May 29, 1923. 1,456,597

W. HUGHES

METHOD OF FORGING

Filed Feb. 7, 1921

Fig. 1.

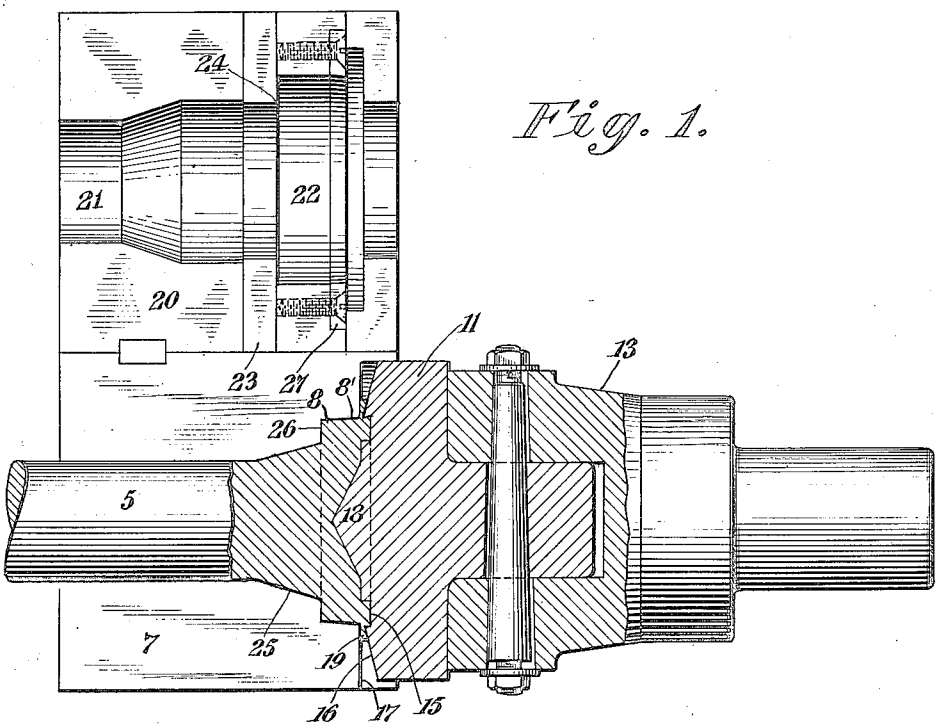


Fig. 2.

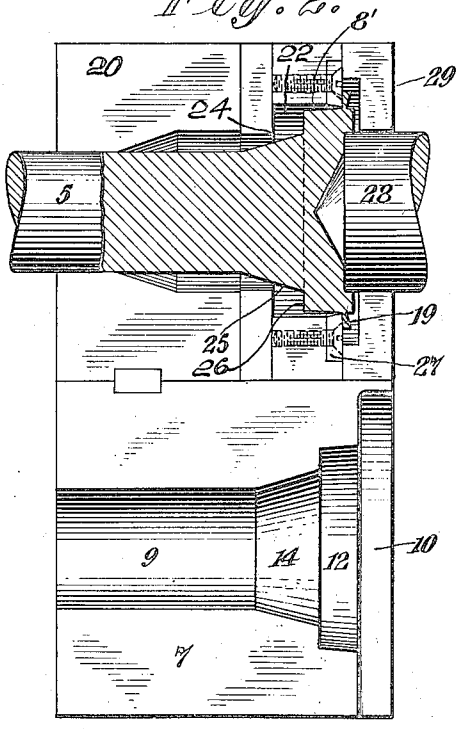
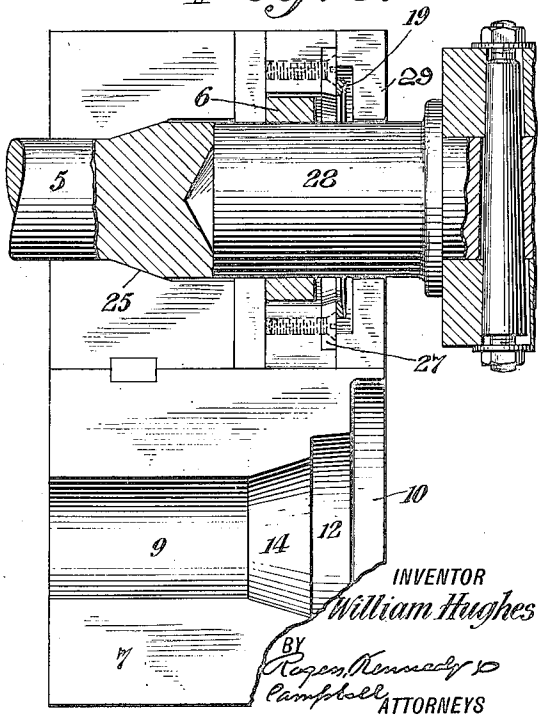


Fig. 3.



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UNITED STATES PATENT OFFICE.

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METHOD OF FORGING.

Application filed February 7, 1921. Serial No. 443,035.

To all whom it may concern:

Be it known that I, WILLIAM HUGHES, a citizen of the United States, residing at Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Methods of Forging, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates primarily to the removal of the flash from forgings, and has for an object to provide an improved method whereby the flash is so located that it may be readily removed.

Heretofore in the production of forgings such as those which are made by upsetting the end of a bar into a suitable cavity of a die by means of a punch, it has been found that the necessarily present surplus metal which is extruded into a flash, locates itself in such a position that its removal becomes a burdensome operation, adding materially to the cost of rough finishing the forging. The flash, as heretofore formed upon these forgings, aside from the disadvantage arising from delay and expense of removal, has been found a source of annoyance in that it renders the piece more bulky to handle, presents a ragged edge which is a menace to the hands of the person having to handle it, and also is annoying in properly placing and locating the forging in the machine which is to operate upon it, in that it is difficult for the operator, by aid of his eye alone, to judge the center of the piece. The presence of the flash makes of this centering operation one of guess work, because it precludes the use of measuring instruments, or fixed stops.

According to my invention the surplus metal is caused to locate the flash in such position, and of such formation that it may be expeditiously removed from the forging while in a hot condition, and before this forging is ejected from the forging machine.

It has been found practically impossible to shear a flash from a forging when this flash is located at the edge or corner of the body of the forging. In the manufacture of bodies having a substantially cylindrical contour, as for instance, in making rings which will be substantially rectangular in cross section when completed, it is a common practice to permit the flash to extend laterally of the body, and in such a position that its outer perimeter coincides substantially with the cylindrical perimeter of the piece. When so located the flash can only satisfactorily be removed by chucking the piece and applying suitable cutting tools. In following this practice each piece while carrying this flash, which is generally sharp and ragged at the edges, has to be handled by quite a number of operatives. It has been proposed to project the flash at substantially right angles to the perimeter of the forging at the end, and permit this to project outwardly radially thereof and to press the freshly forged piece through a stripper plate. This was found objectionable because if the stripper plate engages the flash from the body side of the forging it merely bends it into the position occupied by the previously described flashes without effecting its removal. The impracticability, if not impossibility, of applying the stripper plate to the body of the forging at the face which carried the flash precludes any attempt in this regard, since, as is obvious, the most delicate adjustment would be required to center the stripper plate with the forging.

According to my invention the flash of surplus metal is formed upon the substantially cylindrical perimeter of the forging and inwardly of both ends thereof so that the forging may be passed through the stripper plate, and shear the flash from the forging, as this is located well inwardly of the edge toward which the shear or stripper plate is moving, the tendency of the flash to lie down is not present, and if it were the edge of the stripper plate effects a clean shearing. I also purpose making the flash triangular in cross section with the apex adjacent the body of the forging, thereby expediting the shearing operation.

Upon upsetting the end of a bar, in forging it is found that the upset head on the

bar is of less diameter at the inner or forward side than at the outer side or end. This tendency may be modified by the form given the die cavity in which the upsetting is effected. The above mentioned is a preferred formation in that it assures the proper entrance and centering of the forging piece in the shear or stripper plate, and when the parts are properly proportioned the shear action is directly applied and comes into engagement with the forging at the narrow root of the flash, thereby effecting a clean shear.

When rings are forged according to my invention, the hole for the bore of the ring is punched through the upset head, and the bar and the upset head is carried backwardly against a plate through which the punch enters after passing through the upset head, thereby severing the ring from the bar. This punching action is accompanied by a tendency of the forward or outer side or end of the upset head to circumferentially contract. The location of the flash, and the diameter of the shear edge of the stripper plate are so proportioned in relation to this contracted area that the shearing action is facilitated and the forging immediately thereafter caused to clear the sheared off flash and the shear edge so that the foregoing in its further advance, after the shearing is effected, is free of the shear.

The accompanying drawings illustrate a form of forging apparatus and the manner of carrying out, by aid thereof, my improved method. In which drawings—

Figure 1 is a view partly in elevation, and partly in longitudinal section showing one-half or side of two dies, and also a punch or ram cooperating with one of such dies, or the cavity therein in upsetting the end of a bar, the action illustrated herein being at the end of the upsetting operation.

Fig. 2 represents the dies of Figure 1, but showing the product of the operation of such figure located in the other of the die cavities, and at the commencement of the operation of the punch or ram cooperative with this portion of the die, and

Fig. 3 represents the completion of the punching operation, the commencement of which is shown in Fig. 2.

The product of the form of mechanism illustrated herein for carrying out my invention is annular bodies formed from bar stock. In the drawings a bar is represented at 5, and a finished forging in the shape of a ring at 6. The forging operations herein described are carried out at a single heat, that is, the bar is heated once for the formation of each ring. Two pairs of separable dies located one above the other are preferably employed in carrying out my invention, one die of each pair being shown in the drawings, the cleavage between the matrix dies being represented as at the plane of the surface of the sheet bearing the drawings. The lowermost die 7 is the one which first receives the bar 5, and holds the same during the upsetting of the head 8, the mass of which head subsequently forms the ring 6. The portion 9 of the die cavity is of suitable shape and dimensions that when the bar is placed between the separated dies these will, upon closing, securely grip it and hold it against the action of the upsetting punch. In the illustration the die cavity has an enlarged outer portion 10 adapted to receive the body portion 11 of the punch. Inwardly of this enlarged portion 10 is the cavity 12 in which the head to form the forging is upset. This portion of the die cavity is shown as tapering inwardly or toward the bar for the purpose previously mentioned. The die cavity from the inner edge of the cavity 12 to the bar holding portion 9 is shown as tapering at 14 for accommodating the swelling of the bar during the operations to which it is subjected. The punch is shown mounted in a suitable head 13 adapted to be carried by a ram moving toward and from the dies. The forward end of the punch has a face 15 conforming to the desired shape of the outer side or end of the forging which is met. In the present instance this face is substantially perpendicular to the axis of the bar, and to that of the ring which is being formed. This face 15 is shown located at the bottom of an annular recess the side walls of which give form to the front edge of the forging and commence the formation of the bore cavity which is completed in the succeeding operation. (See 8 and Fig. 1). Surrounding the outer wall of the annular cavity in the punch is a face 16 sloping backwardly from a corner formed with the wall of such cavity. This face 16 makes an acute angle with the face 17 of the die cavity 10. The center portion of the punch is provided with a conical or pointed leading end 18 which assists in upsetting and spreading outwardly the metal for forming the head 8, and also modifies to some extent the work performed in the bore punching operation presently to be described.

The parts are so proportioned relatively to the size of the bar stock that there is a slight amount of excess metal available for forming the head 8, which metal is extruded in a flash represented at 19 within the space between the faces 16 and 17 of the punch and die cavity. It will be seen that this flash and surplus metal is formed upon the substantially cylindrical perimeter of the forging, and inwardly of both ends thereof, and that it is substantially triangular in cross section with the apex adjacent the body of the forging.

After the parts have reduced the material

acted upon to about the formation illustrated in Figure 1, the punch is withdrawn, the dies are separated, and the bar 5 elevated between the dies 20 whereupon the dies are closed and the portion 21 embraces the bar 5, but preferably without exerting the restraining influence found necessary in connection with the lower pair of dies, this portion being more in the nature of a guide or center. The cavity of the upper die 20 is shown as having a portion 22 of somewhat larger diameter than that of the forging. Rearwardly of this portion 22 is a punch plate 23 having a substantially square corner 24 at its forward side the opening in such punch plate being substantially the same contour as the outer end of the completed portion 25 of the bar where this joins the finished flat face 26 at the rear side or end of the head 8. At the front of the die, or rather the portion having the cavity 22, is shown a shear plate 27 the front edge of which is of somewhat smaller area than the die cavity 22 and of suitable size to permit the passage of the rearward portion of the upset head and to engage the perimeter of such head immediately behind the flash 19.

A punch 28 is properly located in position for engaging the head 8 when located in the dies 20 and forcing such head and the bar backwardly through the shear 27, and through the punch plate 23. Preferably the end of the punch 28 conforms to the contour of the bore partially formed by the punch 11. The punch 28 is guided to its work by means of a suitable guide plate 29 secured at the front of the die.

Upon the forward movement of the punch 28 it passes through the guide plate and engages the work somewhat in the manner illustrated in Fig. 2 and pushes the bar and the head 8 backwardly causing the shear to completely remove the flash 19. The further advance of the punch 28 brings the rear face 26 of the head 8 against the punch plate the opening of which is of such dimensions as to have a close working fit with the punch. The punch then advances through the plate thereby severing the forge product, the ring 6, from the bar and forcing the bar backwardly. The action of the punch has a tendency to circumferentially contract the end of the ring which it first engages. To compensate for this action the perimeter of the head is made of slightly larger diameter at such end than at the other end and by suitably proportioning the dimensions of the parts it is found that the complete forging is of the desired formation wherein both ends are of substantially the same diameter.

After the operation just described the punch is withdrawn, the dies are opened, the bar is withdrawn and the finished ring and the severed flash drop out. In the numeration of these three actions it is not intended to indicate that they necessarily occur in sequence as doubtless there will be a considerable concurrence when the operation is being carried on rapidly.

It is, of course, to be understood that the disclosure herein is illustrative of my invention, and that changes may be made within the scope of the claims without departing from the spirit thereof.

I claim as my invention:

1. The method of forging rings which consists in upsetting the suitably heated end of a steel bar into slightly conical formation and squeezing the surplus metal into a circumferential flash located inwardly of the ends of such body, then moving such body, while still heated as aforesaid smaller end first, through a shear plate and engaging such body adjacent the base of the flash and shearing the same from such body.

2. The method of forging rings which consists in upsetting the suitably heated end of a steel bar into slightly conical formation and squeezing the surplus metal into a circumferential flash located inwardly of the ends of such body, then applying a punch to said body and moving the same backwardly against a punch plate and during such movement, and while the body is still heated as aforesaid, engaging the body adjacent the base of the flash and shearing the same from such body, then stopping the rearward movement of the body incident to the movement of the punch, and forcing the punch through the upset head from the larger end thereof thereby forming a hole through the body and reducing the diameter of the larger end and enlarging the diameter of the smaller end.

3. The method of forging rings at a single heat which consists in upsetting the suitably heated end of a steel bar into slightly conical formation and squeezing the surplus metal into a circumferential flash located inwardly of the ends of such body, then passing such body, smaller end first, through a shear plate having an opening approximately the size of the portion of the body by which the flash is carried and causing such shear plate to remove the flash, and then reducing the cross-sectional area of the larger end.

4. The method of forging rings at a single heat which consists in upsetting the end of a steel bar into slightly conical formation, and squeezing the surplus metal into a circumferential flash located inwardly of the ends of such body, then applying a punch to said body and moving the same backwardly smaller end first through a shear plate having an opening approximately the size of the portion of the body by which

the flash is carried and causing such shear plate to remove the flash, then continuing the movement of the body into engagement with the punch plate thereby stopping the rearward movement of the body incident to the movement of the punch, and then forcing the punch through the upset head from the larger end thereof thereby forming a hole through the body and reducing the diameter of the larger end and enlarging the diameter of the smaller end.

In testimony whereof, I have affixed my signature hereto.

WILLIAM HUGHES.