June 9, 1942. W. A. PURTELL 2,285,462

METHOD OF AND APPARATUS FOR MAKING SOCKETED SCREWS

Filed May 26, 1939

Fig. 1.

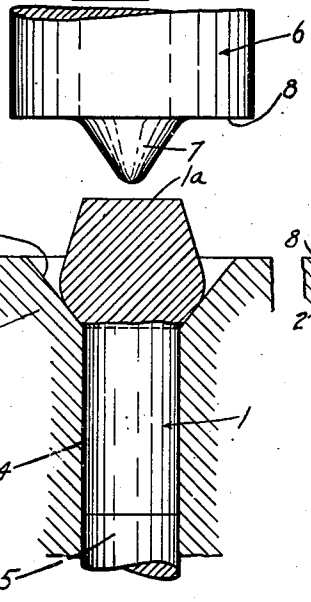


Fig. 2.

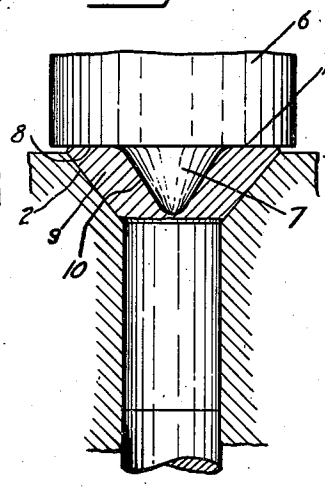


Fig. 4a.

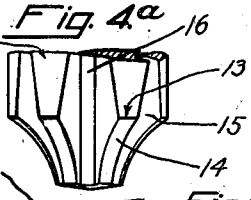


Fig. 4.

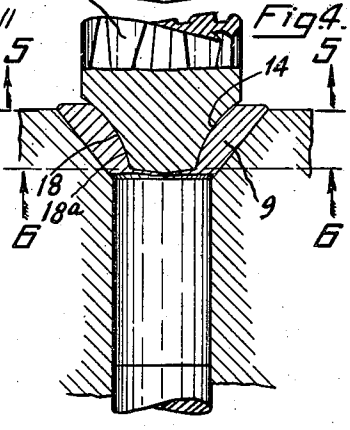


Fig. 3.

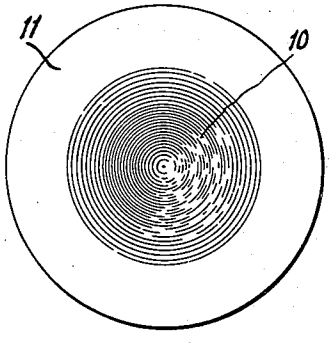


Fig. 9.

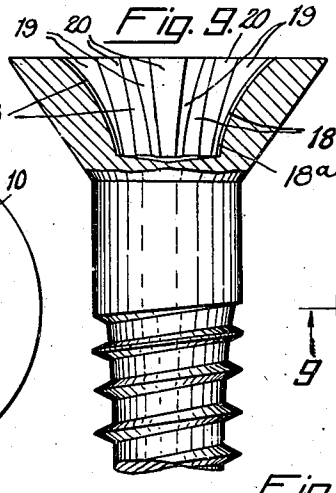


Fig. 8.

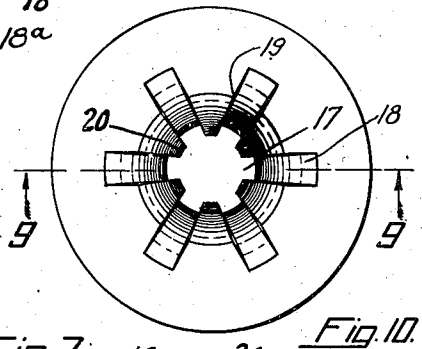


Fig. 5.

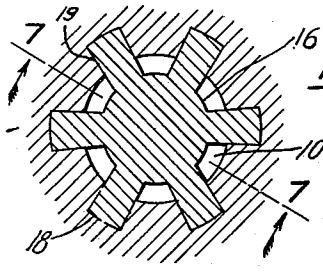


Fig. 6.

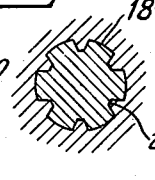


Fig. 7.

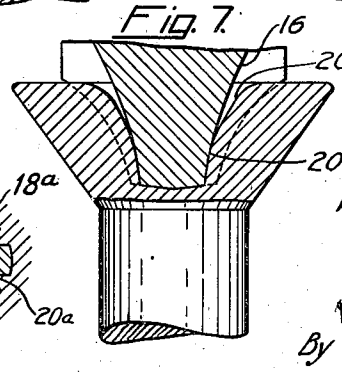
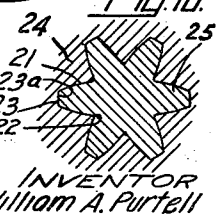


Fig. 10.



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METHOD OF AND APPARATUS FOR MAKING SOCKETED SCREWS

William A. Purtell, West Hartford, Conn., assignor to The Holo-Krome Screw Corporation, a corporation of Connecticut

Application May 26, 1939, Serial No. 275,904

29 Claims. (Cl. 10—7)

My invention relates to methods of and apparatus for making socketed screws.

It has among its objects to provide an improved method for making such screws whereby it is made possible markedly to improve the conformation of the socket and to produce improved binding and guiding surfaces therein adapted to cooperate in an improved manner with a screw driver. A further object of my invention is to provide such an improved method whereby it is made possible to produce a larger and more readily entered target than heretofore possible while avoiding severe displacement of metal during the formation of the socket and in such manner as to produce a stronger socket wall. A further object of my invention is to provide such an improved method wherein the wall of the target is first formed and improved flutes are thereafter formed in the periphery of the wall of the target in such manner as not only to facilitate the formation of the socket, but also to enable new and advantageous movements of the metal relative to the punch. A further object of my invention is to provide improved apparatus adapted to be used in carrying out my improved method, and, more particularly, such apparatus adapted to be used in a header in such manner as to enable the screws to be readily, quickly and inexpensively produced. These and other objects and advantages of my improvements will, however, hereinafter appear.

In the accompanying drawing, I have shown for purposes of illustration one form of apparatus which may be be used in carrying out my improvements.

In the drawing:

Figure 1 is a central sectional view of the preliminary punching mechanism ready to operate on an upset blank;

Fig. 2 is a like view but showing the mechanism after preliminary punching;

Fig. 3 is an enlarged plan view of the blank after preliminary punching;

Fig. 4 is a view similar to Figure 2 but showing the flute forming punch in vertical section in the preliminarily punched blank;

Fig. 4a is a side elevation of the working end of the flute forming punch;

Fig. 5 is an enlarged section on line 5—5 of Figure 4;

Fig. 6 is an enlarged section on line 6—6 of Figure 4;

Fig. 7 is a section on line 7—7 of Figure 5;

Fig. 8 is an enlarged plan view of the completed socket;

Fig. 9 is an enlarged partial side elevation of the finished screw, the socket being shown in section on line 9—9 of Figure 8, and

Fig. 10 is a reduced sectional view corresponding to Figure 5 but showing a modified form of ribbed punch in a modified form of socket.

In Figures 1 to 7, I have shown my improvements applied to use in producing a screw of the construction described and claimed in my copending application Serial No. 275,903, filed May 26, 1939; the screw being formed from a wire blank and having the target initially formed in a preliminary punching operation and the fluted portions subsequently formed in the target wall, all in an improved manner, as hereinafter more fully described.

The blank 1 is preferably in the form of a section of wire or bar stock of suitable length. This blank is first upset in an upsetting die aperture 2 in a stationary die 3, the inner end of the shank then extending into an axial aperture 4 and being supported therein upon a suitable knockout pin 5. The upset end 1a of the blank projects through the aperture 2, herein of conical form, and beyond the latter aperture so that this upset end is adapted to have a preliminary punching formed therein by a movable die 6 having on its working end an axial conical punch 7 surrounded by an annular shoulder 8.

When the punch 6 moves downward, the upset end 1a of the blank 1 is formed into a conical head portion 9 conforming to the shape of the die aperture 2 and filling out the latter, while being punched vertically by the punch 7. More particularly, the conical punch 7 forms an axial conical aperture 10, while the shoulder 8 on the punch forms a flat annular surface 11 on the head 9 surrounding the aperture 10. Here it will be noted that the aperture 10 is of such dimensions that its outer end produces a large axially located, round, mouth, or so-called target, portions of the outer end of which, as will hereinafter appear, are thus completely formed in this preliminary punching operation.

After the blank has been formed into the shape shown in Figures 2 and 3, the punch 7 is withdrawn and moved out of alignment with the blank, and an improved punch 12 is utilized to complete the formation of the socket. As shown in Figures 4, 4a, 5 and 6, this punch 12 is provided with radially located rib portions 13 tapering longitudnially toward the extremity of the punch and provided with concave end walls 14 and converging side walls 15 connected at their points of minimum cross section with a body

portion 16 on the punch 12. Further, as shown in Figures 5 and 6, this body portion 16 is of circular cross section and decreases in diameter toward the extremity of the tool. Although its cross section at its outer end is of less diameter than the mouth of the aperture 10 formed by the conical punch 7, it will be observed that the extremity of this body somewhat enlarges the inner end of the aperture 10, as shown in Figure 7. It will also be observed that the ribs 13 extend radially beyond this body portion 16 in such manner that as the punch 12 moves downward into the aperture 10, the extremities of the ribs form fluted portions 17 conforming in shape to the extremities of the ribs and having convex end walls 18 conforming to the concave surfaces 14, and converging side walls 19 conforming to the side walls 15 on the extremities of the ribs 13. Further, it will be particularly noted that, due to the large aperture 10 and the space provided between the wall thereof and the body portion 16 of the punch 12, the metal in the walls of the aperture 10 is free to flow out of the path of the ribs 13 as the latter move downward to form the fluted portions 17, while the intermediate abutment portions 20 at the upper ends of the aperture 10 retain their original conformation. Further, it will be observed that the lower ends of these portions 20 are convexly shaped by the extremities of the portion 16 on punch 12 as shown at 20*a*, while the convex end walls 18 are similarly formed by concave surfaces 14 on the ribs 13 in such manner as to provide surfaces 18*a* at their lower ends corresponding to the surfaces 20*a*. It will also be noted that surfaces 20*a*, 18*a* and 19 approach the axis of the socket on arcs at increasingly acute angles to said axis, in such manner as to produce at the inner ends of the socket a plurality of series of radially and laterally disposed binding surfaces disposed around the entire socket and adapted effectively to wedge and hold a reciprocably inserted turning tool as described in my application mentioned.

As a result of my improvements, it will be observed that convex end walls 18 including the increasingly acutely angled portions 18*a* are readily provided in the fluted portions, and that like walls or surfaces 20*a* are formed on the abutments 20 in such manner as, with surfaces 19 and 18*a*, to form binding, gripping or wedging surfaces disposed at varying sharp angles to the axis of the socket and thus adapted effectively to retain the screw on a driver end inserted in the socket. Further, the side walls of the fluted portions are so formed as to provide a large contact area and to enable them to cooperate in this retaining function while minimizing camming and enabling the metal to be uniformly displaced as necessary in producing a strong head and eliminating objectionable wear on the punch. Herein, the screw shown in Figures 8 and 9 is completely formed in the two operations described, save for such finishing operations on the top and sides of the head as may be desired. More particularly, the target is so shaped at its upper end by the punch 7 as to enable it to require no further shaping while the fluted portions 17 are formed. Also, these portions 17 are formed at spaced points around the periphery of the preliminary aperture 10, in such manner as to provide a strong socket adapted to receive corresponding turning portions on a screw driver and cooperate therewith without mutilation or breakage of the socket walls.

Attention is further directed to the fact that the preliminary aperture, which is very conveniently formed after upsetting, not only makes easier the operation of the punch 12, but also forms the target wall. Further, the preliminary formation of this target and the subsequent forming of the fluted portions, makes possible a very uniform distribution of the displaced metal and a minimum of severe displacement, in such manner as to produce a strong socket. Moreover, due to the provision of the preliminary punching, it is made possible for the metal displaced by the ribs on the punch 12 to move freely out of the path of these ribs, despite the converging walls 13 on these ribs, and without causing binding or undue wear on the punch.

In Figure 10, I have illustrated a punch of modified cross section which may be used if desired to produce a modified form of screw of the construction described and claimed in my copending application Serial No. 275,902, filed May 26, 1939. Here it will be noted that the tapered ribs of the punch have diverging convex side walls 21 intersecting at their inner ends in a concave line 22 at their junction with the tapered body of the punch, while the screw has corresponding concave intersecting side walls on its fluted portions intersecting on convex lines, the end walls of the slots and the side walls thereof forming binding surfaces generally corresponding to the surfaces 18 and 19 heretofore described. Here, it will be understood that corresponding but narrower convex and concave end walls 23, 23*a* are provided on the screw 24 and punch ribs 25, respectively, and corresponding to the convex surfaces 18 and 14 as heretofore described, so that like improved convex binding, wedging or gripping surfaces, not shown but corresponding to the surfaces 18*a*, and disposed at varying sharp angles to the axis, are formed at the inner ends of the slots or fluted portions, these convex surfaces also preferably extending upward and diverging outward to the mouth of the socket to provide guiding surfaces as heretofore described. Thus, in this construction also the portions 23*a*, 21 and 22 cooperate to produce at the inner end of the socket a plurality of series of turning tool wedging portions disposed around the entire socket. In this construction, both the conical body portion 16 on the punch and the large preliminary socket 10 heretofore described are omitted, although a smaller preliminary punching may be used if desired.

It will be understood that either form of my improved punch may also be utilized as a screw driver if desired, although preferably the bottom extremity of the punch is slightly cut back when so used. Also when used as a screw driver the concave end surfaces on the ribs may be shortened if desired so that there is no contact with the upper portions of the convex end walls of the fluted portions or slots in the screw, it being found that my improved gripping, binding or wedging effect at the inner ends of the slots is such as to make this possible.

While I have in this application specifically described certain embodiments which my invention may assume in practice, it will be understood that these forms have been shown for purposes of illustration, and that the invention may be modified and embodied in various other forms without departing from its spirit or the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent is:

1. The method of making socketed screws which consists in, punching the mouth portion of the socket while preliminarily punching the remainder of the socket, and punching said remainder to produce turning surfaces while the remainder of said mouth portion retains its general conformation.

2. The method of making socketed screws which consists in, punching a bell mounted portion of the socket while preliminarily punching the remainder thereof, and punching said remainder while said portion retains its bell mouthed conformation.

3. The method of making socketed screws which consists in, punching a mouth portion on the socket while preliminarily punching the remainder thereof, and convexly grooving said mouth portion at radially spaced points while punching the remainder of the socket.

4. The method of making socketed screws which consists in, punching a mouth portion on the socket while preliminarily punching the remainder thereof, and punching said remainder while convexly grooving at radially spaced points both said mouth portion and said remainder.

5. The method of making socketed screws which consists in, punching a bell mouthed target aperture in one end of a blank while preliminarily punching the remainder of the socket, and punching convex radial slots in the walls of said aperture extending down to the bottom of the socket while punching the remainder of the latter.

6. The method of making socketed screws which consists in, punching a bell mouthed portion of the socket while preliminarily punching the remainder thereof, and punching said remainder while radially slotting both the latter and said bell mouthed portion and substantially maintaining the conformation of the portions of said bell mouthed portion between the slots.

7. The method of making socketed screws which consists in, punching a blank to form a mouth portion of the socket and a smaller preliminarily punched portion below said mouth portion, and punching said smaller portion to enlarge the same while avoiding enlargement of said mouth portion and forming turning tool receiving and binding portions in the socket walls.

8. The method of making socketed screws which consists in, punching a bell mounted portion of the socket while punching a tapered preliminary socket below the same extending substantially to the bottom of the socket, and punching said tapered preliminary socket to enlarge the same and form the remainder of the socket while radially slotting the latter and said bell mouthed portion.

9. In an apparatus for making socketed screws, punching mechanism for forming the mouth of a socket while preliminarily punching the remainder of the socket, and punching mechanism for punching turning surfaces in the remainder of the socket while portions of said mouth free from turning surfaces retain their general conformation.

10. In an apparatus for making socketed screws, punching mechanism for forming the mouth of a socket while preliminarily punching the remainder of the socket, and punching mechanism for widening and sharpening the axial curvature of the inner portion of the preliminary recess while leaving at least a substantial portion of the wall of the mouth portion of the same general contour.

11. In an apparatus for making socketed screws, punching mechanism for forming the mouth of a socket while preliminarily punching the remainder of the socket, and mechanism for punching the remainder of the socket and radially slotting said mouth portion while maintaining the general conformation of the mouth portion between the slots.

12. In an apparatus for making socketed screws, mechanism for punching a bell mouthed mouth portion in the upset end of a blank while preliminarily punching the socket below said portion, and mechanism for punching said preliminarily punched portion while radially slotting said bell mouthed portion and the remainder of the socket.

13. In an apparatus for making socketed screws, mechanism for punching a bell mouthed mouth portion in the upset end of a blank while preliminarily punching the blank below said portion, and mechanism for punching said preliminarily punched portion while radially slotting said bell mouthed portion and the remainder of the socket and forming turning tool binding surfaces in the bottom of the socket.

14. Apparatus for making socketed screws including a punch having tapered radially located ribs thereon having concave end walls diverging from the axis of the punch at the larger ends of said ribs and disposed in substantial parallelism with the axis of said punch at the smaller end thereof.

15. A tool having radially located longitudinally extending rib portions on its working end tapering toward its extremity and also having concave end walls on the lower extremities of said rib portions having their extremities disposed at increasingly acute angles to the axis of said tool.

16. A tool having radially located longitudinally extending rib portions on its working end tapering toward its extremity and also having concave end walls on the lower extremities of said rib portions and vertically concave portions between said rib portions.

17. A tool having radially located longitudinally extending rib-like portions on its working end disposed in intersecting planes around the latter and tapering toward its extremity and also having concave end walls on said rib portions having their extremities disposed at increasingly acute angles to the axis of said tool.

18. A tool having radially located longitudinally extending rib portions on its working end tapering toward its extremity and also having vertically concave portions on the end walls of said rib portions comprising elongated binding portions leading toward said extremity and disposed at increasingly acute angles to the axis of the tool.

19. A tool having radially located longitudinally extending rib-like portions on its working end disposed in intersecting planes around the latter and tapering toward the extremity of the tool and having end and side walls on said ribs, the lower extremities of said end walls being disposed at increasingly sharp angles to the axis of the tool and said side walls having their lower extremities approaching a vertical plane passing between the same.

20. A tool having radially located longitudinally extending rib-like portions on its working end disposed in intersecting planes around the latter and tapering toward the extremity of the tool and having end and side walls on said ribs,

the lower extremities of said end walls being disposed at increasingly sharp angles to the axis of the tool and said side walls having their lower extremities approaching a vertical plane passing between the same, and the body of said tool having between adjacent side walls concave portions having their lower extremities disposed at increasingly acute angles to the axis of the tool.

21. A tool having radially located longitudinally extending rib portions on its working end tapering toward its extremity and also having side walls on said rib portions converging toward the axis of said tool, and concave end walls on the lower extremities of said rib portions having their extremities disposed at increasingly acute angles to the axis of said tool.

22. A tool having radially located longitudinally extending rib portions on its working end tapering toward the extremity of said tool and also having side walls on said rib portions converging toward the axis of the tool, laterally convex vertically tapered portions on the body of the tool connecting adjacent side walls, and concave end walls on the lower extremities of said rib portions.

23. A tool having radially located longitudinally extending rib portions on its working end tapering toward its extremity and also having side walls on said rib portions diverging toward the body of said tool and intersecting on concave lines, and concave end walls on the lower extremities of said rib portions having their extremities disposed at increasingly acute angles to the axis of said tool.

24. A tool having radially located longitudinally extending rib portions on its working end tapering toward the extremity of the tool and having vertically tapered laterally convex side walls on said rib portions diverging toward the body of said tool.

25. A tool having radially located longitudinally extending rib portions on its working end tapering toward the extremity of the tool and having vertically tapered laterally convex side walls on said rib portions diverging toward the body of said tool, and vertically concave portions on said rib portions between said convex side walls and having their extremities disposed at increasingly acute angles to the axis of the tool.

26. A tool having radially located longitudinally extending rib-like portions on its working end disposed in intersecting planes around the latter and tapering toward the extremity of the tool and also having concave portions between said rib portions and on the end walls of the latter, having their extremities disposed at increasingly acute angles to the axis of the tool.

27. A tool having radially located longitudinally extending rib-like portions on its working end disposed in intersecting planes around the latter and tapering toward the extremity of the tool and also having vertically concave portions on the end walls of said rib portions having their extremities disposed at increasingly acute angles to the axis of the tool.

28. A tool having radially located longitudinally extending rib-like portions on its working end disposed in intersecting planes around the latter and tapering toward the extremity of the tool and also having vertically concave portions on the end walls of said rib portions and vertically concave lines on the body of the tool formed by intersecting side walls of adjacent rib portions and having the extremities of said concave portions and lines disposed at increasingly acute angles to the axis of the tool.

29. A tool having radially located longitudinally extending rib portions on its working end tapering toward its extremity and also having tapered side walls on said rib portions diverging toward the body of said tool, and concave end walls on the lower extremities of said rib portions, said side walls also being laterally convex

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