May 8, 1934. R. L. WILCOX 1,957,924

APPARATUS FOR FORMING METAL ARTICLES

Original Filed Aug. 24, 1932

Fig. 1.

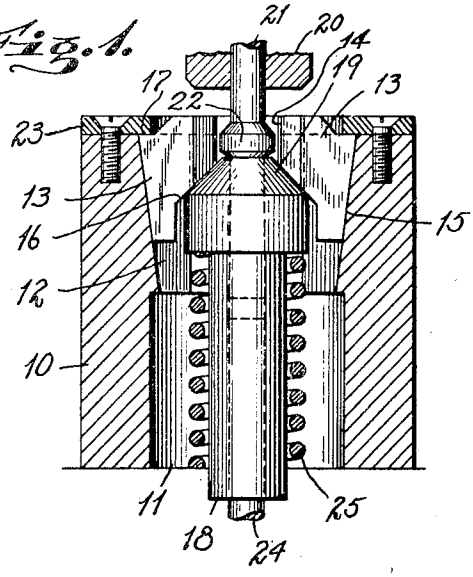


Fig. 2.

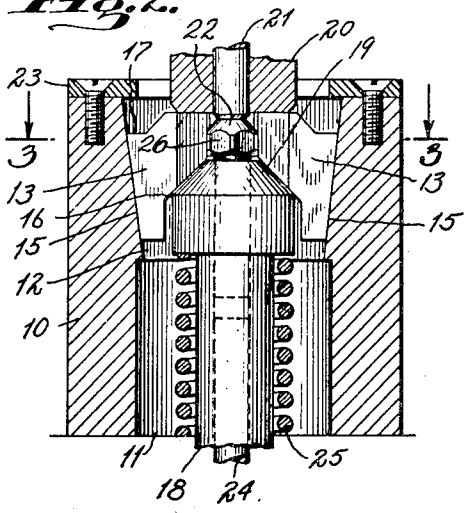


Fig. 3.

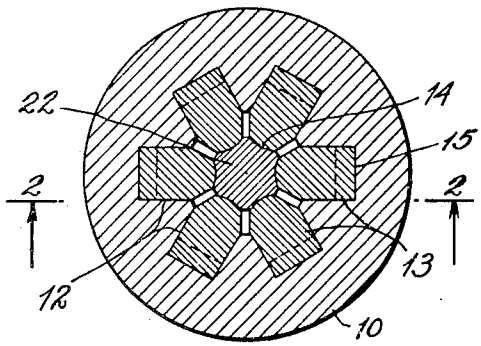


Fig. 4.

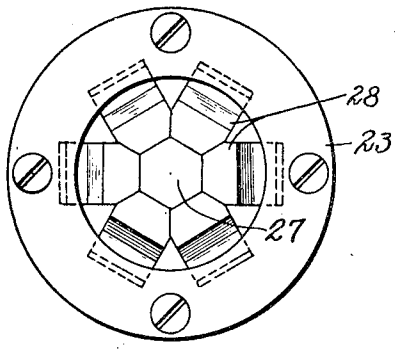


Fig. 5.

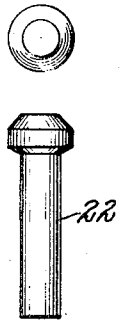


Fig. 6.

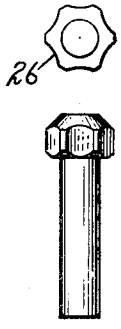
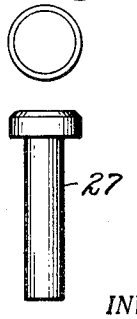


Fig. 8



Fig. 7



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APPARATUS FOR FORMING METAL ARTICLES

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Original application August 24, 1932, Serial No. 630,235. Divided and this application March 30, 1933, Serial No. 663,481

7 Claims. (Cl. 10—18)

This invention relates to apparatus for forming metal articles in a cold state, having a polygonal cross section, particularly bolts, nuts, rivets, screws and the like.

This application is a division of an application filed August 24, 1932, by this applicant, and designated by the Serial Number 630,235.

In the co-pending application there is shown and described a method and means for making articles having a polygonal cross section by a cold process from a substantially cylindrical blank, by upsetting the same to form a blank of greater diameter, and thereafter, applying lateral pressure thereto, initiated by the axial movement of other parts, so as to produce the desired polygonal cross section.

This present invention particularly relates to the means and the apparatus by which this latter pressure is applied.

As illustrated and described herein the invention is applied in the manufacture of an article having an hexagonal cross section but is not limited, however, to such shape.

In the drawing, wherein like characters of reference indicate like parts in the several figures;

Figure 1 is a transverse sectional view of one form of the improved apparatus with a portion of a punch adjacent thereto;

Figure 2 is a similar view with some of the parts in other positions than as shown in Figure 1;

Figure 3 is a cross sectional view thereof with the parts in section as they appear upon line 3—3 of Figure 2;

Figure 4 is a view of the apparatus with dies of another form than as shown in the preceding figures;

Figure 5 is a view of a blank, prepared by other mechanism, as presented to the apparatus disclosed herein by Figures 1, 2 and 3;

Figure 6 is a view of the same blank with the head having a fluted cross section;

Figure 7 is a view of a blank, prepared by other mechanism, as presented to this apparatus, the head of which is to be shaped substantially as shown in Figure 8;

Figure 8 is a view of a completed blank with a conventional hexagon head shaped by this apparatus.

The blanks shown in Figures 5 and 7 may be produced by the method and means set forth in the said co-pending application, or in any other manner, as may seem most desirable.

This invention relates particularly to mechanism for subjecting a blank so formed, to lateral pressure at predetermined places around its perimeter to produce either a plurality of depressions and form a fluted blank, substantially as shown in Figure 6, or a blank with flat sides, substantially as shown in Figure 8, such pressure being initiated by the movement of a tool toward the head of the blank and in the same axial plane, the blank during all of the operations thereon remaining in a cold state.

The apparatus herein disclosed and shown is constructed with a body member 10, which is held stationary in a suitable die block or the like. Through the body member is an opening 11 of plural diameters, in the walls of the smaller diameter of which are a plurality of radial slots 12. The rear walls of these slots, six in number, are at an angle to the axis of the opening 11, as the apparatus shown is designed to produce an article that is hexagonal in cross section. A greater or less number of faces will correspondingly increase or reduce the number of required slots. Movable in each slot, in the form of apparatus shown in Figures 1, 2 and 3, is a pressure die 13. These dies 13 are formed with a rounded nose 14 that is substantially parallel with the corresponding faces of the other dies in the group, and an outer cam face 15, which rides against the angular wall of the slot 12, an inner cam face 16, and a stop shoulder 17. It is preferable that the dies 13 should not contact with each other, but that an open space be left therebetween substantially as shown in Figure 3, whereby to accommodate the flow of the metal. Movably mounted within the opening 11 is a sleeve 18, having a cone head 19, the angle of inclination of which is substantially the same as that of the cam faces 16, which engage therewith.

The diameter of the cone head 19 is substantially the same as that of the smaller diameter portion of the opening 11, within which it is slidably mounted. A punch 20, actuated by any suitable mechanism to cause it to move toward and away from the body member 10, has a pressure pin 21 movably mounted therein.

Either the blank 22 or 27, whichever is being operated upon, with its cylindrical head is presented by suitable transfer mechanism in line with the apparatus herein shown, so that the axis thereof is substantially coincident with that of the body member 10 and the punch 20. When so positioned, the several parts are as shown in Figure 1, the upper edges of the dies 13 being substantially flush with the top of the plate 23, secured to the body member 10, and the stop shoulders 17 against the underside thereof, which limit the movement of the dies in one direction.

As the punch 20 moves toward the body member 10, the pressure pin 21 engages the head of the blank and projects its shank into the opening in the sleeve 18. The underside of the head is now against the top of the sleeve 18 in the position substantially as shown in Figure 1. The sleeve 18 thus serves both as a platform and centering guide for the blank. Continued movement of the punch 20 brings the pressure face thereof against the top of all of the dies 13, which by reason thereof are moved axially within the body member 10. The dies 13 under this action move inwardly toward the axis of the blank by reason of the engagement of the cam faces 15 with the angular walls of the slots 12. Endwise pressure is also thus applied to the sleeve 18 through the engagement of the cam faces 16 on the dies with the cone head 19. During this movement of the punch, the pressure pin 21 recedes within the punch 20 against the tension of a spring (not shown), and the nose 14 of each of the dies 13 is forced against and into the walls of the head of the blank, forming the depression 26, which continue to increase in depth during the movement of the punch 20. This inward movement of the dies 13 imparts an endwise movement to the sleeve 18, which thereafter moves away from the head of the blank, now tightly held between the dies 13. At one extreme position of the parts, the top of the cone head 19 is distant from the underside of the head of the blank, substantiallly as shown in Figure 2, leaving an open space therebetween. Pressure against the outer wall of the head of the blank elongates the same so that it is higher after this operation than before. Moving the sleeve 18 away from the head of the blank permits the flow of the metal substantially parallel with the shank on the underside of the head without being restrained by the sleeve. Such flow, however, does not occur in all cases, the character of the metal and its degree of hardness being determining factors. As the spring actuating the pin 21 is relatively light, there is practically no resistance to the flow of the metal upwardly as the punch 20 is advanced. At the latter portion of such withdrawal motion, the pressure pin 21 is carried with it as a unit. When the blank has been thus released from the endwise pressure of the punch 20, the knockout pin 24 advances and engages the end of the shank of the blank within the sleeve 18. During such action the dies 13 move with the blank until the stop shoulders 17 engage the plate 23, thus freeing the friction thereof upon the cam faces 15. The spring 25 moves the sleeve 18 and by reason of its cam engagement with the dies 13, the latter are moved outwardly releasing the blank from the die. The continued movement of the knockout pin 24 completely ejects the blank from the die. The dies and sleeve are now ready for the next succeeding blank.

The curvature of the bottom of the depressions 26 is determined by that of the nose 14 of the dies. These, in turn, are shaped so that the metal at the bottom of the depressions will flow outwardly under a common pressure on these and other parts of the head, and the entire flow of the metal in the head will produce the final form of article, such as shown in Figure 8, without the formation of a flash or fin, and with a suitable chamfer upon one or both sides, as desired.

After the blank is ejected from the apparatus it is carried by suitable transfer mechanism into line with other tools for subsequent operations.

It is desirable in some cases to make the sides of the head flat, as shown in Figure 8, directly from a cylindrical head without the intermediate step of forming depressions. In such case, dies 28 are used instead of the dies 13 and the cylindrical head of the blank is first formed very much larger in diameter and of considerably less height than with the blank shown in Figure 5.

The relative difference in diameters and height is shown by comparison of Figures 5 and 7. This latter showing a blank 27 which is presented to the sleeve 18 in the manner above described, and pressure being applied thereto through the action of the punch 20, in the same manner as for the blank having the fluted head. These dies 28 in their innermost positions contact with each other instead of being separated by spaces as in the dies for the fluted head. Any irregularities formed at either the top or bottom of the head of the blank 27 by the action of the dies are removed in a succeeding pressure operation, which may or may not be necessary, depending in a large measure upon the character and degree of hardness of the metal upon which the operations are performed.

An endwise movement of the body member 10 will impart the required in and out movement of the pressure dies 13, or other means may be substituted for the same purpose within this present invention.

While the invention as disclosed herein relates particularly to the production of bolts, rivets and screws, it is equally adapted for the production of like articles, such as nuts.

Within the scope of the appended claims, the details of the embodiment of the invention, as herein disclosed, may be varied or altered without departing from the spirit thereof.

What I claim as new is:

1. In apparatus of the character described for making by a cold process articles having a polygonal cross section; a body member having an opening therein with a plurality of slots extending outwardly therefrom, the outer walls of which are at an angle to the axis of the opening; a platform having a conical head within the opening; and a die in each of the slots having engagement with said conical head and with the angular walls of the slot, whereby movement of the dies in one direction will impart movement of the platform.

2. In apparatus of the character described for making by a cold process articles having a polygonal cross section; a body member having an opening therein with a plurality of slots extending outwardly therefrom, the outer walls of which are at an angle to the axis of the opening; a platform having a conical head within the opening; and a die in each of said slots having engagement with said conical head and with the angular walls of the slot, whereby movement of the dies in one direction will impart movement of the platform, and movement of the platform in the opposite direction will impart movement to the dies.

3. In apparatus of the character described for making by a cold process articles having a polygonal cross section; a body member having an opening therein with a plurality of slots extending outwardly therefrom, the outer walls of which are at an angle to the axis of the opening; a platform having a conical head within the opening; and a die in each of said slots having engagement with said conical head and with the angular walls of the slot, whereby movement of

the dies in one direction will impart movement of the platform, the angle of inclination of the walls of the slot and that of the conical head being different, whereby movement of the dies in one direction will impart an accelerated movement to the platform in the same direction.

4. In apparatus of the character described for making by a cold process articles having a polygonal cross section; a body member having an opening therein with a plurality of outwardly extending slots in the wall thereof corresponding in number with the polygonal faces, the outer wall of each of the slots being at an angle to the axis of the opening; a die movable in each of the slots having an outer wall with the same relative angle as the outer wall of the slots; a punch or the like for applying pressure to the outer end of each of the dies, whereby the same are caused to move into the body member and inwardly toward each other by reason of the engagement of the said angular walls; and means within said opening, engaging said dies, for moving the same outwardly in the body member and radially away from each other, said means during such action maintaining all of the dies in the same position relative to the axis of the opening.

5. In apparatus of the character described for making by a cold process articles having a polygonal cross section; a body member having an opening therein with a plurality of outwardly extending slots in the wall thereof corresponding in number with the polygonal faces, the outer wall of each of the slots being at an angle to the axis of the opening; a die movable in each of the slots having an outer wall with the same relative angle as the outer wall of the slots and a cam wall forming an inner face; a punch or the like for applying pressure to the outer end of each of the dies, whereby the same are caused to move into the body member and inwardly toward each other by reason of the engagement of the said angular walls; and means within said opening, engaging the cam faces of said dies, for moving the same outwardly in the body member and radially away from each other.

6. In apparatus of the character described for making by a cold process articles having a polygonal cross section; a body member having an opening therein with a plurality of outwardly extending slots in the wall thereof corresponding in number with the polygonal faces, the outer wall of each of the slots being at an angle to the axis of the opening; a die movable in each of the slots having an outer wall with the same relative angle as the outer wall of the slots; a punch or the like for applying pressure to the outer end of each of the dies, whereby the same are caused to move into the body member and inwardly toward each other by reason of the engagement of the said angular walls; and means within said opening and having contact with each of said dies whereby the angular walls of the dies and slot are maintained in contact with each other.

7. In apparatus of the character described for making by a cold process articles having a polygonal cross section; a body member having an opening therein with a plurality of outwardly extending slots in the wall thereof corresponding in number with the polygonal faces, the outer wall of each of the slots being at an angle to the axis of the opening; a die movable in each of the slots having an outer wall with the same relative angle as the outer wall of the slots; a punch or the like for applying pressure to the outer end of each of the dies, whereby the same are caused to move into the body member and inwardly toward each other by reason of the engagement of the said angular wall; and a movable member within the opening to receive the shank of a blank and form an inner support for the said dies irrespective of their relative positions within the body member.

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