apparatus for making socketed head blanks, comprising in part dies and punches, each die having a recess in its working face, the cross sectional shape of the recess in one die being substantially the same as that of the head of the blank in its finished form, and the recess in the other die having a cross sectional shape different than that of the head of the blank, the space between the walls thereof and the center of the recess varying at different points about said center.

7. An apparatus for making a socketed head blank by pressure, comprising in part means for holding the blank, a punch, means for forcing the punch into the blank and thereby forming a socket, a member having a cross section smaller than the punch held stationary within the socket and a second punch for applying pressure to the end of the blank outside of the member and causing the metal of the blank to flow toward and around the member and thereby reforming the socket.

8. Apparatus for making a socket in a blank, comprising in part a tool that applies pressure solely to the end of the blank over the socket area, and thereby forming a socket therein, a second tool that applies pressure solely outside of the socket area and a matrix mounted in the second tool which projects into the socket formed by the first mentioned tool and passively determines the final shape and size of the socket while the blank is under the pressure of the said second tool to substantially that of the matrix.

9. In apparatus for making a socketed head blank, the combination with a die; of a punch to form a socket in the blank; another punch that applies pressure to the blank outside of the said socket; a matrix movable therein and in one position a portion thereof projecting beyond the working face of the punch, said portion in cross section being smaller than but having substantially the same shape as the said socket; and means within the punch guiding the matrix in its movement having an opening therethrough substantially corresponding in shape with said matrix.

RICHARD LESTER WILCOX.