A. F. ARTHUR.

METHOD OF FORMING DIES.

APPLICATION FILED APR. 27, 1916.

1,231,323. Patented June 26, 1917.

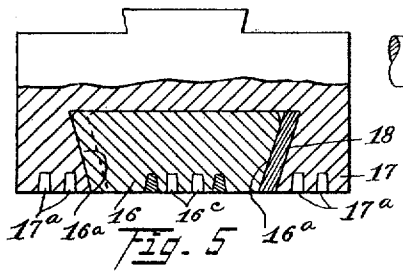


Fig. 5

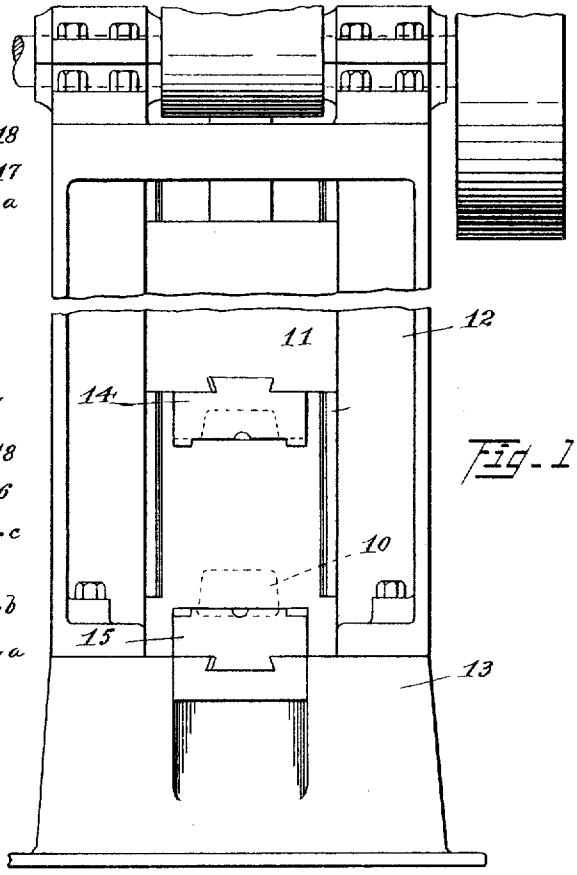


Fig. 1

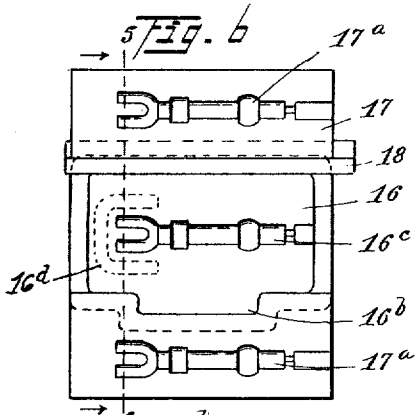


Fig. 6

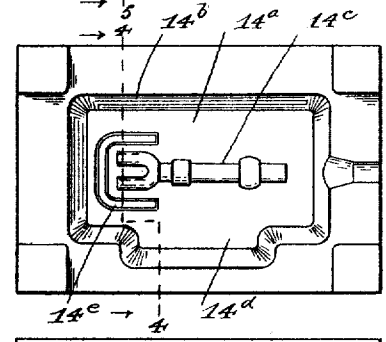


Fig. 2

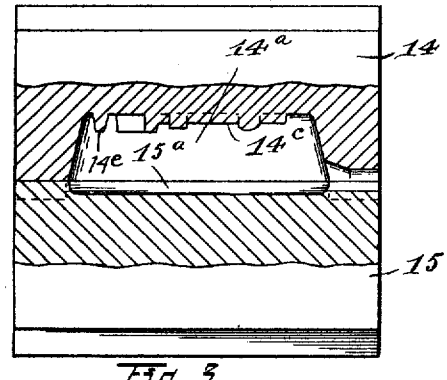


Fig. 3

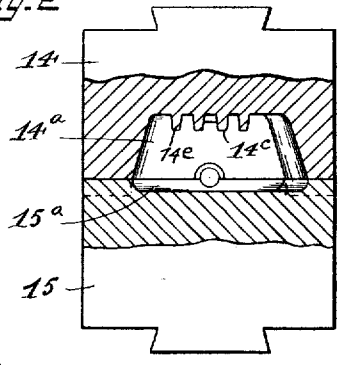


Fig. 4

Inventor
Albert F. Arthur
By Thurston & Kwis
Attorneys

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ALBERT F. ARTHUR, OF CLEVELAND, OHIO, ASSIGNOR TO THE CLEVELAND HARDWARE COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

METHOD OF FORMING DIES.

1,231,323. Specification of Letters Patent. Patented June 26, 1917.

Application filed April 27, 1916. Serial No. 93,832.

To all whom it may concern:

Be it known that I, ALBERT F. ARTHUR, a citizen of the United States, residing at Cleveland, in the county Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Methods of Forming Dies, of which the following is a full, clear, and exact description.

This invention relates to a method of forming dies, particularly for drop hammers and presses, and has for its object to provide a method by which accurate and durable dies may be formed much more cheaply and quickly than with the methods generally in use at the present time.

Dies for drop hammers and presses are usually formed either by hand or with die sinking machines, but in either event a great deal of time and labor is required to produce a die particularly if the pattern is at all complicated or intricate.

According to my method the dies are formed by a forging process and are as accurate or more accurate and can be used for as long a period of time as those produced by the old methods.

My invention may be briefly summarized as consisting in certain novel steps of the method which will be described in the specification and set forth in the appended claims.

In the accompanying sheet of drawings, Figure 1 is a side view of a portion of a drop hammer showing master dies which may be employed in carrying out my method in one of its forms; Fig. 2 is a bottom or face view of the upper master die or matrix; Fig. 3 is a view partly in longitudinal section and partly in side elevation, showing the upper and lower master dies which are employed; Fig. 4 is a view partly in end elevation and partly in cross-section of the same along the line 4—4 of Fig. 2; Fig. 5 is a view partly in end elevation and partly in cross-section showing the die formed in accordance with my process mounted in a die block or holder in which is cut a pair of break-down or roughing-out dies, the section being taken along the line 5—5 of Fig. 6; and Fig. 6 is a face view of the same.

In carrying out my process the die is forged from a block or body of suitably heated metal which is shown by dotted lines at 10 in Fig. 1, in a drop hammer or press, the former of which is indicated conventionally in Fig. 1, wherein 11 represents the hammer or hammer head which moves vertically in suitable guides 12 toward and from a base or anvil 13.

In forming the dies I employ two master dies 14 and 15, which are placed in a drop hammer or hydraulic press, and when a drop hammer is used, which is preferred, the former is attached to the hammer head 11 and the latter to the base or anvil 13. The upper master die 14 in which the major portion of the die is formed from the body of heated metal 10, is in the form of an inverted hollow matrix having a rather deep depression 14^a with tapering side walls 14^b and having on the bottom or base the pattern 14^c which is usually in cameo. At one side of the matrix there is a lateral offset portion 14^d, the purpose of which will be explained. The lower master die 15 is provided with a rather shallow depression 15^a which corresponds in contour to the contour of the recess or depression 14^a in the upper master die.

The block or body 10 is placed in the depression of the lower master die and is forged between the two master dies and this shapes the body 10 to the shape of the pocket formed in the two master dies, forcing the metal out into the lateral offset portion 14^d and thus forming a shank or projection which is employed in locking the die which is formed by the process in a suitable holder or shoe for use in drop hammers or other forging machines. At the same time the pattern 14^c is impressed in or transferred to the forged metal, the pattern if in cameo in the master die being reproduced, of course, intaglio in the forged die. When this die is forged in a drop hammer the block or body of heated metal will be struck repeatedly by the upper die, and in order that the dies will always register, one of the dies is provided at its corners with lugs and the other with recesses which receive the lugs at each stroke.

For some dies, that is with dies whose patterns 14^c are of not too irregular or intricate designs or shapes, master dies formed in the manner so far described are sufficient to produce accurate and well formed pattern impressions in the block or body from which the die is formed. However, with many other designs or shapes of patterns to be formed in the die additional means must

be provided to form accurate well defined dies in view of the fact that immediately after the forging stroke the metal has a tendency to spring away from certain portions of the pattern in the master die. This is overcome entirely by another expedient which I employ which consists in the use of a so-called barrier or projection 14e which is arranged adjacent the part or parts of the pattern where needed. As shown in the main figures, the retaining wall or projection 14e extends part way around the pattern but it may extend entirely around the same if desired and if the shape of the pattern requires it.

The tendency of this barrier or projection is to hold the metal in toward the pattern and particularly to keep it from springing away therefrom right after the blow is struck. It also serves another useful purpose and that is it protects the pattern and prevents it being broken. I have found that in some instances, particularly when the pattern has narrow fairly deep portions, the side pressure of the metal tends to break off portions of the pattern. Particularly is this true if the depth of some portion of the pattern is greater than its width or thickness. This barrier, therefore, by minimizing or restraining the flow or lateral movement of the metal, results in a very accurate and well defined reproduction or transference of the pattern from the master die to the heated block being formed into the die, and minimizes the bending or breaking stresses to such an extent that the pattern is not broken.

The effect on the completed forged die of the retaining wall or projection 14e, or of the plurality of projections, if the barrier is in more than one part or section, is to form in the face of the die adjacent the pattern a depression or groove of precisely the shape of the projection or retaining wall. This depression or groove is, of course, superfluous in the die which is formed and must be filled with metal. This can be easily done by means of a suitable oxyacetylene or electric welding outfit.

The die formed in accordance with this process is shown at 16 in Figs. 5 and 6, and by referring to Figs. 5 and 6, and particularly the former, it will be seen that the tapered walls 14b of the master die 14 not only are useful in forming accurate reproductions of the pattern, but the die is, by reason of these tapered walls, formed with tapered sides 16a which facilitate the mounting and holding of the die in the shoe or die holder 17. Additionally, however, by reason of the lateral offset or depression 14d in the upper master die there is formed at one side of the die 16 a shank or locking projection 16b which fits into a suitable pocket or depression formed in the holder or shoe 17. By reason of the tapered side walls 16a of the die and the locking projection 16b, the die 16 is by means of a key 18 so securely held or locked in the shoe that it can be used for a long period of time in a drop hammer or press for turning out commercial forgings in the customary manner. In this instance the holder or shoe 17 is provided on its face with two roughing-out or breaking-down dies 17a, which as here shown are formed and preferably cut directly in the shoe. Inasmuch as the roughing-out dies need not be accurately formed or need not conform in shape precisely with the article to be forged they can be cut in the shoe very conveniently or cheaply.

The advantage of the composite die shown in Figs. 5 and 6 wherein the finishing die 16 is removably held in the holder 17 and the roughing-out dies 17a are cut directly in the shoe, is that in the event the finishing die becomes worn or damaged from use it can be replaced with a new die 16. In this way the die has very long life, it being understood that the roughing-out dies do not need replacement in view of the fact that they can stand a great deal of wear and even breakage without impairing the usefulness of the composite die 16, 17.

It may be stated that in forging the locking projection or shank 16b at the same time that the die proper is forged, there is provided opposite the central part of the die 16 an increased thickness of metal which has a tendency to strengthen the die as a whole, and the added strength is provided at a point where it is most useful. Additionally, it should be noted that in this manner the entire die, including the facilities for holding or locking the same in the holder, are formed in the most economical manner with no waste of metal.

The intaglio pattern which is formed in the die 16 is shown at 16c in Figs. 5 and 6, and in Fig. 6 there is shown by dotted lines at 16d a groove or depression which was formed by the retaining wall 14e and which has been completely filled flush with the face of the die 16 in the manner previously explained.

It will be understood that in practice the composite die shown at Fig. 5 will be duplicated so as to form upper and lower dies which can be employed in a drop hammer or press for the production of commercial forgings.

When the dies are forged in a drop hammer the master dies are preferably arranged as here shown, that is to say the die 14 is secured to the hammer head and the other master die is secured to the base or anvil, but the relative positions of the dies may be reversed and particularly is this true if the forging is done in a press such as a hydraulic press.

In two co-pending applications filed April 27, 1916, Serial Numbers 93,835 and 93,836, I have disclosed and am claiming two different forms of master dies which may be utilized in carrying out the method claimed herein.

In a third co-pending application, Serial No. 93,834, filed April 27, 1916, I am claiming the composite die shown in Figs. 5 and 6 of this application but not claimed herein.

Having thus described my invention, what I claim is:—

1. The method of making forgings particularly forged dies for drop hammers and presses, which comprises forging a body of metal between a pair of master dies, one having a pattern on its face and adjacent the pattern between the latter and the sides of the dies holding in the metal so as to check the lateral flowing thereof with respect to the pattern.

2. The method of making forgings adapted especially for the production of forged dies for drop hammers and presses, which comprises forging a body of heated metal between a pair of master dies, one having a pattern on its face and during the forging operation forcing a barrier into the metal adjacent the pattern between the latter and the sides of the dies.

In testimony whereof, I hereunto affix my signature.

ALBERT F. ARTHUR.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."