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2,873,627

MULTIPLE PUNCH AND DIE SETS

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2 Sheets-Sheet 1

FIG 1

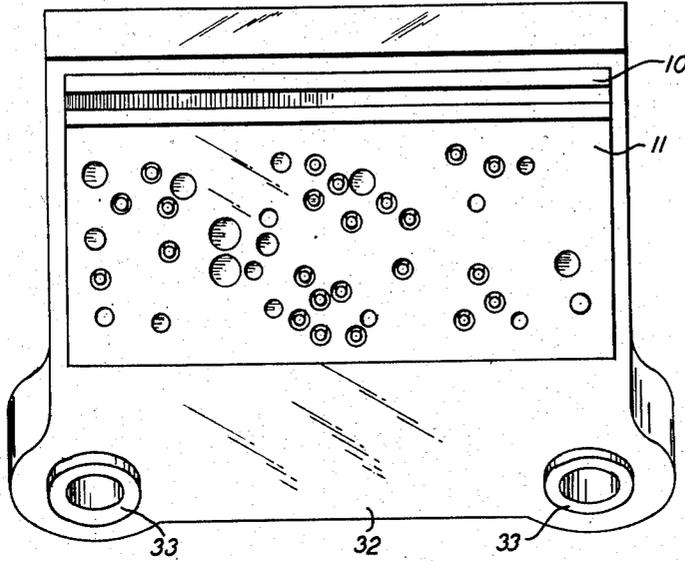
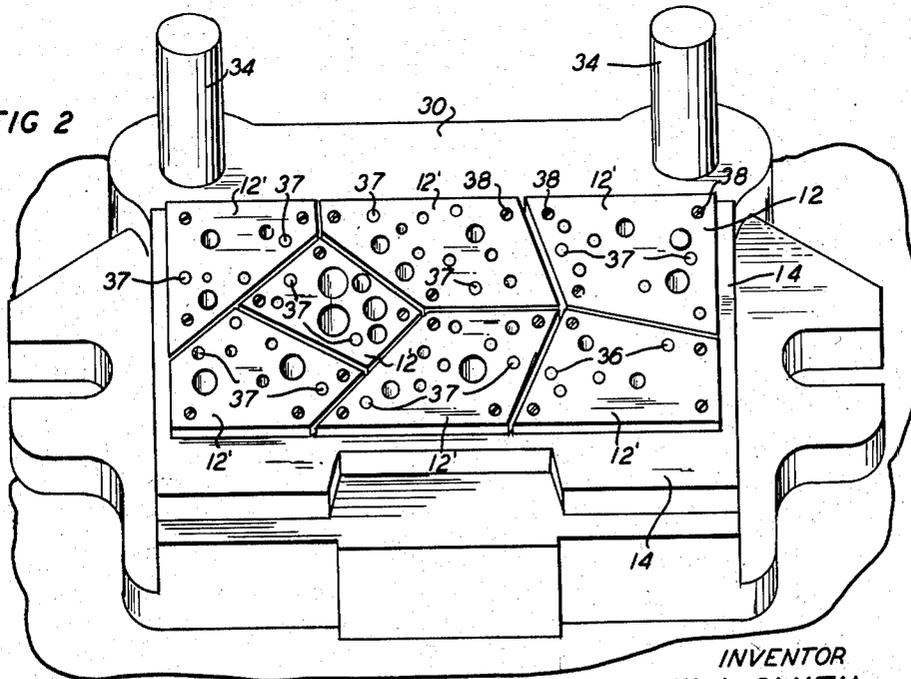


FIG 2



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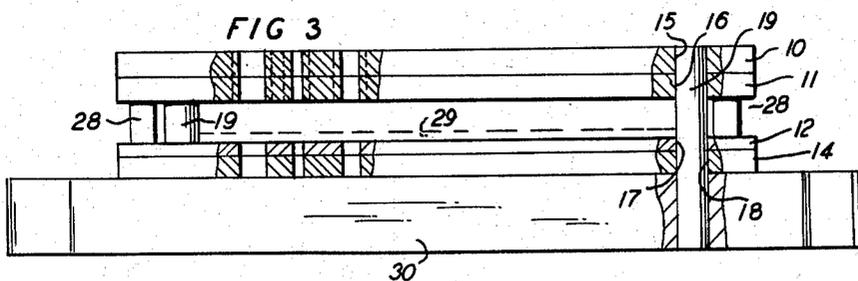
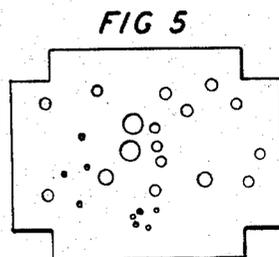
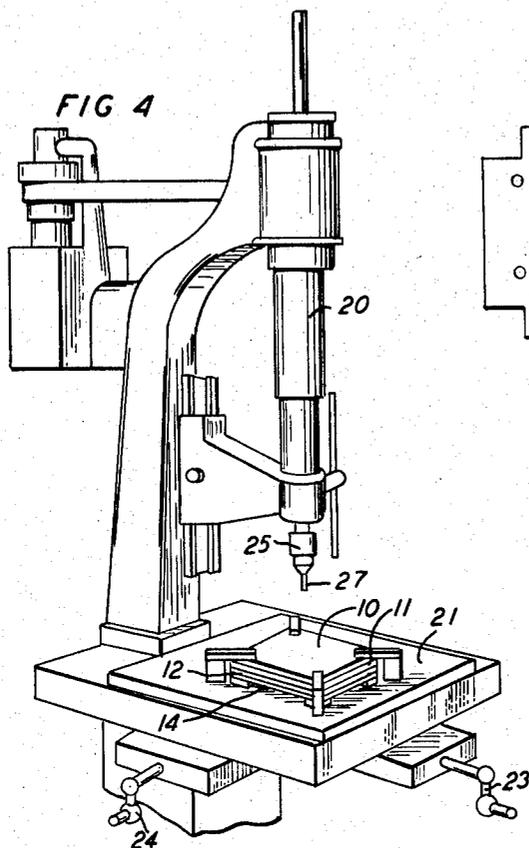
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## MULTIPLE PUNCH AND DIE SETS

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4 Claims. (Cl. 76-107)

This invention relates to multiple punch and die sets, particularly of the low cost types, and methods of making the same.

Frequently plates or panels, having numerous closely positioned holes therein are required in such small numbers that the cost of conventional punch and die sets is not warranted. To produce these perforated plates and panels without the costly conventional punch and die sets, commercially known individual punch and die units may be employed. It is possible to set up successive groups of these units but, due to the physical size of the punch and die holders and their hold-down extension members, numerous successive arrangements of the units are often required to make a single plate or panel. In one instance, the number of holes required in a panel made it necessary to use seventeen different settings of the individual punch and die units. This required considerable time for the setting up operations and either a large number of presses; if one is provided for each setting or the added dismantling time if fewer presses are available. The numerous settings multiplied not only the time required for perforating each plate or panel, but also the possibility of inaccuracies in the locations of the holes.

Objects of the present invention are a punch and die set, including a novel die, which is simple and economical in structure and readily and accurately manufacturable, and a highly efficient method of making the same.

One of the greatest problems in making punch and die sets, particularly when a multiplicity of punches and dies are to be employed, is the keeping of the dimensional changes in the die structure during the hardening process within tolerable limits. In one embodiment of the invention, according to the object, this problem is solved by cutting the die plate containing a multiplicity of die cavities in sections to divide the die cavities into groups and to minimize the possibility of variations in the die segments, particularly the respective positions of the die cavities during the hardening process.

In following the method in this embodiment of the invention, the punch and die sets for the multiplicity of differently arranged punches and dies may be made readily at low cost. More specifically, the method comprises initially connecting a punch plate, a stripper plate, a die plate and a back-up plate for the die, in their respective positions by two dowel pins extending through all of the plates. Spacers are disposed in out-of-way positions between the stripper plate and the die plate to receive another plate to serve as a stop for tools used for enlarging the holes in the punch plate and the stripper plate and protect the die plate. The drilling, boring and reaming operations may be performed in a jig boring machine to produce the holes in the various plates of the desired sizes and, in this manner, assuring accurate positioning and aligning of the various groups of holes in the plates. Subsequently, after the holes in the die plate have been completed and while the die plate is connected through the initial locating pins on the back-up plate, the die

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plate is marked to divide it into sections. After marking the die plate two additional sets of holes for dowel pins are drilled in the marked sections of the die plate where selected groups of die holes are to be included in predetermined sections of the die. Also, holes are drilled and counter-sunk in the different sections of the die plate for mounting screws and aligned drilled holes are tapped in the back-up plate. The die plate is now ready to be cut along the marked lines by, for example, a band saw, to divide the die plate into its plurality of sections. The various sections are heat-treated to produce the necessary hardness and returned to the backing plate where, through the aid of the additional pairs of dowel pins, the die sections may be disposed in their respective positions on the back-up plate and secured in place by the mounting screws. After mounting the back-up plate on a die shoe which has been provided with the necessary larger holes for the die openings the shoe may be mounted in the conventional manner on the bed of a press. The punch plate, after receiving a series of punches in the holes thereof, is fixedly mounted on the punch holder which is connected to the ram of the press. The stripper plate is connected in a conventional manner to the punch plate and spaced therefrom with suitable spring means such as the conventionally known dished washers.

Other objects and advantages will be apparent from the following detailed description when considered in conjunction with the accompanying drawings, wherein:

Fig. 1 is an isometric view of the upper portion of the punch and die set mounted on a punch holder of a punch press;

Fig. 2 is an isometric view of the lower portion of the punch and die set mounted on a die shoe which in turn is mounted on a bed of the press;

Fig. 3 is a front elevational view illustrating a group of plates in position for producing the necessary holes therein;

Fig. 4 is an isometric view of a jig boring machine wherein the numerous holes of the plates may be processed, and

Fig. 5 is a top plan view of a plate produced by the present embodiment of the punch and die set.

Referring now to the drawings, the species of punch and die sets selected to illustrate the invention begins with four plates of suitable sizes and thicknesses and produced from desired materials. These plates include a punch plate 10, a stripper plate 11, a die plate 12 and a back-up plate 14. In carrying out the steps of the method, these plates are initially clamped together for the drilling and reaming of aligned holes 15, 16, 17 and 18 respectively therein at desired positions away from where subsequent holes are to be processed in the plates to receive dowel pins 19 to secure the plates in their respective positions. Through the aid of a jig boring machine 20 (Fig. 4) of a commercially known type wherein a work support 21 may be moved forwardly, rearwardly or to either side, calibrated distances through the actuation of hand-cranks 23 and 24, the connected plates 10, 11, 12 and 14 may be moved relative to the axis of the tool holding chuck 25 for carrying out successive drilling, boring and reaming operations to produce the necessary holes in the plates. It is to be understood that the holes in the die plate 12 are smaller than the other aligned holes. For example, the holes in the back-up plate 14 are larger than their die holes to allow escapement of the punch parts, the holes in the punch plate 10 are to be of the desired size to removably receive their respective punches and the holes in the stripper plate 11 are to be of desired sizes for free movement of the respective punches therein. Therefore, a series of drilling, boring and reaming operations may begin with the smaller sizes required for the dies or die holes, after

which the holes in the plates 10 and 11 may be enlarged by changing the tools 27 of the jig boring machine 20. To make possible an efficient carrying out of several method steps in the production of the various holes in the plates, spacing bars 28 are positioned adjacent the ends of the plates between plates 11 and 12 and, during subsequent boring and reaming operations performed on plates 10 and 11, an auxiliary plate 29 may be positioned to rest on the die plate 12 serving to stop movement of the various tools 27 used in subsequently boring the holes in the plates 10 and 11 and thereby protect the die holes.

After all the drilling, boring and reaming operations have been completed on the four plates, plates 10, 11 and 12 are removed from the dowel-pins 19 and the dowel-pins are employed in mounting the back-up plate 14 on a die shoe 30. When these two members 14 and 30 are mounted in the jig boring machine, the back-up plate acts as a guide for drilling the necessary holes in the die shoe. At the same time the holes in the back-up plate are enlarged.

The punch plate 10 is ready to receive the necessary punches in the various holes thereof and for mounting in the conventional manner on a punch plate 32 which is fixed to a ram of a press and provided with conventional bushings 33 for guide rods 34 of the die shoe 30. The stripper plate may be movably connected to the punch plate in a conventional manner and spaced from the punch plate by suitably known spring means causing the stripper plate to function in the conventional manner during the operating cycles of the press.

The die plate 12 is returned to the back-up plate 14 and located in its proper position thereon through the aid of the dowel pins 19. The next step of the method includes marking the upper surface of the die plate in any suitable manner to divide all of the die holes into selected groups so that the die plate 12 subsequently may be divided into a plurality of smaller plates to reduce the number of die holes or cavities as equally as possible in smaller areas. After the die plate is marked, through the aid of the jig boring machine 20, a pair of holes 36 is drilled in each marked section of the die plate, continuing the drilled holes into the back-up plate to receive dowel-pins 37. Following this step and before mounting the dowel-pins 37 in place, additional holes are drilled and counter-sunk in the different sections for mounting screws 38 and corresponding holes are drilled and tapped in the back-up plate 14 for the mounting screws.

When these steps of the method are completed, the die plate 12 is removed from the back-up plate 14, the back-up plate is provided with the various dowel-pins 37 and, through the aid of suitable means such as a band saw, the die plate is cut along the marked lines to divide the die plate into the plurality of section 12'. These sections pass through a hardening step of the method wherein they are heat-treated to produce a "Rockwell hardness" R. C. 62-63. After the hardening step of the method has been completed, the various sections 12' are returned to their respective positions and, through the aid of the dowel-pins 37, they are located accurately on the back-up plate 14 where they are firmly secured in place by the mounting screws 38. The back-up plate 14 is secured in place on the die shoe which is then mounted on the bed of the press. The method is completed and this specie of the punch and die set is complete, installed, and ready for operation.

It is apparent, by following the steps of the method, that the cost of producing the punch and die set is low, particularly when considering the numerous perforating

operations which are performed simultaneously, enabling the production of plates or panels with many perforations therein regardless of how closely they are positioned with respect to each other. Furthermore, by reducing the single die plate to a plurality of smaller sections containing smaller groups of die holes, prior to carrying out the hardening step of the method; keeps the dimensional changes which may take place during this step within tolerable limits. Furthermore, should damage occur to any portion of the overall die, only that section of the die wherein the damage occurs need be replaced, leaving all of the other sections to continue their usefulness throughout the life of the die and reducing maintenance of the punch and die structure to a minimum. Also, should changes be made, such as the removal or the addition of other punches and dies, these changes may be made readily.

It is to be understood that the above described arrangements are simply illustrative of the application of the principles of the invention. Numerous other arrangements may be readily devised by those skilled in the art which will embody the principles of the invention and fall within the spirit and scope thereof.

What is claimed is:

1. The method of forming a multiple die comprising securing a die plate and a back-up plate together, drilling a plurality of aligned pairs of holes in the plates, dividing the die plate into a plurality of individual members, heat-treating the die members to harden them, and securing the die members in their respective positions to the back-up plate.

2. The method of forming a multiple die comprising securing a die plate and a back-up plate together, drilling a plurality of aligned pairs of holes in the plates, marking the die plate to divide the holes of the die plate into smaller groups, cutting the die plate along the markings to divide the die plate into a plurality of individual die members, heat-treating the die members to harden them and securing the die members in their respective positions to the back-up plate.

3. The method of forming a multiple die comprising securing a die plate and a back-up plate together, drilling a plurality of aligned pairs of holes in the plates, marking the die plate into areas for groups of the holes therein, drilling holes through the die plate and into the back-up plate for securing means for each area, cutting the die plate along the markings to divide the die plate into individual members for the areas, heat-treating the die members to harden them, and securing the die members in their respective positions on the back-up plate.

4. The method of forming a multiple punch and die set from a punch plate, a stripper plate, a die plate and a back-up plate for the die plate comprising securing the plates against displacement relative to each other in stacked formation with space between the stripper plate and the die plate, drilling a plurality of aligned sets of holes in the plates, boring the holes in the punch plate and the stripper plate to enlarge them for their respective punches, and inserting a stop plate between the stripper plate and the die plate prior to the boring step.

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