

July 7, 1953

L. E. RESSEGER
COLD COINING

2,644,352

Filed Dec. 22, 1944

2 Sheets-Sheet 1

Fig. 1.

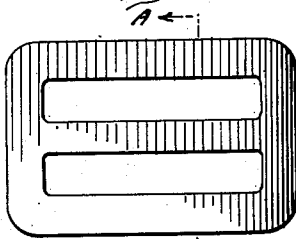


Fig. 6.

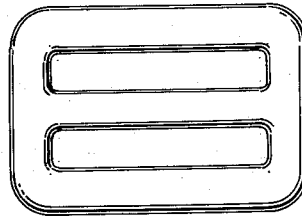


Fig. 2.

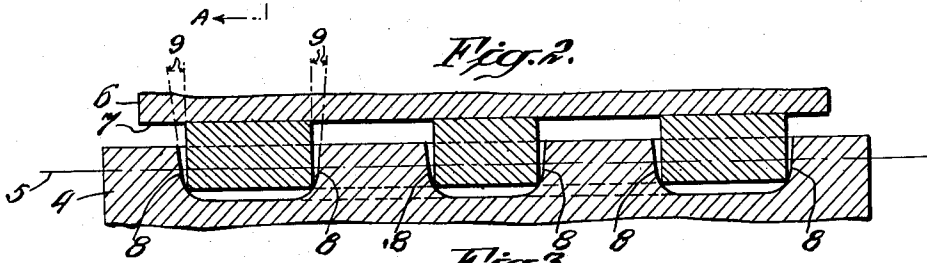


Fig. 3.

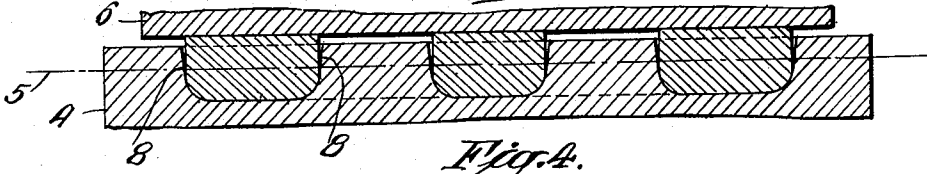


Fig. 4.

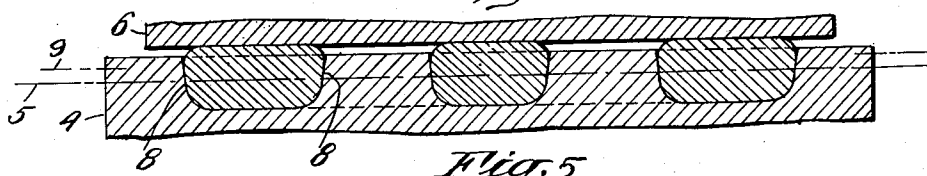


Fig. 5.

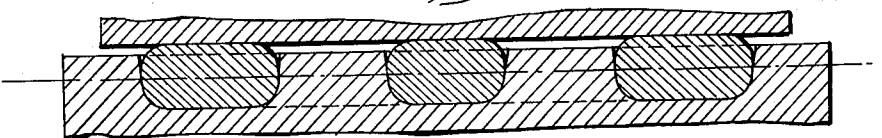


Fig. 7.



Fig. 8.

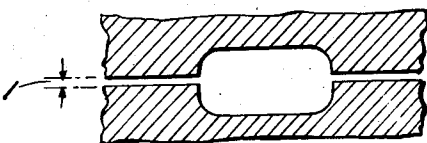


Fig. 9.

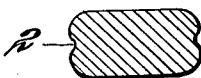


Fig. 10.



INVENTOR.

L. E. Resseger

BY

Vaughn & Kennedy
ATTORNEYS

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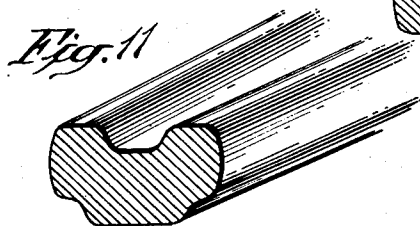
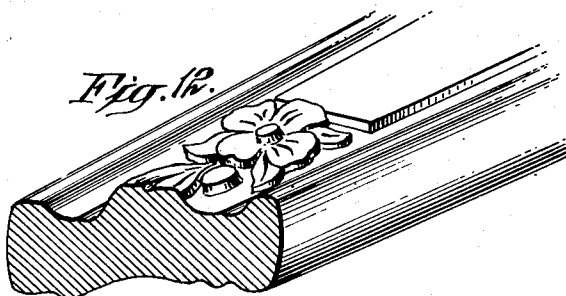
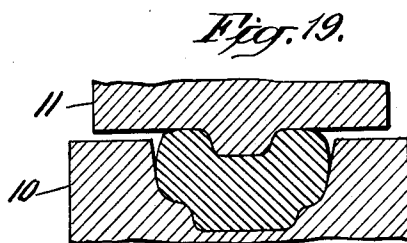
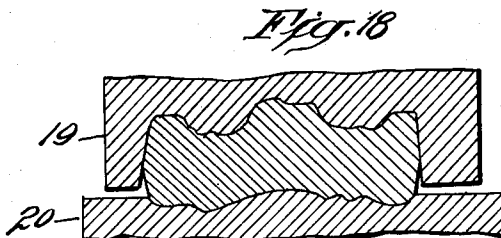
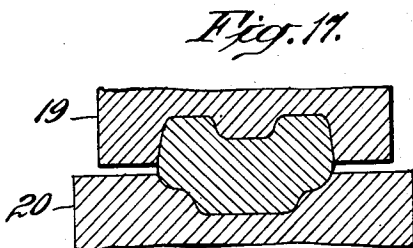
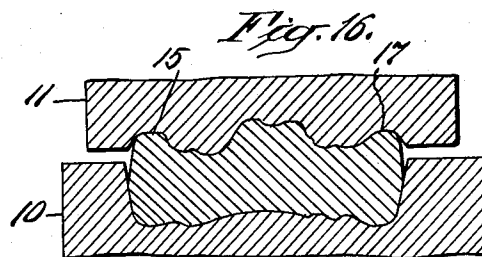
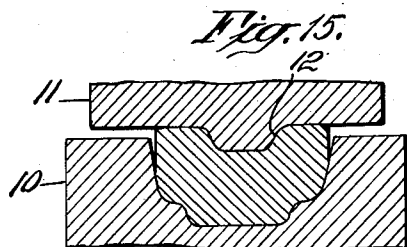
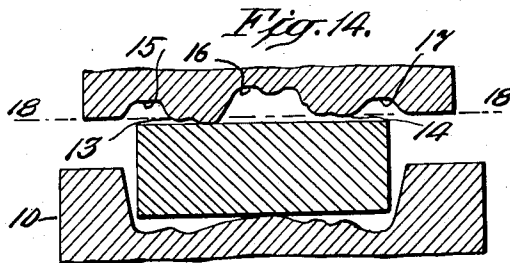
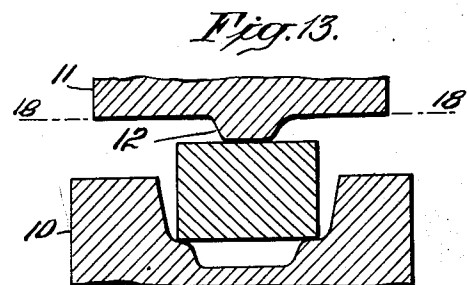
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INVENTOR.
Lloyd E. Resegger
BY
Vaughan & Kennedy
ATTORNEYS

UNITED STATES PATENT OFFICE

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COLD COINING

Lloyd E. Ressegger, Oneida, N. Y., assignor to
Oneida, Ltd., Oneida, N. Y., a corporation of
New York

Application December 22, 1944, Serial No. 569,365

4 Claims. (Cl. 78—81)

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This invention relates to improvements in the forming of metal articles and more particularly in so-called cold coining.

It is an object of the invention to provide a cold coining method by means of which construction of the dies is simplified.

Another object of the invention is to provide methods of coining by which the need for accurate registry of dies is eliminated or reduced.

A further object of the invention is to provide methods of coining by which the number and complexity of finishing operations are reduced.

With these and still further objects which will appear in the following full description in mind, the invention consists in the methods of manufacture which will now first be fully described in connection with the accompanying drawing and will then be more particularly pointed out in the appended claims.

In the drawing,

Figure 1 is a plan view of a blank to be formed into a metal article, in this case, a buckle;

Figures 2 to 5, inclusive, are views in vertical cross section showing the successive forming operation and dies utilized therefor, only the operating faces of the dies being shown;

Figure 6 is a plan view of a completed buckle thus formed from the blank of Figure 1;

Figures 7 to 10, inclusive, illustrate the conventional coining method heretofore practiced, showing in vertical cross section a blank (Figure 7), a pair of forming dies (Figure 8), a formed article having the defect of a so-called raw edge (Figure 9) and a formed article having the defect of a so-called flash (Figure 10);

Figures 11 and 12 are perspective views showing sections at points along a surface decorated article to be formed by coining, in this case, a knife handle; these two views are partial perspectives and sections through the same article;

Figures 13, 15, 17 and 19 are views showing in vertical cross section at a point corresponding to the section of Figure 11 the successive steps and dies involved in forming the article of Figures 11 and 12;

Figures 14, 16, 18 and 20 are similar views taken at a point corresponding to the section of Figure 12.

In Figures 13 to 20, inclusive, the two sets of views are pairs of sections at different points through the same blank and the same pair of dies, Figure 13 corresponding to Figure 14, Figure 15 to Figure 16, Figure 17 to Figure 18, and Figure 19 to Figure 20. The section of Figure 13 presents a different appearance from that of Fig-

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ure 14 because the sections are taken at different points, where the article to be produced has different cross-sectional shapes. The two views, however, represent sections through a single pair of dies, and the same is true of the other pairs of sections referred to.

The practice heretofore in the cold coining of metal articles is illustrated in Figures 7 to 10 of the drawing. In practicing such a method, a blank of rectangular or other section, such as shown in Figure 7, is formed by a pair of cavity dies such as shown in Figure 8. The depth of cavity of the upper and lower dies is normally approximately the same and the entire side walls of the die cavities serve as forming and molding elements against which the metal is forced, so that the cavities of the dies form a mold corresponding in shape to the article to be produced. Since the dies cannot be struck into complete contact, a small clearance such as indicated on an exaggerated scale by the numeral 1 in Figure 8 will exist. In consequence of this necessary clearance between the dies, there are three possible types of formation which may occur in the article along a line corresponding to the clearance between the dies. If it so happens that the size and formation of the blank and the flow of metal are all exactly correct at a given point, the side surface of the finished article may be smooth and unroughened. If, however, the metal flow is such that the blank is not forced outwardly to a sufficient extent, a raw edge or groove 2, such as shown in Figure 9, will be created. Where there is excess flow, a flash or rib, such as shown in Figure 10, will be created. In any actual forming operation, the line of the article which corresponds to the clearance between dies will normally have either a raw edge or a flash and both difficulties may exist at different points of the same article. A smooth surface without flash or raw edge is exceptional and will normally exist only at points along the die clearance line of the article where a flash is changing into a raw edge or vice versa.

It will also be observed that in the conventional practice, accurate mitre or registry of the dies is vital, as lack of registry will produce a defect in the nature of an off-set shoulder.

Where flash or raw edges are created, expensive finishing operations to eliminate the defects are necessary and the difficulty is aggravated wherever there are apertures in the article, since in such cases abrasive belts or straps must be utilized to finish the walls of the aperture. As a result, the finishing operations required on an

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article formed by conventional cold coining are extensive and expensive, due to the nature of the finishing operations, the surface contours ultimately produced are irregular, even though the dies themselves may be perfectly regular.

In the method shown in Figures 1 to 6, inclusive, these defects of prior coining methods are eliminated and an article without flash or raw edge in the finished surface is produced. The successive views in Figures 2 to 5, inclusive, show the forming dies and blank in section in a plane corresponding to the line A—A of Figure 1. It will be understood that the cavity die 4, when viewed in plan, will have a cavity outline similar in shape to that of the blank of Figure 1, and that the dies are struck together in any usual form of coining press under very great pressure. As shown in Figure 2, the cavities of the die 4 extend well above the plane 5, which is located mid-way between the surface of the upper die and the bottom of the cavity when the dies are in struck position. The upper die has a plane working surface 7 and it will be apparent that no close lateral registry or mitre of the dies is necessary. The side walls 8 of the cavities of die 4 are slanted to give a considerable draft angle 9, which serves two purposes. The first effect of the draft angle is that only the lower portion of the blank, which may be approximately one half of the blank, is forced against the cavity wall and formed or molded thereby. In consequence, the molding action of the side surface of the die is confined to an area adjacent one face of the blank and extending only part way across the side surface. The second effect is that the sloping side walls make it much easier to place the blank within the cavity die and assist very materially in obtaining the proper flow of metal and forming action. Figure 3 shows the dies of Figure 2 in struck position and it will be observed that the lower half of the blank below the center surface 5 has been formed into a shape corresponding to that of the cavity, while the upper half of the blank is unformed.

The second step in the forming of the article consists in repeating the first coining operation with reversal of dies by turning the partially formed blank upside down in the cavity die 4 and again subjecting it to the coining operation. The result of this operation is shown in Figure 4 and it will be observed that the previously unformed side of the blank has now been formed so as to conform to the cavity die for about three-quarters of the thickness of the blank and approximately up to the line 9 of Figure 4. At this point, both faces of the blank are formed and the sides are partially formed.

In the next step, the blank is again turned upside down with the die 4 and struck again. This operation completes the formation of the article of Figure 6, finishing the side surfaces, and these surfaces, instead of requiring grinding or similar finishing operations, are completely and smoothly worked. Final finishing can be accomplished by tumbling or any other suitable cleaning or polishing operation, depending upon the service requirements for the article.

While the process of the invention has been described as requiring the use of only a single cavity die for the three successive coining operations, it will be understood that a succession of such dies may be utilized where convenient for production reasons. The cavity dies utilized in the successive steps are all similar, because of the fact that the two faces of the article to be

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formed are similar. Where these faces are dissimilar, the successive cavity dies will be correspondingly dissimilar, the process being otherwise the same.

The molding action on the sides of the blank by the cavity dies used in the successive or repeated coining operations will preferably be such as to provide an overlap so as to work the entire article. In the example shown, accordingly, the concave die used in the successive operations will form the side surface somewhat more than half way across the same.

The process of the invention may be utilized for the formation of articles having raised and depressed surface ornamentation or other irregular surface contour. Such utilization is shown in Figures 11 to 20, inclusive, in which there is illustrated the formation of an article such as a knife handle from a suitably shaped blank of rectangular cross section.

The first forming step is accomplished with a lower cavity die 10 as shown in Figures 13 and 14, which is similar to the cavity die 4 of Figure 2 except that the conformation of its lower portion is irregular and is designed to mold one face of the blank to a shape similar to that of the lower face of the finished article of Figures 11 and 12. The upper die 11 is, in principle, a plane faced die similar to the die of Figure 2 but, due to the surface contour to be formed, is provided with projecting portions such as shown in section at the points 12, 13 and 14 of Figures 13 and 14 and also with recessed portions such as indicated at 15, 16 and 17 in Figure 14. The depth of the cavities, however, will be no greater than the height of the raised portions of the ornamentation and, in general, where the surface being formed by the upper die has both raised and lower portions intermediate its edges, the projections of the dies corresponding to the lowered portions will extend beyond the general plane of the die face which is indicated by the broken line 18—18 in the figures. The cavity die is formed with sloping sides adjacent its edge, as in the die of Figure 2, so as to provide a similar draft angle, but the upper die wherever there is a cavity adjacent its edge, is preferably formed with a very sloping side wall for such cavity, providing a very large draft angle where the cavity adjacent the edge of the blank has any depth. As a result of these features, the dies, when in struck position as shown in Figures 15 and 16, will have a forming action similar to that exhibited in Figure 3. At such a section as represented in Figure 15, it will be observed that the upper die adjacent the edges of the blank is plane so that there is no forming action along the edge of the blank at such points. Where the surface design requires a cavity in the upper die adjacent an edge of the blank, such as the cavities 15 and 17 previously referred to, the large draft angle provides an action similar to that which occurs at a section such as shown in Figure 15. As shown in Figure 16, the forming action at the edge of the blank will be slight, the die merely serving to round the edge, or the edge forming action may be entirely eliminated by widening the cavity. Considering the upper die 11 as a totality, it will comprise sections in which the die surface adjacent and overlapping the edge of the blank is a plane surface and, where the shape of the article and its surface ornamentation requires a cavity adjacent the edge, such cavity will have the large draft angle or lateral enlargement previously referred

to. With regard to the lower die, it will be observed that the forming action of the cavity extends only approximately half way from the bottom of the cavity die to the upper die. Due to the irregular contours of the faces of both dies, there is no precise measurable dimension corresponding to the vertical position of the surface 5 in the die of Figure 2, but corresponding distances may be stated with reference to average levels of the die surfaces. In any event, approximately half the surface of the side of the article adjacent one face thereof is not subjected to molding action by the dies during each coining operation, and in this respect the forming action is similar to that of Figures 2 and 3.

The next step in the formation of the article involves the repetition of the coining operation, using a pair of dies in which the plane and concave dies are reversed with respect to the blank faces. As is apparent, the concave die may be the lower die or upper die depending upon the positioning of the partially formed blank. As shown in Figures 17 and 18, the blank is left with the same side uppermost and the cavity die 19 is now the uppermost die. This die has suitably shaped contours for accommodating the conformation produced by the die 11. Its contours may be such as to subject the surface to further working and forming or it may be and preferably is such as to match the surface conformation produced during the first step so that the forming of the article surface during the second step is reduced. The side walls of this die are formed with a draft angle similar to that of die 10 so that again the forming action, as shown in Figures 17 and 18, which show the dies in struck position, takes place over approximately the upper half of the side surfaces of the article. The lower die 20 is provided with a cavity sufficient to accommodate and substantially fit the surface conformation produced by the lower cavity dies of Figures 13 and 14 and is thus modified from a flat surface die to a minimum extent. As will now be apparent, the dies of Figures 17 and 18 may be regarded as the dies of Figures 13 and 14, with the upper portion of the cavity die 10 removed so that this die will engage only one face of the blank and with side walls added to the upper die for the purpose of forming the sides of the blank and converting this die into a cavity die.

After this second coining operation, the faces of the article are normally, and preferably, completely formed, and the side surface partially so. The next operation involves the reuse of the dies of Figures 13 and 14, or similar dies, as shown in Figures 19 and 20, so that the side surfaces of the article are again subjected to a coining operation with a second reversal of concave and "flat" dies. Following this operation, the article is completely formed and the side surfaces are completely worked and finished and no flash or raw edge will be produced. As in the case of the article of Figure 6, the finished article of Figures 11 and 12 may now be subjected to a tumbling or other polishing operation without need for grinding.

In the processes as above described, it will be noted that the molding action of the side walls

of the cavity dies extends across approximately half the width of the side surface at each step. It will also be noted that in the articles thus formed, the greatest width of the article occurs approximately at the middle of the side surface. Where the greatest width of the article is closer to one face or the other, the forming action of the cavity dies will be correspondingly modified so that, for example, where the greatest width is twice as far from one face as from the other, the forming action of the cavity die during one step may extend approximately two-thirds across the width of the side surface, while that of the cavity die in the preceding or succeeding step will extend across approximately one-third of the width of the article. The precise extent and degree of overlap of the successive molding actions is not critical as the side surfaces, in any event, are formed by successive working rather than merely by molding, as in conventional coining methods.

What is claimed is:

1. The method of coining metal articles which comprises subjecting a blank to coining by a pair of dies, both of which force the metal of the blank faces throughout their area to flow into contact and to be molded to conform to the die contours, one of which has substantially no molding action on the side surfaces of the blank and the other of which is formed with a draft angle, whereby its molding action on the side surfaces of the blank is confined to an area adjacent one face thereof and extending only part way across the width thereof, and repeating this operation upon the partly formed blank with reversal of dies having side surface molding action and substantially no such action with relation to the faces of the blank, the side surface molding action during the repetition being also confined to an area adjacent one face thereof and extending only part way across the width thereof.

2. The method according to claim 1, in which the side surface areas so subjected to molding action have overlap, whereby the sides of the blank are completely worked.

3. The method according to claim 1, in which the stated operation is repeated until the blank faces are completely formed, and is thereafter repeated with reversal of dies to complete formation of the sides of the article.

4. The method according to claim 3, in which the side surface areas so subjected to molding action have overlap, whereby the sides of the blank are completely worked.

LLOYD E. RESSEGER.

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