

Nov. 13, 1928.

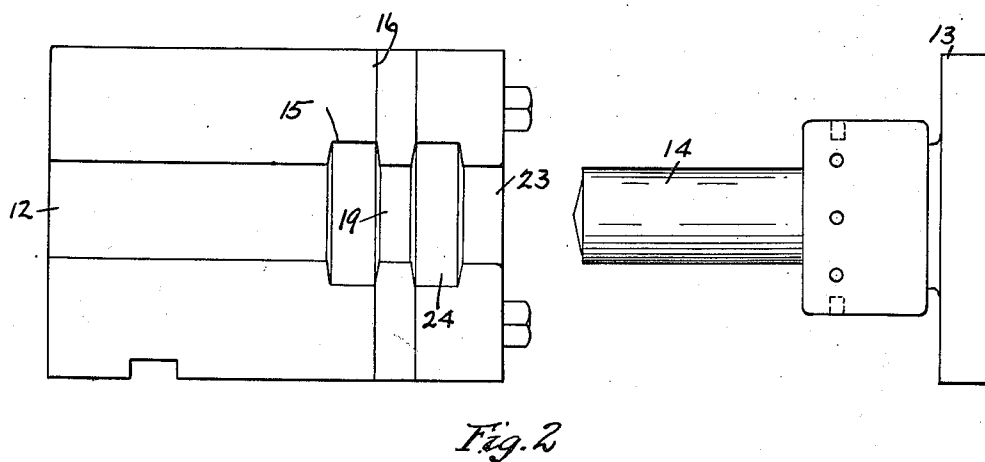
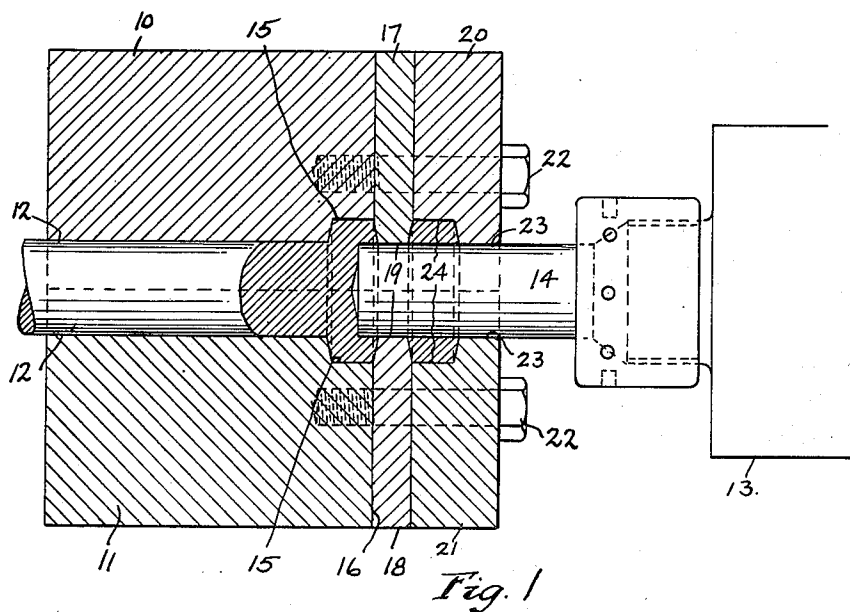
J. R. BLAKESLEE

1,691,878

METAL WORKING

Filed Aug. 11, 1923

3 Sheets-Sheet 1



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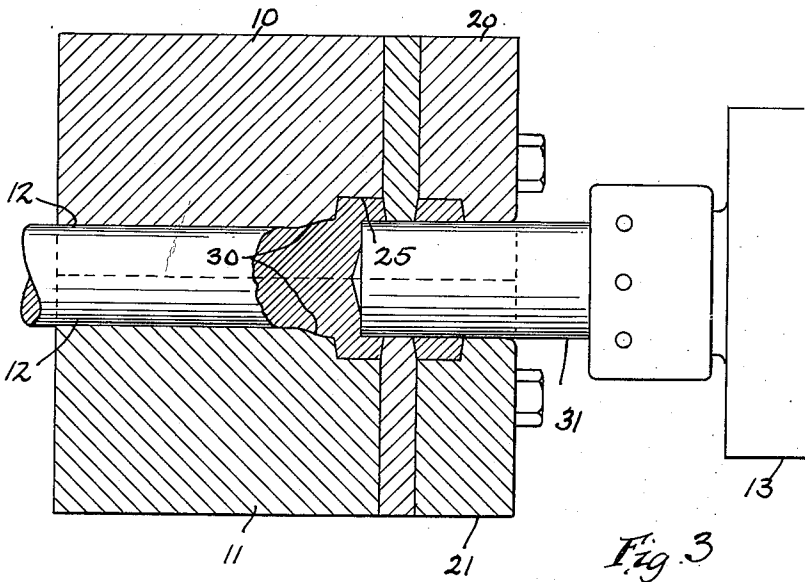


Fig. 3

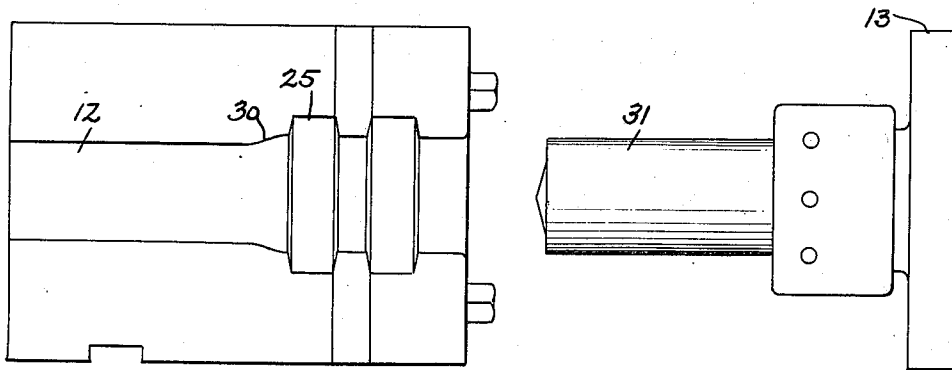


Fig. 4

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3 Sheets-Sheet 3

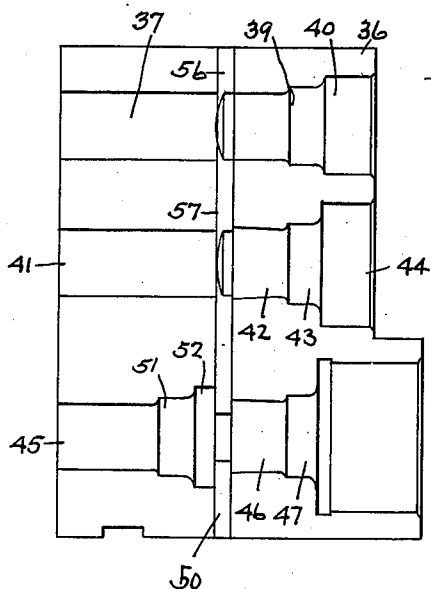


Fig. 5

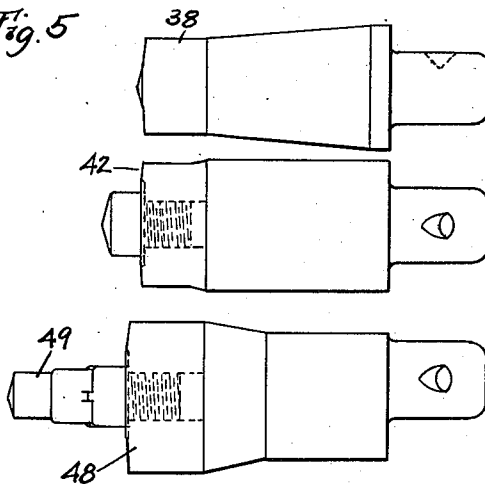


Fig. 7

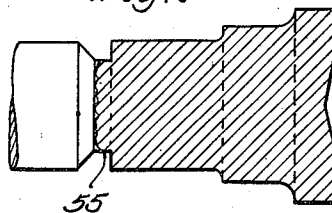


Fig. 8

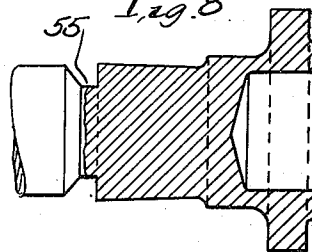
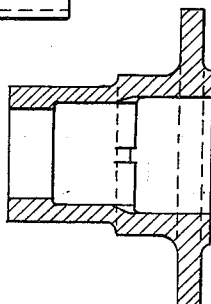


Fig. 9



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METAL WORKING.

Application filed August 11, 1923. Serial No. 656,881.

The present invention, relating as indicated to improvements in metal forming, is directed to an improved method of manufacturing nuts, rings, or other articles of general annular form that are made by upsetting a solid rod or bar of stock and then punching out a central portion in order to produce the finished article.

The object of the invention is to provide a method or process of this character, together with mechanism for use therein, wherein the metal punched from the center of the article being formed is utilized to preliminarily form the next succeeding blank. In the case of forming simple articles, such as nuts or rings, the external shape of the succeeding blank is completely formed by the punching operation on the previously finished blank, and when forging other articles of more intricate configuration wherein several forming operations are necessary, the punching operation is used to preliminarily form or to take the place of the first forming operation on the next blank. To the accomplishment of the foregoing and related ends, said invention, then, consists of the steps and means hereinafter described and particularly pointed out in the appended claims.

The annexed drawings and the following description set forth in detail one improved method of and mechanism for carrying out the invention, such disclosed mode and means, however, constituting but one of the various ways in which the principle of the invention may be used.

In said annexed drawings:

Fig. 1 is a transverse longitudinal central view through the dies and stock illustrating the action of the punching tool in a preliminary formation of a second article;

Fig. 2 is an elevational view of one half of the die member showing the punch withdrawn;

Fig. 3 is a view similar to Fig. 1 but illustrating the preliminary formation of a blank in which the hole to be punched is of greater diameter than the stock.

Fig. 4 is a view similar to Fig. 2 showing the parts seen in Fig. 3;

Fig. 5 is an elevational view of the die

and punch members for forming an article having a number of different outside diameters;

Fig. 6 is a front elevation of the dies illustrated in Fig. 5; and

Figs. 7, 8 and 9 show an article in its sequential steps of formation.

Only so much of the general forming mechanism, such as the dies and punches of the machine, is illustrated in the foregoing figures as is deemed necessary in order to show the manner in which articles may be formed in accordance with the present novel method. The die members include two relatively transversely movable gripping dies 10 and 11, which have their inner faces formed with complementary recesses 12 adapted to receive and grip the work when said dies are forced together. Movable longitudinally of the line of feed of the work, or in other words in coaxial alignment with the recesses in the dies 10 and 11 is a header slide 13, shown in fully advanced position in Figs. 1 and 3 and in retracted position in Figs. 2 and 4. A punch 14 of the diameter of the hole to be formed in the article is suitably carried at the front end of the header slide to be movable into the composite recess formed between the die members.

The particular construction of the dies 10 and 11 and their cooperating elements will now be described in detail. As has been previously stated, the dies are provided with complementary recesses 12, the configuration of which depends upon the shape of the stock to be gripped therein. These recesses are formed at the rear end of the die halves proper and are enlarged at the front ends thereof to provide annular or otherwise shaped recesses 15 in the front face 16 of said dies. The shape of such recesses may be of a nature to conform with the outer configuration of the article to be formed. Secured to the face 16 of the dies 10 and 11 are punch plates 17 and 18 provided with complementary recesses 19, which, when the dies are gripped together, form an aperture of the same diameter as the punch 14. In front of the punch plates 17 and 18 are mounted other plates or supplemental die members 20 and 21, each of said sets of dies and plates (10,

17 and 20 or 11, 18 and 21) being rigidly held together by bolts or other suitable means 22. The members 20 and 21 are also provided with complementary apertures 23 in line with the recesses in the punch plates and die members proper. The apertures 23 in said last mentioned members are of a size to receive the punch 14 at the forward end thereof and are enlarged as at 24 to provide a recess in which may be received the blank as formed in the recesses 15. In the embodiment of the invention illustrated in Figs. 1 and 2, the punch 14 is of the same diameter as the bar of stock.

The operation of the forging or upsetting of the end of a bar of stock is well known to those skilled in the art of metal forming and it is not deemed necessary to go into detailed description thereof other than to say that the tool or punch carried by the sliding header 13 is forced against the end of the stock, which is rigidly held by the die members, to upset such stock to conform with the shape of enlarged recesses provided at the front end of the dies. Heretofore the practice has been to form or upset the stock by a punch or the like, then to release the grip on the stock bar proper, and then to punch out the desired hole in the upset end, the punched out portion forcing the bar of stock backwardly in the dies. The present novel method operates to utilize this punching out of the stock to preliminarily form the next blank on the front end of the bar. In operation when starting a new bar of stock, the forward end is protruded a slight distance beyond the punch plates 17 and 18 for the purpose of providing sufficient metal for the upset and the punch is moved forward through the recesses 23, which operation causes the metal in the end of the bar to flow into the enlarged recesses 15. Thus, the outer configuration of the first blank is formed. The dies 10 and 11 are then separated and the stock moved forward to place the blank, formed as described above in recesses 15, into the recesses 24, forward of the punch plates. The condition is now present for the application of my improved method and the punch is reciprocated to punch out the center of the blank held between the supplemental dies 20 and 21. Such punching operation will force the surplus stock bar back through the punch plates and into the recesses 15 in the dies 10 and 11, thus forming the next succeeding blank on the end of the bar of stock.

In Figs. 3 and 4 I have shown a set of dies and punch similar to that described above but have included therein a slight modification in structure which is especially adapted for use in forging articles from bar stock when the punch used, or, in other words, the diameter of the opening in the finished article, is of greater diameter than the stock. The same gripping recesses 12 are provided

in the dies 10 and 11 as is also an enlarged recess 25 similar to the recess 15 in which the outer shape of the blank is initially formed. In the present embodiment the hole to be punched in the blank is of greater diameter than the bar stock and it has been found necessary in such case to swell or increase the diameter of the stock directly back of the blank to a size equivalent to the diameter of the punching tool. If this were not done, the stock after the punching operation would be left with a short shoulder which in the next forming or upsetting of the end of the stock would fold under and a cold-shut would result, therefore weakening the structure of the article formed. Adjoining the recess 25 the recesses 12 are enlarged, as at 30, to provide an annular recess of greater diameter of the stock and equal to that of the punching tool 31. The forming operation of the die as shown in Figs. 3 and 4 is identical with that of the dies of Figs. 1 and 2, the only difference being in the enlarging of the bar directly back of the blank preliminarily formed by the action of the punch upon the blanks held in supplemental dies 20 and 21.

The present method is also intended to be useful in the forming of more complex articles, such as wheel hubs or the like, wherein several successive forming operations are necessary to produce a completed article. As in the previously described embodiments of the invention, after the end of a new bar has been once upset, as by the action of an initial forming tool, such independent initial forming operation on the succeeding blank is performed during the punching of the metal from the center of the article being formed. While not necessarily limiting to this invention the punching is done during the final operation in the forging of the blank and therefore the next succeeding blank is being preliminarily formed as the finished blank is being severed from the stock.

Referring now to Figs. 5 to 9 inclusive, I have illustrated therein the various steps in the forging of a wheel hub within the purview of my invention. As before, I employ relatively movable die members 35 and 36, the inner faces of which are formed with a plurality of complementary recesses wherein the stock is received in its various stages of operation. As shown, the stock is first placed in the recess 37 nearest the top of such dies and is thereafter moved into the next recess and so on until the end of the stock has been completely formed into the desired shape. The recess 37 is used only when starting a new bar of stock, at which time a tool 38 is employed to upset the end of the bar to conform with enlarged annular recesses 39 and 40 provided at the outer end of recess 37 in the dies 35 and 36. The dies are then separated and the stock with the preliminarily formed blank on its end is moved into

the next succeeding recess 41, in which said blank is acted upon by a tool 42 to further form it. It is understood that the recess 41 will of course be provided with recesses 42 and 43 to accommodate the configuration of the blank as preliminarily formed and also with a recess 44 into which the tool 42 is adapted to further upset the stock. The dies are again separated and the stock moved into the next recess 45 and, similar to the die parts described immediately above, the stock as formed by the preceding operation is received in enlarged recesses 46 and 47 provided at the outer end of recess 45. It will be obvious that as many recesses as may be found necessary to form the desired article may be provided in the dies 35 and 36, or that a number of dies, each set having a single recess therein, may be used successively. In the present embodiment, the blank X is finally formed in the recesses 45, 46 and 47 and the stock in the center of the blank is simultaneously punched therefrom by a tool 48. The forward end 49 of tool 48 is shaped to punch out the center of the blank, which operation is similar to the punching operations of the first two embodiments of this invention hereinbefore described, a punch plate 50 being provided directly back of the recess 46 through which the metal acted upon by punch 49 is forced. In accordance with this invention, the metal punched from the article being formed is simultaneously forced back into a second set of enlarged recesses 51 and 52 and preliminarily forged into the outer configuration of the next succeeding blank. These enlarged recesses 51 and 52 are formed in the dies 35 and 36 directly back of the punch plate 50 and are similar in size and shape to the recesses 39 and 40. Consequently the front end of the stock bar is formed by the punching operation with an upset portion similar in size and shape to a blank as formed in the recesses 39 and 40, and therefore, after the tool 48 has performed its function and the completed blank is severed from the bar of stock, the stock may be placed in the recess 41 with its preliminarily upset end in the recesses 42 and 43.

As seen in Fig. 9, the interior of the article formed may have a number of varying inside diameters, the same being produced by providing the tool 48 with several different sized punch portions. Also, if the hole in the article being formed is of less diameter than the original bar of stock, it will be necessary to reduce the size of such stock as at 55 directly back of the blank so that the punch plate will function properly. This reduction of the stock may be accomplished in various

ways and is herein shown as by providing the dies 35 and 36 with swaging plates 56 and 57 located rearwardly of the recesses 39 and 42 respectively.

In operation the stock when placed in either of the recesses 37 or 41 is acted upon by the swaging plates during the closing of the die members and is reduced to the shape of an oval, as seen at 58 in Fig. 6. Next, in shifting the stock from recess 41 to recess 45 it is turned 90 degrees, therefore placing the ends of the oval so that they may be properly acted upon by the plates 50 in the closing of the dies, the plates 50 serving as swaging plates as well as punch plates.

It will be apparent, from a consideration of the foregoing, that I have accomplished the objects primarily stated and that I have devised a new and highly useful method for use in metal forming which will not only produce more satisfactory work, but will increase the output with given equipment, since a single operation now serves a dual purpose. While in the drawings the stock illustrated is of general circular cross section, it will be obvious that my invention contemplates the holding and forming of articles from other stock, such as square or hexagonal, it being only necessary to provide the dies with grooves or recesses of the proper shape.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the means and the steps herein disclosed, provided those stated by any one of the following claims or their equivalents be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In a mechanism of the character described, the combination of relatively movable dies having complementary gripping recesses of substantially uniform diameter formed in their inner faces, two mutually equal-diametered sets of enlarged gripping recesses of substantially uniform diameter formed at one end of said gripping recesses; a punch plate separating said sets of enlarged recesses; and a punch co-operating with said dies and said punch plate.

2. In a mechanism of the character described, the combination of relatively movable dies having complementary gripping recesses formed in their inner faces, two mutually equal-diametered sets of enlarged recesses formed at one end of said gripping recesses; a separable punch plate between said sets of enlarged recesses; and a punch co-operating with said dies and said punch plate.

Signed by me this 6th day of August, 1923.

JOHN R. BLAKESLEE.