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2,359,682

PUNCH PRESS DIE

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FIG. 1

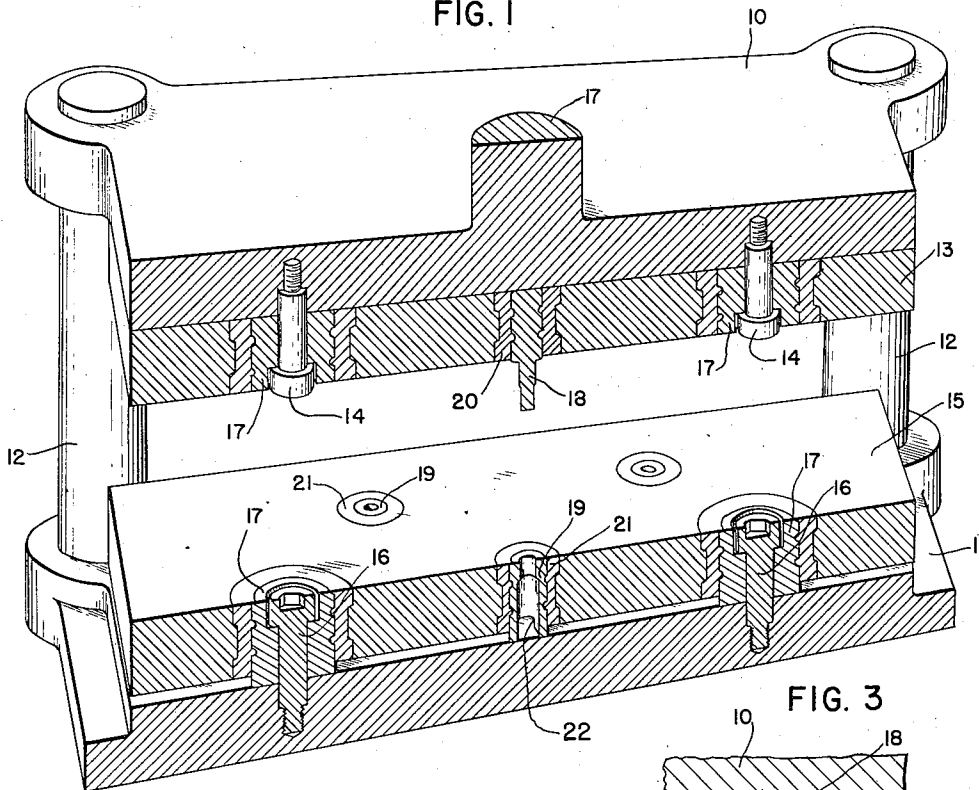


FIG. 3

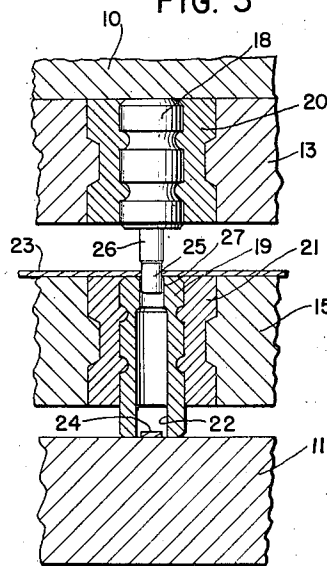


FIG. 2

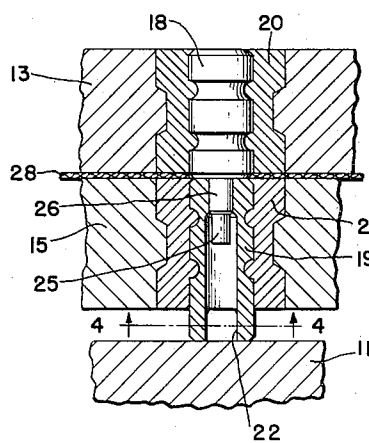
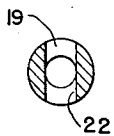


FIG. 4



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PUNCH PRESS DIE

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4 Claims. (Cl. 164—118)

This invention relates to punch presses and more particularly is concerned with improvements in the dies employed in connection with such presses.

In order to insure proper cooperation between the die elements of a press of the type referred to, it is necessary, and also the practice, to so design the said elements that there will be a predetermined clearance between their cooperating cutting edges. Such clearance serves three purposes. It reduces the power required to operate the press; it promotes a smooth shearing action; and it prevents actual contact between the cooperating edges of the die elements and hence avoids nicking and breaking such edges. The amount of clearance is dependent principally upon the gauge of the stock and its composition.

In the fabrication of a modern airplane it is not unusual to employ several hundred thousand rivets, thereby necessitating the formation of over half a million holes in the parts to be riveted, in addition to the usual number of bolt and pilot holes. The formation of rivet, and other, holes in such large numbers has presented one of the major problems in the mass production of aircraft. Heretofore, it has been proposed to utilize steel perforating dies for punching the rivet holes in order to increase production. Such dies afford an ideal solution to the problem of forming rivet holes, as they may be employed to punch simultaneously all the holes in a part, regardless of the pattern, spacing and size of such holes. However, apart from requiring the use of materials, now considered critical, the employment of perforating dies has had the objection that their manufacture has necessitated the exercise of a high degree of skill in order to obtain proper alignment of the cooperating die elements.

One object of the present invention, therefore, is to overcome the above objection, this object contemplating a punch element which is so formed that it will enable the production of dies, comparable in action to steel dies, from inexpensive, non-critical materials and without the exercise of a high degree of skill.

A further object is to provide a die element which is so designed that its alignment with a companion element may be effected rapidly, accurately and without the aid of special tools.

The invention is illustrated in the accompanying drawing, in which:

Figure 1 is a perspective view, partially in section, of a punch press having die elements embodying the features of the invention.

Figure 2 is a fragmentary, sectional view

through companion die elements which are shown in the relative positions in which they are supported while the punch element is being mounted in its pad.

Figure 3 is a generally similar sectional view with the die elements shown in connection with a sheet of stock and in the relative positions which they occupy upon completion of a punching operation.

Figure 4 is a detail section taken along line 4—4 of Figure 2.

Although the die elements of the invention are not necessarily so limited in use, they may be employed to particular advantage as perforating dies and are so illustrated in connection with a subpress which, as shown in Figure 1, comprises upper and lower bolster plates 10 and 11, respectively, the former being movably mounted on guide rods 12 which are carried by the bolster plate 11 and being adapted to be actuated by a principal press in accordance with conventional practice. A punch pad 13, which may be of "Masonite" or the like, is secured to the upper bolster plate by bolts 14 while a die pad 15 of similar material is secured to the lower bolster plate by similar bolts 16. Mounting of the punch and die pads upon their respective bolster plates is preferably accomplished with the aid of line-up bushings 17. The latter are recessed to accommodate the heads of the bolts and may be anchored in the pads by "Cerromatrix," a bismuth-lead-tin-antimony alloy which melts at a temperature of the order of 245° F., or a similar alloy.

Cooperating punch and die elements are indicated at 18 and 19, respectively. The said elements may be of any desired number and size and may be arranged in any desired spacing and pattern. They may either perforate, or otherwise deform, the stock material to be acted upon. The punch element 18 is preferably anchored in the pad 13 by a filling 20 of "Cerromatrix" or the like while the die element 19 is anchored in the pad 15 by a similar filling 21, it being noted that the line-up bushings 17 employed in connection with the die pad 15 and the die elements 19 support the die pad in spaced relation with respect to the upper surface of the lower bolster plate and that the extension of the die element is cut away at opposite sides to form openings 22. Provision is thus made for permitting the escape from the die elements of the slugs produced in the punching operation.

Referring to Figure 3, it will be noted that the parts of the press are shown in the positions they

occupy upon completion of a punching operation, the stock in which the hole is formed in such operation being indicated at 23 and the slug produced at 24. In accordance with the invention the punch element 18 is formed between its tip portion 25 and shank portion with a guide section 26, the diameter of the tip portion being predetermined so that its cutting edge will be suitably smaller in diameter than, and hence have the proper clearance with respect to, the cutting edge provided by the lip portion 27 of the die element 19. The diameter of the guide section 26 of the punch, on the other hand, is of substantially the same diameter as the diameter of the cutting edge on the die element and is so formed that the guide section 26 will enter the die element 19 with a relatively tight sliding fit. The difference in diameter between the tip portion and guide section of the punch element is, it is noted, exaggerated for the purpose of clarity. The punch described has the advantage that it enables the die elements to be accurately aligned with respect to one another in their respective pads to thereby insure a predetermined uniform clearance between the cutting edges of the said elements, such alignment being effected in the operation in which the punch elements are mounted in the punch pad.

After the die elements 19 have been mounted in the pad 15, the latter is supported in the position shown in Figure 2 and the punch elements 18 are inserted into the companion die elements, the guide sections 26 of the punch elements being caused to enter the die bores as shown in Figure 2. The punch pad, in which suitable openings have been previously drilled, is then arranged over the punch elements and upon the die pad, a sheet of paper 28 preferably being first placed upon the die pad. Thereafter the molten material which is to form the fillings 20 is poured into the openings around the punches and in the openings around the bushings 17 and permitted to solidify, the paper 28 preventing the molten material from flowing onto the die pad.

To attach the pads 13 and 15 to the upper and lower bolster plates 10 and 11, respectively, of the subpress so that the punch and die elements will be properly aligned, it is only necessary, assuming the lower pad has been secured to the lower bolster plate by the bolts 16 and the upper pad to be arranged upon the lower pad with the guide portions 26 of the punch elements occupying the openings in the die elements 19, to lower the upper bolster plate upon the upper pad, drill holes through it into the upper pad and insert suitable dowel pins. Thereafter the upper bolster plate may be elevated and, while utilizing the dowel pins to hold the upper pad in the proper position, be drilled and the inner ends of the holes threaded to receive the bolts 14 which may thereupon be inserted and tightened.

From the foregoing it will be apparent that as the guide sections 26 of the punches are coaxial with respect to the tip portions and have a relatively tight fit in the die bores, the cutting edges of the punches will be held in concentric relation with respect to the cutting edges of the dies. This relation will be maintained in the operation of the press, it being understood that in such operation the movement of the punch pad toward the die pad is terminated before the guide sections of the punches enter the bores of the companion dies. The construction described has the advantage that the clearance which may be predetermined in any particular instance to insure the best per-

formance of the press will be uniform with respect to the die elements of each pair.

It will be noted that in the punching operations the vertical thrusts which are developed are transmitted substantially wholly through the punch and die elements, the "Masonite" pads and fillings 17, 20 and 21 serving merely to hold and guide the said elements and to prevent their lateral displacement. The use of "Masonite" or similar material for the punch and die pads has the advantage that mounting and alignment of the punch and die elements are greatly facilitated. The pads may be readily formed with the necessary openings and, as the latter are considerably oversize with respect to the elements for which they are formed, any necessity for drilling such openings with a high degree of accuracy is avoided.

The features of the invention are not necessarily limited to use in connection with die elements for producing rivet holes but may be employed to equal advantage in connection with die elements of various shapes and sizes and for various purposes. In the event that any of the die elements should be broken, or otherwise become unsuitable for the purpose in view, such elements may be readily removed and be replaced by melting out the filling material which holds them in place, if in an isolated position, or drilled out if located in a confined area in which the use of heat might loosen adjacent punches. In the event that a particular assembly should become obsolete, the die elements, bushings and filler material may be readily reclaimed for further use as they will not be damaged or impaired by the heat required to melt the filler material.

I claim as my invention:

1. A punch element adapted to be carried by a holder and having a tip which may be caused to enter a die opening in a companion element which is adapted to be carried by a cooperating holder, the tip of said punch element and said companion element being formed with coating, annular working edges designed to have a predetermined, over-all working clearance and said punch element also being formed with an integral annular guide portion which is located behind said tip and which may be caused to enter the die opening in said companion element to establish and maintain said working clearance while said elements are being attached to said holders, the working edge and guide portion of said punch element having a difference in diameter corresponding substantially to said clearance.

2. A punch element adapted to be carried by a holder and to be moved by the latter into a die opening in a companion element which is adapted to be carried by a cooperating holder, said elements being formed with coating working edges designed to have a predetermined, over-all working clearance and said punch element being also formed behind its working edge with a guide portion which may be caused to enter and occupy the die opening in said companion element to establish and maintain said working clearance while said elements are being attached to said holders.

3. A punch element adapted to be carried by a holder and to be moved by the latter into a die opening in a companion element which is adapted to be carried by a cooperating holder, said elements being formed with coating, annular cutting edges designed to have a predetermined, over-all working clearance and said punch element being also formed behind its working edge

with a guide portion which may be caused to enter and occupy the die opening in said companion element to establish and maintain said working clearance while said elements are being attached to said holders, the cutting edge and guide portion of said punch element having a difference in diameter corresponding substantially to said clearance.

4. A punch adapted to be carried by a holder and to be moved by the latter into cooperating relation with a companion die, said punch and die

being formed with coacting, annular cutting edges designed to have a predetermined, over-all working clearance and said punch being also formed behind its working edge with a guide portion 5 which is cooperable with said die to establish said working clearance while said punch is being attached to said holder, the working edge and guide portion of said punch having a difference in diameter corresponding substantially to said clear- 10 ance

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