STEEL RULE DIES

5 Claims. (Cl. 76-107)

This invention relates to a method of making dies, and more particularly to a method for making steel rule blanking dies and punches for working sheet metal.

The type of die to which the present invention relates comprises essentially a male punch member which is received within a cutting blade construction (referred to as a "steel rule") which is configured to exactly match the contour of the punch section. In use of such dies, sheet metal is positioned between the two die members which are then brought together to stamp out a part from the sheet metal corresponding to the configuration of the die members.

In constructing a steel rule die, the punch is formed and mounted on one support member and the steel rule is formed and mounted on a second support member. The support members are then mounted in a punch press, one of the members being fixedly mounted and the other member being mounted on a movable portion of the punch press to facilitate relative movement of the punch and steel rule towards and away from each other during the stamping operation. As will be appreciated, the punch and steel rule must be formed and located on the punch press with respect to each other so that they will exactly register when brought together. Several methods have been proposed in the past for forming and locating the punch and steel rule on their respective supports. The present invention proposes a method of constructing such dies in which the technique used for locating the punch and steel rule is believed to be superior to those proposed in the past and which results in an overall improved die.

An object of the invention is to provide a method for making a steel rule die in which the various support members for the die cutting elements are initially drilled and reamed as a unit for fastening elements and dowel pins to permit subsequent handling of the individual support members while ensuring accurate relocation of these members relative to each other when finally mounted in a punch press.

Another object of the invention is to provide a method of making a steel rule die in which the punch member is first fabricated and wherein the outline of the punch member is transferred to the support for the steel rule section without distortion.

A further object of the invention is to provide a method of forming openings in the steel rule die support members using the impressed outline of the punch member as a guide without the necessity to use the punch member itself as a template.

It is a further object of the invention to provide a method of making a steel rule die in which the punch section of the die may be fabricated in several component parts which are readily heat treated and reduced the cost of machining and fabricating.

Another object of the invention is to provide a punch member which may be composed of several sections, each of which is individually replaceable thus lowering die maintenance cost.

A still further object of the invention is to provide a die which may be constructed with the punch member in multi-sections which are small and thus can be surface ground in a small and relatively inexpensive surface grinder.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

In the drawings:

FIGURE 1 is a view in perspective of the various support members for the die elements showing the means for providing openings in each of the members for subsequently supporting and dowelling these members;

FIGURE 2 is a view in perspective illustrating the method of locating the punch section with respect to the support members for the punch section and for the steel rule;

FIGURE 3 is a view in perspective similar to FIGURE 2 illustrating the drilling of openings in the support members for the reception of individual cylindrical punches;

FIGURE 4 is a view in perspective of the punch section mounted on its support member preparatory to transferring the outline of the punch to the wooden support member for the steel rule;

FIGURE 5 is a view in perspective illustrating the formation of a slot in the wooden support member to receive the steel rule;

FIGURE 6 is a view in perspective illustrating the bending operation to form the steel rule to the desired configuration;

FIGURE 7 is a view in perspective of a portion of a steel rule with a bridging opening formed therein;

FIGURE 8 is a view in perspective of the finished steel rule prior to insertion into the wooden support member;

FIGURE 9 is a view of the wooden support member with the steel rule mounted therein and with the cylindrical punches mounted therein;

FIGURE 10 is a sectional view of a portion of the wooden support member with the steel rule mounted therein;

FIGURE 11 is a view of the completed die mounted in a punch press; and

FIGURE 12 is a view in perspective of an embodiment of the punch section in which the punch is provided in a plurality of sections.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring to FIGURE 1, it will be noted that a drill template 10 is provided having a generally square shape.

The template 10 is fabricated from a soft metal such as magnesium. The function of the template 10 is to act as a guide for simultaneously drilling and reaming registering openings in the die element support members. The template 10 is preferably made from a jig which is also used to form similar openings on punch press master shoes so that when the support members are secured to the shoes all of the members will be relatively located as desired. An opening 16 is provided adjacent each corner of the template. The openings 16, when transferred to the other die support members, serve to receive threaded fastening means for securing the support members to a punch press. A pair of pilot openings 18, 20 are provided in the template 10 for forming dowel pin openings in the support members. As will be noted, all of the pilot openings are chamfered to facilitate passing a drilling or reaming element therethrough.

The support members indicated in FIGURE 1 include a plywood board 22 for the steel rule, a steel mounting plate 24 for the punch element, and a steel plate 26 which serves as a back-up plate for the plywood board 22. Be-
Before forming the openings, the support members and drill template are clamped together in the order shown by means of a clamp 28. The openings 16, 18, 20 in the template are then used as pilot openings for drilling registering openings 16a–c, 18a–c, 20a–c in the member 56. The dowel pin openings 18a–c and 20a–c are then reamed and the openings 16a and 16b are counterbored to receive the head of a cap screw.

This assembly is then taken apart and the plate 24 is laid on top of the plywood board 22 as illustrated in FIGURES 2 and 3. Dowel pins 22a, 22b, 22c are then inserted through the openings 18a, b and 20a, b to accurately locate and hold the two pieces with respect to each other. An article template 12 is then located at the desired position on the plate 24 and the entire assembly is clamped in place by means of a clamp 34. The article template 12 has the contour of the part to be fabricated in the die. As will be appreciated, various shapes may be used as desired. The template 12 also is provided with five pilot openings 14 which, in the embodiment illustrated, receive cylindrical punches for punching corresponding openings in the part produced by the die. The face of the template 12 is manually scribed onto the surface 35 of the plate 24 by means of a scribe 38. The assembly is then moved to a drill press 40 as shown in FIGURE 3 and openings are drilled in the member 22, 24 corresponding to the pilot openings 14 in the template. The openings 14b in the plywood board are subsequently used to retain the previously mentioned cylindrical punched members and the openings 14c in the plate 24 are subsequently used as slug clearance openings for the portions of material punched out by the punches. Subsequent to the drilling operation illustrated in FIGURE 3, the assembly is taken apart and the cylindrical punches to be used are inserted into the openings 14b. If the openings are not quite large enough, they are redrilled to accurately fit the punches. The openings 14a in the plate 24 are preferably drilled a little larger than the punches for clearance of the slug of metal. The diameter of these openings may be enlarged approximately one sixteenth of an inch.

A punch section 42, as may be seen in FIGURE 4, is then fabricated from a machinable tool steel capable of being hardened by subsequent heat treatment. The article template 22 is used as the template to initially form the punch out. The punch 40 is then accurately machined so that it is an exact duplicate of the outline which previously has been scribed onto the plate 24. The punch 42 is then secured to the plate 24 by means of a screw 44 and dowel pins 46, 48. The punch 42 is not hardened at this time. Then, as shown in FIGURE 11, the plate 24 is provided with a plurality of parallel support bars 59 which are welded to the underside thereof. The function of the bars 59 is to position the plate 24 above the press support surface 51 so that the edges of metal punched out by the cylindrical punches may fall entirely through the die and be removed. The plate 24 is then mounted by means of cap screws 54 on parallel support bars 57 which are secured to a shoe 53. The member 53 is secured to the bottom fixed member 56 of a punch press. The plywood board 22 and back-up plate 26 (which is secured thereto by wooden screws 55) are then secured by cap screws 58 to shoe 50 which is secured to the upper movable member 62 of the press. The shoe 60 and bars 57 are provided with threaded openings corresponding to the openings 16 in the drill template 10 for receiving the screws 54, 58 and also with permanent dowel pins to engage the dowel pin openings 18a–c and 20a–c.

The upper press member 62 is then moved downwardly to bring the punch section 42 into contact with the surface of the plywood board 22. Sufficient pressure is applied so that the outline of the punch 42 is impressed on the surface of the board 22. The plywood board is then removed from the press.

Then, as may be seen in FIGURE 5, three pairs of spaced apart openings 64, 66, 68 are formed along the outline impressed by the punch 42. The board 22 is then placed in a jig saw 70 and the board is sawed immediately adjacent the impressed line by the saw 72. Dowel pin openings 18a–c and 20a–c are then inserted and the openings 16a and 16b are counterbored to receive the head of a cap screw.

As illustrated in FIGURE 6, a steel rule 78 is then bent to conform to the configuration of the slot 76. The rule may be formed in a conventional bender 80. The bender 80 has the table 82 upon which is secured a member 84 having an arcuate recess 86 of the desired radius. The rule 78 is placed against the member 84 and a section thereof is forced into the recess 86 by means of a movable member 88 having an exterior peripheral radius corresponding to the radius of recess 86. The member 89 is removable secured in a clamp 90 which is actuated by means of an operating handle 92. If the radii to be formed on the steel rule are relatively small, then a soft rule must be used and this rule must be subsequently heat treated to harden it. However, if the radii are large or if no radii are to be formed, then a hard rule may be used initially which does not require subsequent heat treatment.

Once the rule has been formed to the desired shape, recesses 94, 96, 98, as illustrated in FIGURES 7 and 8, are formed therein to bridge the material between the openings 64, 66, 68 in the board 22 thus permitting insertion of the rule 78 into the board as illustrated in FIGURE 9. A portion 100 of the rule will extend out of the board, as best seen in FIGURE 10, to perform the desired punching operation when the die is in use. As illustrated in FIGURE 10, the outer edge of the rule is provided with a slanting surface 102 to form a cutting edge 104. This cutting edge is subsequently flattened to give an improved cutting action.

After the rule 78 is inserted into the board 22 hardened cylindrical punch members 106 are then inserted into the openings 14b and the back-up plate 26 is secured to the underside of the board 22. The punches are preferably inserted from the back side of the board and are rapped with a rawhide mallet to be certain that they are flush with the back surface of the board.

The board 22 is then again mounted in the punch press and the punch press is brought together. The outline of the punches 106 is thus impressed on the punch member 43. The punch 42 is then removed from the openings 24 and the openings corresponding to those impressed by the punches 106 are drilled. The steel rule section is then removed and the edge is ground to form the flat edge 79 thereon which is necessary in the punching of metal.

The die is then remounted on the press and the press is again actuated to bring the rule and punch in contact. The punch 42 is preferably coated with machinist's blue and any discrepancies between the die elements are indicated on the punch 42. The punch is then removed and filled to exactly match the rule 78. The punch and rule are then hardened by heat treatment and are ready for use.

Then, as shown in FIGURE 11, resilient rubber stripping elements 108, 110 are secured to the board 22 and plate 24 respectively. The function of the elements 108, 110 is to eject the metal part from the die after it has been formed. Instead of rubber elements, spring-loaded
metal elements may be alternately used for this purpose. The die is then ready for tryout on sheet metal 112 which is placed on the punch 42. The die members are brought together to punch out a part from metal 112. If the punched part is satisfactory, the die is ready for production use.

For the sake of simplicity, the punch member 42 has been illustrated as an integral part. However, as illustrated in FIGURE 12, the punch section may be constructed as a plurality of sections 114-120 which when mounted adjacent one another on a support 122 will form the desired punch contour. There are several advantages to the FIGURE 12 construction and this construction is particularly desirable when the punch section is relatively large. Large punches are costly and difficult to machine, have a relatively large warpage when heat treated, and are expensive to replace when damaged in use. These problems are alleviated when the multisection construction is employed.

Having thus described my invention, I claim:

1. A method of making a cutting die for blanking a part out of sheet metal comprising forming a metallic male punch having the shape of the part to be blanked; mounting the punch on one member towards the punch; providing a pair of opposite members; mounting a relatively soft easily compressible support member on the other member of the punch press; actuating the press to impress the shape of the punch on the punch; forming a discontinuous opening in the support member immediately adjacent and around the outline of the impressed shape; forming a cutting blade in the shape of said opening; forming slots in said blade at the points of discontinuity of said opening; inserting the blade in the opening with the slots in registry with the points of discontinuity and with a portion of the blade extending from the first support member towards the second punch; inserting the first punch element in the first support member through the punch opening previously formed with a portion of said first punch extending from the first support members towards the second punch; providing a support for the blade and first punch on the surface of the first support member remote from the second punch; actuating the press to impress the shape of said first punch on the second punch; and forming an opening in the second punch in accordance with the impression made by the first punch.

5. A method of making a cutting die for blanking a part out of sheet metal comprising forming a metallic male punch having the shape of the part to be blanked; mounting the punch on one member of a punch press having a pair of opposing members; mounting a relatively soft easily compressible support member on the other member of the punch press; actuating the press to impress the shape of the punch on the support member; forming an opening in the support member immediately adjacent and around the outline of the impressed shape; forming a cutting blade in the shape of said opening; forming slots in said blade at the points of discontinuity of said opening; inserting the blade in the opening with the slots in registry with the points of discontinuity and with a portion of the blade extending from the first support member towards the second punch; and providing a support for the blade on the surface of the first support member remote from the punch.

References Cited by the Examiner

UNITED STATES PATENTS

2,018,392 10/55 Willink 76-107 X
2,495,221 1/50 Berlin.
2,816,461 12/57 Oesfinger 76-107
2,899,849 8/59 Laughter et al.
2,927,190 3/60 Duleboll et al. 76-107 X

GRANVILLE Y. CUSTER, Jr., Primary Examiner.
FRANK E. BAILEY, Examiner.