Sept. 4, 1928. 1,683,011

B. T. ANDREN

PROCESS FOR FORGING

Filed April 14, 1926

Fig. 1.

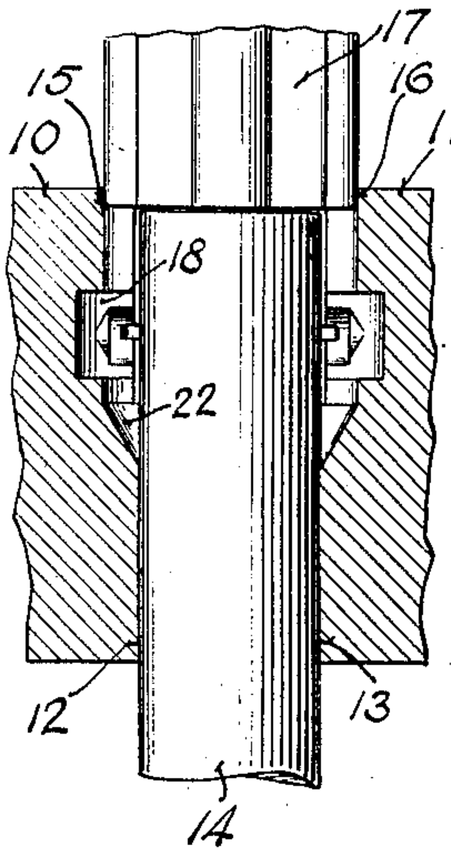


Fig. 2.

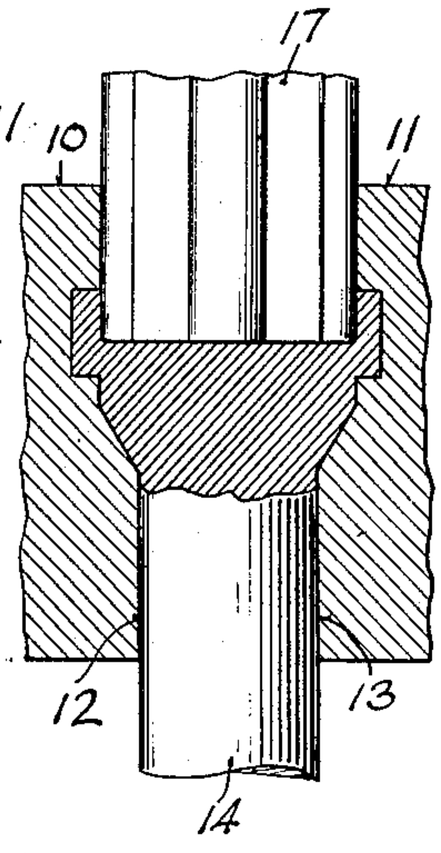


Fig. 3.

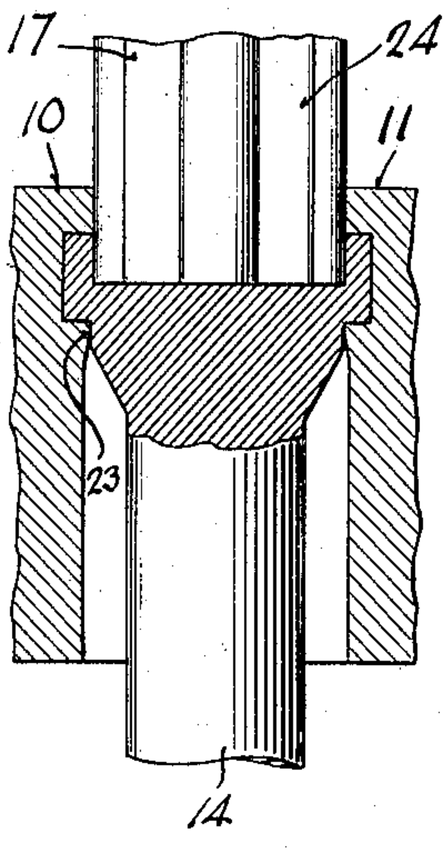


Fig. 4.

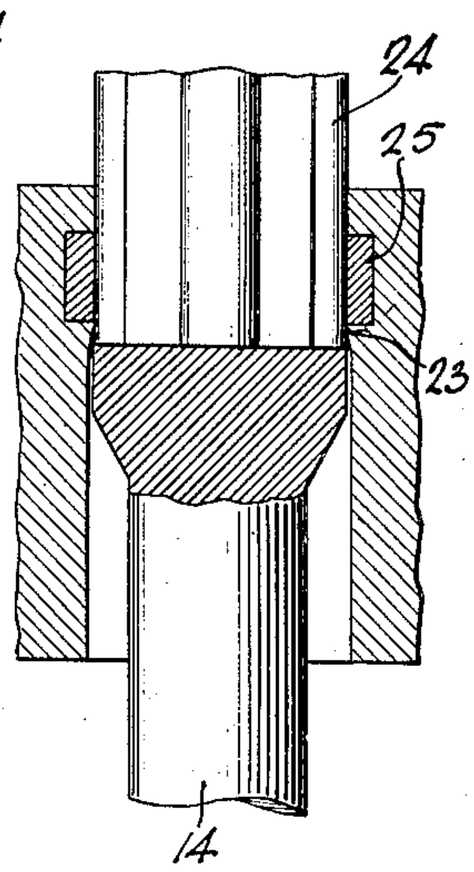


Fig. 5.

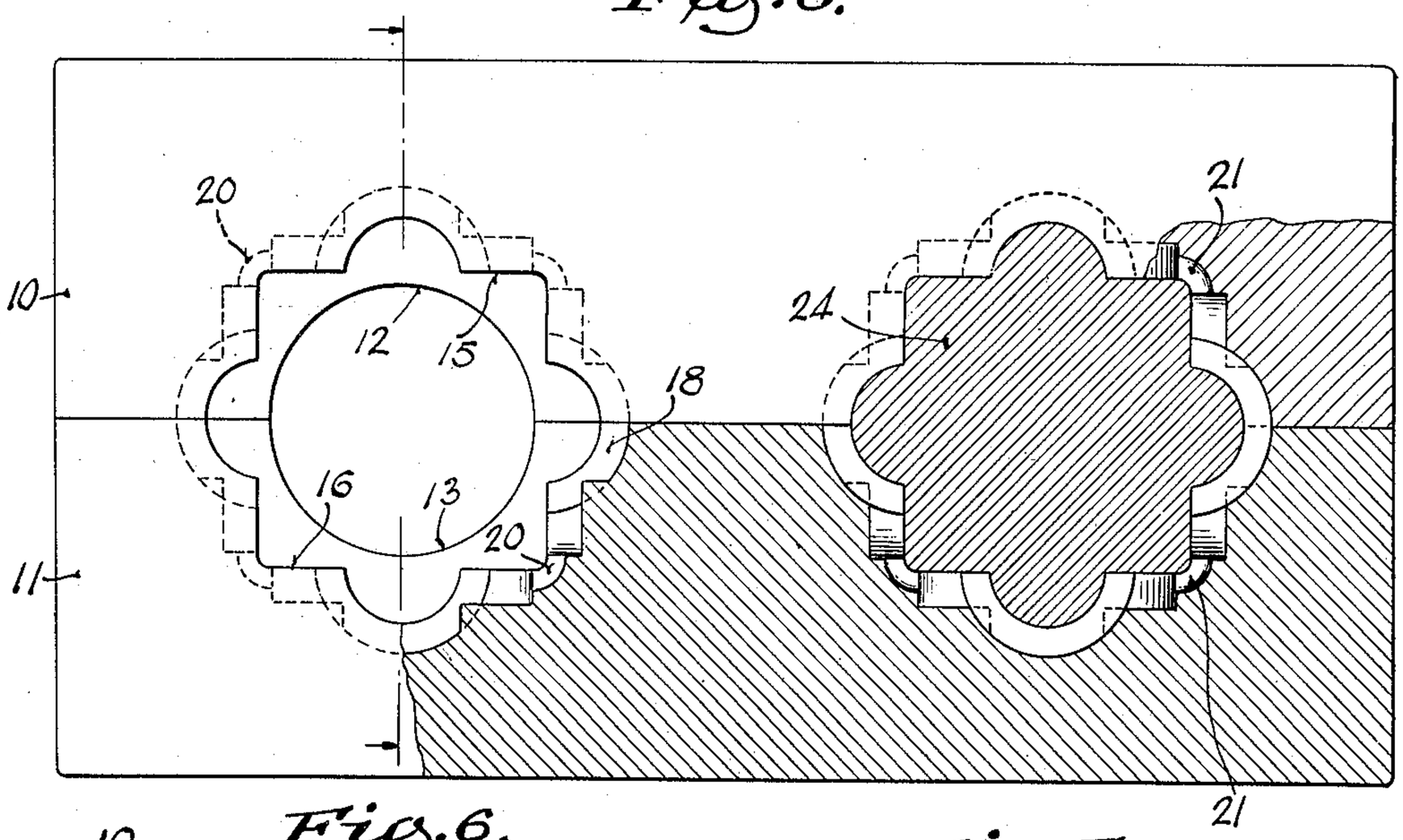


Fig. 6.

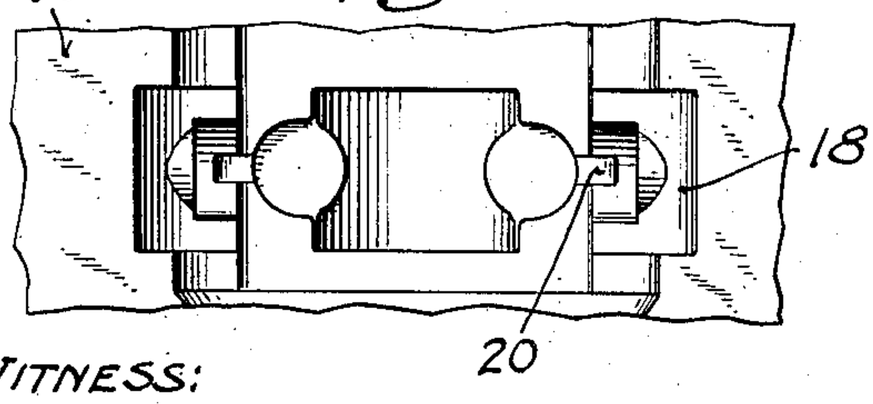
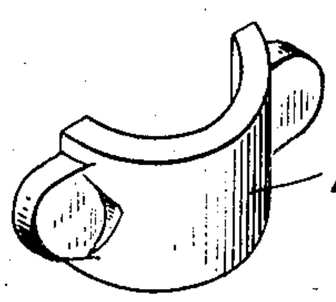


Fig. 7.



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Patented Sept. 4, 1928. 1,683,011

UNITED STATES PATENT OFFICE.

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PROCESS FOR FORGING.

Application filed April 14, 1926. Serial No. 101,908.

The present invention relates to an improved process for forging, whereby shaped articles can be produced in a single operation, such operation requiring no greater amount of time for its performance than is required in the production of such articles by the practice of prevailing methods involving a succession of operations. As a result, quantity production is largely increased and the cost of the articles proportionately reduced.

The method comprises the steps of upsetting one end of a metal bar by an endwise pressure applied thereto, such pressure causing the metal to flow laterally with respect to the length of the bar into the undercut recesses in the meeting faces of a separable die and filling the same, whereby the forged articles produced generally in circular form or arrangement will have imparted thereto the contours defined by the recesses in the die.

In the expression of the metal into the recesses of the die to form the shaped articles, the plunger or ram, through which the pressure is exerted upon the end of the bar to cause the lateral flow of the metal, penetrates the expanded portion for a substantial distance. Such operation produces at the end of the bar, a recess bounded by an approximately circular wall composed of the article or articles being produced, the latter through such penetration being partially severed from the stock bar upon which the forgings are formed.

The method may be employed advantageously in producing a plurality of forgings in one operation, by multiplying the number of undercut recesses in the opposed faces of the die members. In all forms of the forging, the upset penetrated end of the bar presents a ring-like enlargement having a diameter in excess of that of the bar upon which the enlargement is formed.

In order to effect severance of the ring-like forging from the end of the bar, the bar is transferred to another die, which may be separable and have complemental undercut recesses in its opposed faces in which the forged part is positioned, and a second plunger or punch of the same formation of the first one, but having a range of movement somewhat in excess of the other, is entered into the recess. Upon longitudinal pressure being applied thereto, the punch serves to sever the forged ring from the end of the bar, as by shearing the comparatively thin metal connection between the ring to the bar, and at the same time pushes the latter out of the die.

The apparatus used comprises a separable die having in the opposed faces thereof the before described undercut recesses for imparting the desired contours to the forged articles, and also such formation as will enable the bar to be securely clamped and held against longitudinal movement when upsetting pressure is applied by the plunger or ram to the end thereof. The second die may be provided with like undercut recesses for receiving the deformed end of the bar, and holding it when pressure is applied by the punch to the end of the bar to sever the ring-like forging.

The novel features of the invention will be pointed out in the appended claims.

In the accompanying drawing:

Figure 1 shows the first die in section in a plane parallel to the axis of the bar, the view showing the formation of the undercut recess, and also showing in side view the plunger or ram and the end of the bar upon which the latter operates at the commencement of the upsetting operation.

Fig. 2 is a similar view showing the position of the plunger or ram at the conclusion of the upsetting operation, and showing also how the expressed metal is caused to expand and fill the undercut recesses in the die to form the forged articles, the upset end of the bar being shown in longitudinal section for the sake of clearness.

Fig. 3 is a similar view of the second die and its co-operating plunger or punch, and showing the deformed end of the bar as positioned in the recesses of the die and held so as to permit the ring-like forging at the end thereof to be sheared from the bar in the movement of the punch.

Fig. 4 is a similar view showing the manner in which the punch operates to shear the forged ring from the end of the bar.

Fig. 5 is a plan view, partly in section, showing a separable die as one unit for both the forging operation and the shearing operation.

Fig. 6 is a face view, enlarged, of one of the separable dies, showing the formation of undercut recesses therein.

Fig. 7 is a perspective view of a completed article forged in a die such as is shown in Fig. 6, and created as a separate entity by

dividing the forged ring into its constituent elements.

In the drawing, the numerals 10 and 11 indicate the co-acting members of a separable die, in the opposed faces of which channels 12 and 13 are formed, the purpose of such channels being to clamp and retain against longitudinal movement during the subsequent forging operation, a stock bar 14, out of which the forged articles are formed. In line with the channels, the opposed faces of the dies are provided with other channels 15 and 16 in which a plunger or ram 17 is guided for operation in the direction of the length of the stock bar 14. Between the channels in which is clamped the stock bar 14 and the channels in which the plunger or ram 17 is guided, the opposed faces of the dies are provided with undercut recesses 18 which are designed to accord with the contour of the articles to be produced.

The present invention has been illustrated as applicable to the manufacture of bearing caps of the construction illustrated in Fig. 7 and indicated by the numeral 19, but obviously it is capable of use in connection with other articles. In the present instance, the undercut recesses 18 formed in the opposed faces of the dies 10 and 11 are multiplied, so that a plurality of the articles may be manufactured in one operation. The undercut recesses into which the metal is expanded to form the shaped articles may be connected by shallow channels 20, into which the metal will also flow during its expansion into the undercut recesses, so as to unite the articles by a thin flash or fin 21, which latter may be easily clipped so as to disconnect and separate the articles.

In producing the forged articles, the end of the stock bar 14 is heated to create a suitable state of ductility so that the metal will flow readily under pressure. The heated end of the bar is positioned in the channels 12 and 13 of the first set of dies which are then moved into clamping relation therewith so as to restrain any longitudinal movement of the bar, and the plunger or ram 17 is actuated toward the bar by any suitable mechanism. The pressure exerted by the plunger or ram upon the heated end of the bar produces an upsetting or deformation of the end of the bar, at which time the metal of the latter will flow laterally into the undercut recesses and fill the same, thereby giving the desired formation to the articles. The die at the lower side of the recesses 18 may be cut away as at 22, so as to permit the spread of the metal into the cavity so formed. This action will facilitate the second, as well as the succeeding forging operations, inasmuch as a partially upset bar is provided beforehand. The plunger or ram operates with a close fit in the guiding channels 15 and 16, and the length of its movements are such that it penetrates for a substantial distance the end of the bar 14, thereby creating a recess which is surrounded by a wall of generally circular form, which latter is composed of the forged articles. The result of the forging operation is indicated in Fig. 2.

After the end of the bar 14 has been deformed in the manner described so as to effect the formation of the articles, the forged end of the bar is positioned in a second set of dies, the latter being provided with undercut recesses which are the counter-part of those in the first die. However, the second dies do not clamp the bar as before, but only the forged end thereof, inasmuch as the opening therethrough is enlarged so as to permit free movement of the bar, which is retained in the die only by its connection with the ring-like forging at the end thereof. The lower end of the second die, viewing Fig. 3, is formed as a generally circular shoulder 23 and defines an opening having the diameter and contour of the punch 24, which is a counter-part of the plunger or ram 17. Upon pressure being applied to the punch 24, the ring-like forging 25 formed by the lateral displacement of the metal at the end of the bar is severed from the bar on a line parallel with the inner wall of the forging, and the freed bar is pushed into the clearance in the die, as shown in Fig. 4.

The operations described are repeated and the production continued. The thin flash or fin 21 connecting the articles is severed, so as to impart to the article its completed form, as shown in Fig. 7. But by omitting the shallow connecting channels 20 at the time of cutting the recesses in the dies, the forged articles will be separately formed, but the ring-like enlargement formed by the several articles at the end of the bar will exist as before, although broken into its constituent elements. The forging dies and the punching-out dies may both be formed in one unit, or in separate units, as convenience may make desirable. Nor is it necessary that the merely holding dies of the second set be undercut, for the recess may be open at the top for the full diameter of the forging, and constricted at the bottom in the degree necessary to preserve the relations of the shoulder 23 and punch 24, as described. But by undercutting the recess in the ring holding or punching die, possible distortion of the forging is avoided, and means for stripping the ring from the punch is provided.

Having thus described my invention, what I claim and desire to secure by Letters Patent of the United States, is:

1. The method of forging simultaneously a plurality of shaped articles, which comprises the steps of providing a forging die with article shaping recesses in plural number equal to the number of articles to be so produced, heating the end of a metal bar and

arranging and holding the bar with its heated end in the die, exerting pressure upon the heated end of the bar to expand the metal laterally into the several recesses of the die, holding the expanded end portion of the bar against movement, and then applying pressure to the bar to move it longitudinally and sever the shaped articles therefrom.

2. The method of forging simultaneously a plurality of shaped articles, which comprises the steps of providing a forging die with article shaping recesses in plural number equal to the number of articles to be so produced, heating the end of a metal bar and arranging and holding the bar with its heated end in the die, exerting longitudinal pressure upon the heated end of the bar to expand the metal laterally into the several recesses of the die, holding the expanded end portion of the bar against movement, and then applying pressure to the heated end of the bar to move the bar longitudinally and sever the shaped articles from the bar.

3. The method of forging simultaneously a plurality of shaped articles, which comprises the steps of providing a forging die with article shaping recesses in plural number equal to the number of articles to be so produced, heating the end of a metal bar and arranging and holding the bar with its heated end in the die, exerting longitudinal pressure upon the heated end of the bar to expand the metal laterally into the several recesses of the die, holding the expanded end portion of the bar against movement, and then applying a punch to the heated end of the bar within the expanded portion to sever the expanded portion from the bar.

In testimony whereof, I have signed my name at Milwaukee, this 12th day of April, 1926.

B. T. ANDREN.