

Aug. 7, 1945.

F. K. KIRSCH

2,381,062

PUNCH AND DIE MOUNTING

Filed June 30, 1943

3 Sheets-Sheet 1

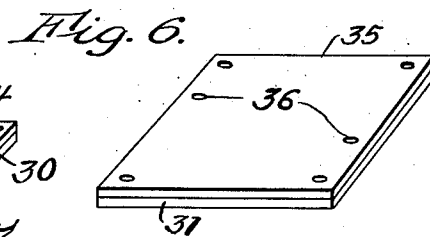
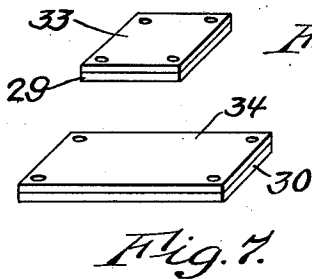
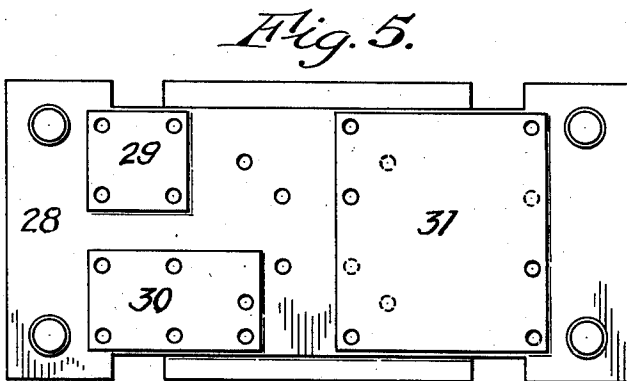
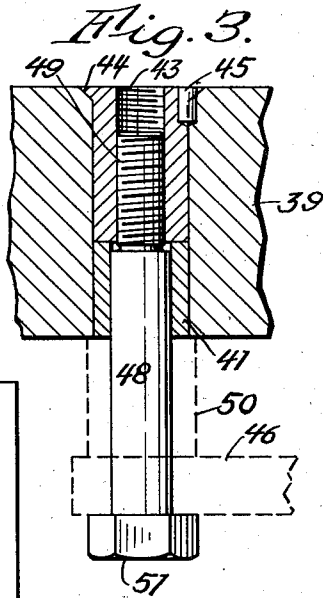
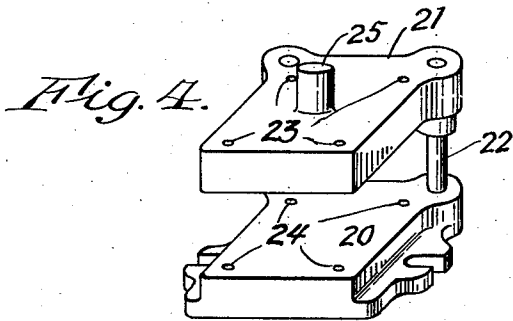
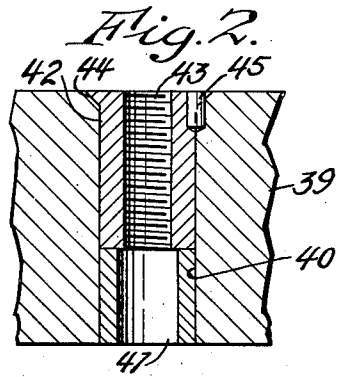
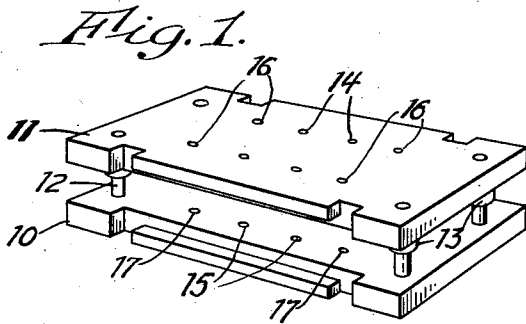


Fig. 8.

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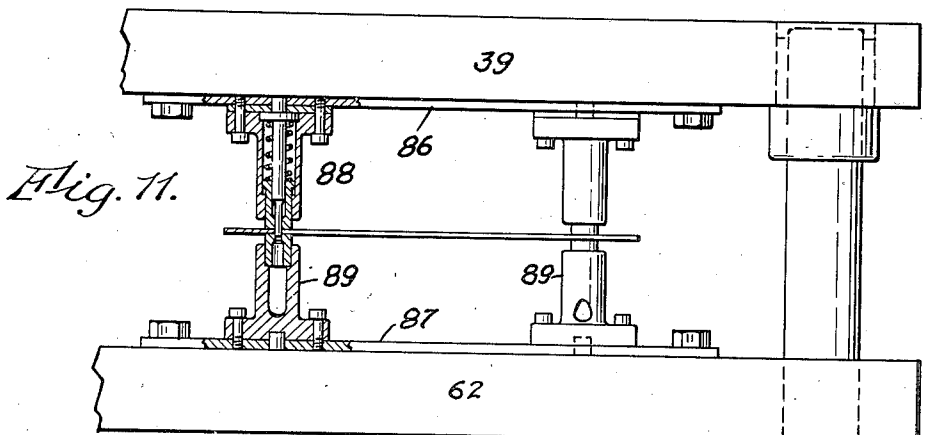
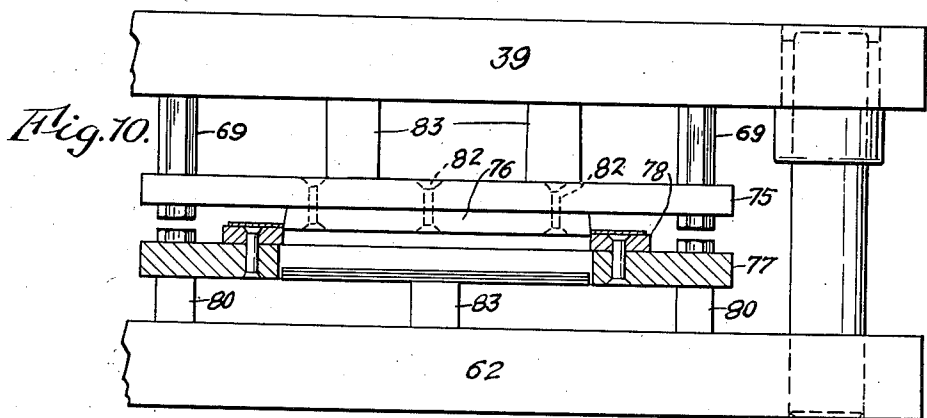
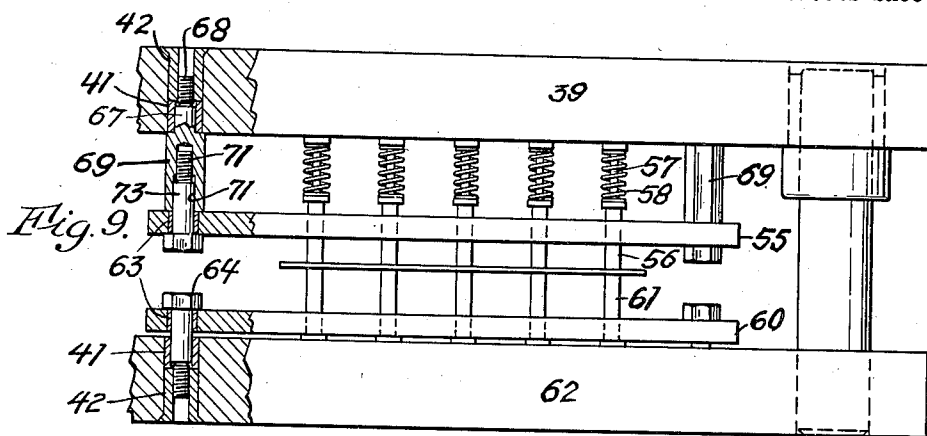
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PUNCH AND DIE MOUNTING

Filed June 30, 1943

3 Sheets-Sheet 2



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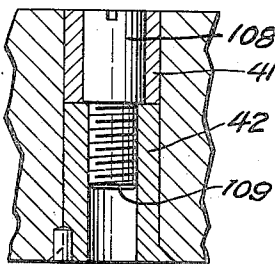
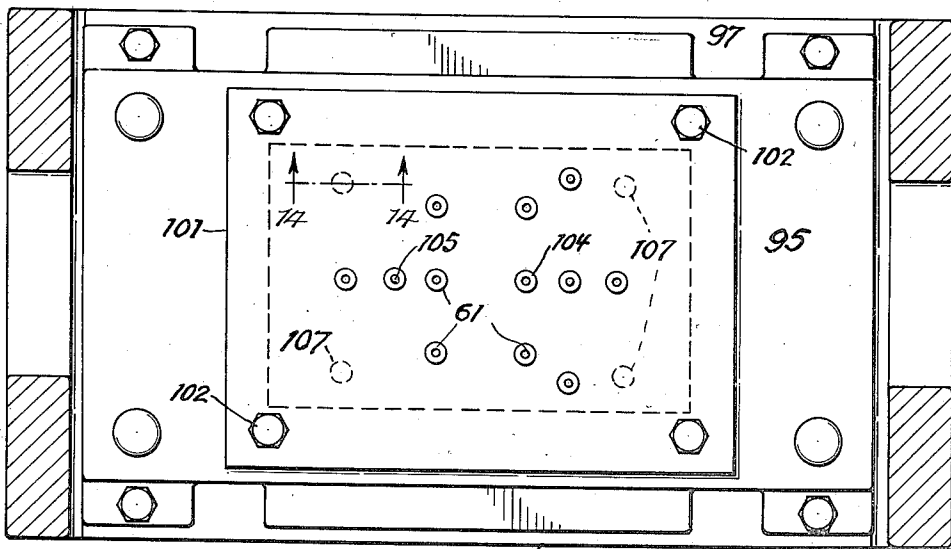
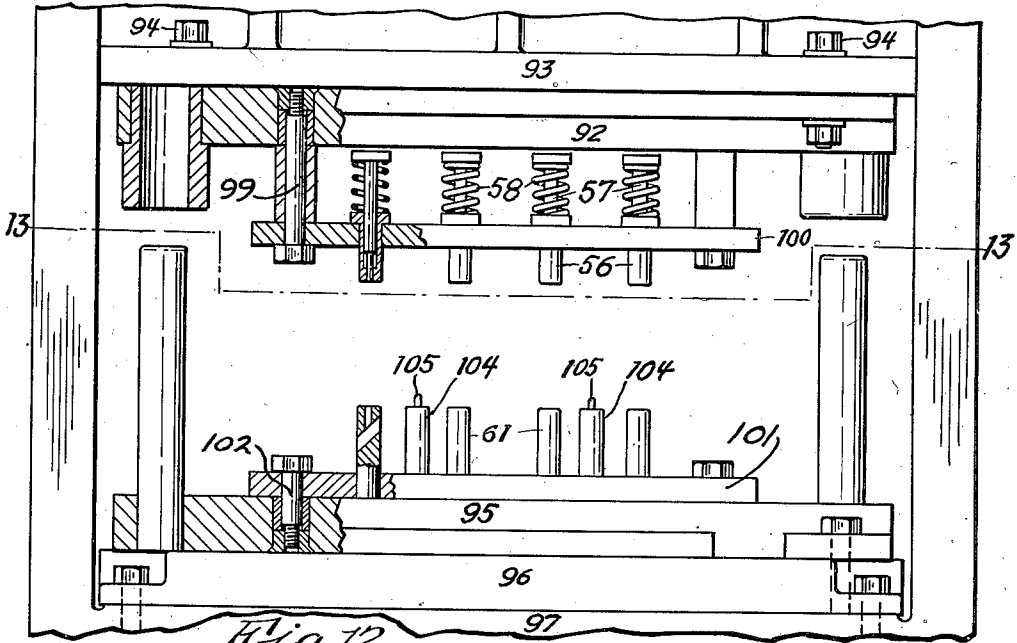
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PUNCH AND DIE MOUNTING

Filed June 30, 1943

3 Sheets-Sheet 3



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2,381,062

PUNCH AND DIE MOUNTING

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Application June 30, 1943, Serial No. 492,797

26 Claims. (Cl. 164-99)

This invention relates to improvements in mounting punch and die implements or die sets.

One of the objects of this invention is to provide an improved method and means for mounting punch and die implements on die sets so that any set of implements can be quickly and accurately mounted on any die set. It is also an object of this invention to provide method and means of this kind by means of which punch and die implements can be properly mounted on a die set without requiring the services of an expert die setter. It is a further object to provide a method and means of this kind which may be standardized to make it possible to assemble punch and die implements or apparatus on any number of different die sets by using holes already formed in the die set.

A further object is to provide apparatus of improved construction, by means of which mounting plates having punches and dies mounted thereon can readily be accurately located and secured to the punch holder and die shoe of a die set. A further object is to provide die sets with accurately formed and positioned holes, each having a locating bushing and a securing bushing pressed therein, for cooperation with bolts having separate locating and securing portions formed thereon. It is also an object of this invention to provide means of improved construction for plugging holes in the die set which are not used and which might interfere with the proper functioning of the punch or die units.

Further objects and advantages of this invention will appear from the following description and claims.

In the accompanying drawings:

Fig. 1 is a perspective view of a large conventional die set showing standardized locating holes formed in accordance with my invention and positioned in pairs one directly above the other.

Fig. 2 is a fragmentary cross sectional view of the upper part of a die set showing bushings for the accommodation of the bolts for attaching mounting plates and at the same time assuring their accurate positioning on same.

Fig. 3 is a similar fragmentary cross sectional view, showing an attachment guided in its bushing to maintain accuracy in relation to other like bolts and to its mounting plate.

Fig. 4 is a perspective view of a die set for use in a smaller punch press showing the stem by which the upper part is attached to the ram of the press and the standardized holes located on exactly the same center line spacings as in a portion of the die set shown in Fig. 1.

Fig. 5 is a plan view of the die shoe of a large die set showing a standardized spacing of holes and mounting plates of three different sizes in position thereon.

Fig. 6 is a perspective view of a pair of mounting plates which will exactly fit over any four locating holes of the die set shown in the upper left-hand portion of Fig. 5.

Fig. 7 is a perspective view of a pair of mounting plates which will exactly fit over any four locating holes as shown in the lower left-hand portion of Fig. 5.

Fig. 8 is a perspective view of a pair of mounting plates which will exactly fit over any four locating holes as shown in the right-hand portion of Fig. 5 and having two other holes for holding screws where necessary.

Fig. 9 is a fragmentary front view, partly in section, of a standardized die set having punch and die plates mounted thereon so that each punch is in axial alignment with its die due to the accuracy of the spacings of the holes through which the attachment bolts enter.

Fig. 10 is a similar view of the same die set, as shown in Fig. 9, and showing how blanking dies may be quickly and accurately mounted thereon by using the same accurately spaced locating holes, as shown in Fig. 9.

Fig. 11 is a similar view of the same die set as Fig. 9 and showing how the "Die set and templet mounting" shown in Patent No. 2,275,706 may be used in this apparatus.

Fig. 12 is a front elevation, partly in section, of a standardized die set mounted in a press which is only partially shown, the die set having punch and die implements mounted thereon, the punch holder of the press being shown in raised position.

Fig. 13 is a sectional plan view, on line 13-13, Fig. 12, showing a die carrier mounting plate in position on a die shoe.

Fig. 14 is a sectional view showing the filler plug used to provide a flush surface over mounting holes when punch or die elements may be located in position over them, the section being taken on line 14-14, Fig. 13.

In the particular die set shown in Fig. 1, 10 represents the die shoe, 11 the punch holder, 12 the guide posts, and 13 the guide post bushing, all of which parts when assembled are known as a "die set." Die sets of this nature are a standard commercial commodity which may be obtained from different manufacturers. As these die sets are required for the basic mounts for punch and die implements for blanking, punch-

ing, forming, drawing and other operations on sheet metal, they have heretofore always been supplied (except in special cases) with the main portions of the punch holder and die shoe plain, i. e. without holes for attaching the punch and die implements thereto.

Heretofore each die maker or designer provided means according to his own ideas for securing the punch and die to the die set and each time that a punch and die was mounted on a die set, an expert die setter was required to mount the punch and die in correct relation to each other. In order to overcome this difficulty, I provide each die set with a series of holes which are formed accurately with their axes perpendicular to the faces of the die shoe and punch holder of the die set and arranged in accurately predetermined spaced relation to each other, and arranged with each hole of the punch holder in accurate axial alignment with a hole in the die shoe. I also adopt a standard spacing of these holes, so that other die sets will have holes similarly spaced. I then provide the punch and die mounting plates, on which the punch and die implements are mounted, with holes which are spaced relatively to each other in the same manner as the holes in the die set, and the punch and die implements are mounted on these mounting plates, so that they will cooperate correctly with each other when the holes of the plates are in axial alignment. Consequently, when these mounting plates with the punch and die implements thereon are to be placed on a die set, it is merely necessary to place accurately fitting pins into at least two holes of punch mounting plate and punch holder, and to place at least two accurately fitting pins into corresponding holes of the die mounting plate and die shoe. The plates may then be secured to the die set, and it will be obvious that when so mounted, the die implements will be correctly located with reference to the punch implements. Furthermore, if all die sets of a shop or of a number of shops are provided with holes identically spaced, and all die and punch mounting plates are provided with two or more holes spaced according to the spacing of holes in the die sets, then any set of plates may be easily and quickly secured to a die set without the aid of a skilled die setter and without removing the die set from the press, so that the press will be idle only for a minimum interval of time.

Any suitable or desired arrangement of aligning holes may be employed. For example, the holes may be arranged at the intersections of straight lines equally spaced and extending lengthwise and crosswise of the die set, the crosswise lines extending at 90 degrees from the longitudinal lines. By adopting a standard spacing of these lines from each other, both for the die set and the mounting plates, any set of mounting plates may be secured to any die set, providing that the same is large enough, or a number of sets of small mounting plates may be mounted at the same time in a larger die set. These mounting plates may then be produced in quantities with holes bored therein according to the standard adapted. The larger die sets can have the holes therein spaced to accommodate several sets of smaller mounting plates and when large mounting plates are used thereon, preferably the same holes which serve for the smaller plates are also used for the larger plates.

In the die set shown in Fig. 1, I have provided a middle series of holes 14 in the punch holder

or upper member 11 of the die set, which holes are formed in axial alignment with correspondingly spaced holes 15 in the die shoe 10. These holes may, for example, be spaced at distances of six inches from each other so as to accommodate a plate somewhat larger than six inches square. Any suitable dimensions may, of course, be selected. I have also provided two additional series of holes 16 in the punch holder 11, which may be spaced in any suitable or desired relationship to the holes 14 preferably in alignment therewith so that these holes 16 may accommodate a punch supporting plate of larger dimensions. The die shoe 10 is provided with holes 17 in axial alignment with the holes 16.

In Fig. 4, I have shown a small die set having a die shoe 20, a punch holder 21, and guide posts 22. In this small die set, the punch holder is provided with holes 23 arranged in axial alignment with holes 24 of the die set and these holes may be spaced in the same relationship to each other as the holes 14 and 15 of the larger die set shown in Fig. 1. The die set shown in Fig. 4 is provided with a stem or projection 25 by means of which the punch holder may be mounted on the ram of the press in the usual manner.

In Fig. 5, I have shown the die shoe 28 of the larger die set in which the holes are formed and spaced to accommodate die mounting plates of different sizes. For example, the die set is provided with holes to support a die-mounting plate 29 of the smallest size in the upper left-hand corner thereof, and another die mounting plate 30 of larger size is arranged in the lower left corner, the die shoe having holes suitable for accommodating these two plates. At the right-hand side of Fig. 5, a still larger die mounting plate 31 is shown which has holes in its corners arranged for cooperation with corresponding holes of the die shoe and intermediate of these holes, additional locating or securing means may be provided for holding the die mounting plate in correct relation on the die shoe 28. It will be noted that the holes shown in Fig. 5 are so arranged in the die shoe that in place of the three die mounting plates 29, 30 and 31 shown in this figure, a single large plate covering substantially the usable area of the die shoe could be used and the holes provided for the small plates could be employed for fitting large plates to the die shoe. Also two plates of the size of plate 31 could be mounted on the die shoe. Since the spacing of the holes in any die set is made standard according to my invention, there will be no difficulty on the part of the die designer to select punch and die mounting plates having the holes therein located to cooperate with holes in the die set and to arrange these punch and die units on these plates so that they will cooperate with each other.

In Fig. 6, I have shown a punch mounting plate 33 for cooperation with the die mounting plate 29, these plates being of the smallest size, suitable for use on a die set, such as shown in Fig. 4, or for use with the openings 14 and 15 of the die set shown in Fig. 1, or for use on a larger die set, as indicated in Fig. 5. In Fig. 7, I have shown a larger size of mounting plates, the punch mounting plate 34 being arranged for cooperation with a die mounting plate 30 similar to that shown in the lower left corner of Fig. 5.

In Fig. 8, I have shown the die mounting plate 31 of Fig. 5 arranged to be used in conjunction with a punch mounting plate 35. In these plates, in addition to the corner holes, I have shown intermediate holes 36 which may be

employed when it is considered advisable to provide additional support for the plates on the die set.

The holes described in the die set and in the punch and die mounting plates may be used in conjunction with accurately machined pins for locating the mounting plates in correct relation to the die set and other suitable means may be provided for securing the mounting plates in their correct positions. It is possible, however, to combine the supporting means for the mounting plates with the locating means for these plates. I have illustrated this type of arrangement in Figs. 2 and 3, in which I have also shown two bushings in each hole of the die set. In these figures, 39 represents the punch holder or upper member of the die set, and 40 represents one of the locating holes accurately formed in the punch holder. I preferably provide bushings for the locating holes, and in the construction shown in Figs. 2 and 3, I provide a locating bushing 41 having a smooth or cylindrical inner surface for cooperating with the locating pin, and a securing bushing 42, which may for example have a threaded inner surface 43. The securing bushing 42, in the construction shown, is provided with a head or outwardly flaring flange portion 44 which limits the extent to which the bushing may enter into the hole 40, and suitable means may be provided for preventing the turning of the bushing 42 in the hole 40 of the punch holder, such for example as a dowel or pin 45, which acts as a key between the securing bushing 42 and the punch holder 39.

The bushing 41 may cooperate with any suitable aligning or locating means for locating a punch mounting plate 46, Fig. 3, on the die set, and the securing bushing 42 may cooperate with suitable means for securing the punch mounting plate 46 in its correct position. The locating means may be a separate part from the securing means. In the construction illustrated in Fig. 3, I have provided a bolt which incorporates both of these means, the bolt having a stem or shank 48 which is accurately machined so as to have a snug fit within the locating bushing and in a correspondingly accurately formed hole in the punch mounting plate 46. The bolt also has an end portion 49 of reduced diameter which is threaded to cooperate with the threaded securing bushing 42. 50 represents a spacer which may be of any suitable or desired form, for example, in the form of a sleeve extending about the shank portion 48 of the bolt or in the form of a rail arranged between bolts, or the spacing means may be in the form of a series of blocks positioned to space the mounting plate 46 in definite parallel spaced relation to the punch holder 39 of the die set. The bolt shown is provided with a head 51, by means of which it may be turned.

It will be obvious from the foregoing that the shank portion 48 of the bolt will position the punch mounting plate 46 so that the hole therein will be coaxial with the locating bushing 41 and by tightening the bolt, the punch mounting plate 46 will be securely held in this relationship. It is, of course, well known to those skilled in the art that screw threads cannot be relied upon to support a bolt coaxial with a hole, but by means of the locating bushing and the accurately formed shank 48 of the bolt, a high degree of accuracy in mounting the plate 46 can be attained. Obviously, the same construction shown in Figs. 2 and 3 may be used on a die shoe for securing a die mounting plate thereto, in which

case, the construction employed would be identical with that shown in Figs. 2 and 3, but inverted. It will also be obvious that the bushings 41 and 42 may be omitted and the locating and securing holes may be formed directly in the punch holder and die shoe of the die set.

In Fig. 9, I have shown how the mounting plates with the punch and die implements mounted thereon may be secured to a die set by means of my improved construction. In this figure, 55 represents a punch mounting plate having a plurality of punch units applied thereto, each punch unit including a stripper sleeve 56 slidably arranged in an accurately formed hole in the punch mounting plate, a punch 57 extending into the stripper sleeve 56 and above it into contact with the punch holder 39 of the die set, and a stripper spring 58 interposed between the head of the punch and a flange at the upper end of the stripper sleeve 57. When the work is being penetrated during the movement of the punch holder 39 toward the die shoe 62, the stripper sleeves 56 slide upwardly in their holes in the punch mounting plate 55 while the punch penetrates the work. 60 represents the die mounting plate which has dies 61 pressed into accurately formed holes in the plate 60, the lower ends of the dies resting directly on the die shoe 62 of the die set.

The punch and die mounting plates 55 and 60 are provided with accurately formed locating holes therein, spaced according to the standard spacing adopted for the die sets, and in the construction shown, these holes in the two supporting plates may be provided with bushings 63. The die mounting plate 60 is secured to the die shoe 62 by means of a bolt similar to the one described in connection with Fig. 3, having an accurately formed cylindrical body portion or shank 64 which when inserted through the bushing 63 of the die mounting plate and the locating bushing 41 of the die shoe will ensure accurate positioning of the die mounting plate 60 on the die set, so that the plate may then be secured in this position by means of the screw-threaded portion of the bolt which cooperates with the threaded bushing 42.

In the case of the punch mounting plate 55, because of the height of the punching units above this plate, I have provided another form of spacing member, this spacing member also serving to align or locate the punch mounting plate 55 and is in effect an extension of the locating and securing bolt. This extension or spacing member is provided with an accurately formed cylindrical locating portion 67 adapted to cooperate with the locating bushing 41 in the punch holder of the die set and a screw-threaded portion 68 which serves to secure this spacing member to the securing bushing 42 of the die set. This spacing member includes a spacing part 69 of larger diameter than the cylindrical portion 67 and which preferably has a hexagonal or other non-circular exterior surface so that it can be readily turned by means of a wrench. This portion is of the exact length required between the lower surface of the punch holder 39 of the die set and the upper surface of the punch mounting plate 55, against which the lower end of the spacing member 69 bears.

This spacing member is bored out to form a hole therein having an accurately bored cylindrical portion 70 and a portion 71 of smaller diameter which is screw-threaded. This spacing member is adapted to cooperate with a bolt simi-

lar to those described and having an accurately machined cylindrical shank portion 73 fitting into the cylindrical portion 70 of the bore of the extension member and adapted to fit accurately in the bushing 63 of the punch mounting plate. The end of this bolt is of reduced diameter and threaded to cooperate with the threaded portion 71 of the extension or spacing member. It will be obvious that by first positioning the spacing member into fixed relation to the punch holder 39 of the die set and then using the bolt for securing the punch mounting plate thereto, the bolt will be in correct axial alignment with the spacing member, and consequently, the hole in the bushing 63 of the punch mounting plate 55 will be in correct axial alignment with the bushing 41 in the punch holder 39. Since this bushing is in correct axial alignment with the corresponding bushing 41 of the die shoe, it will be obvious that the various punching units mounted on the punch mounting plate 55 will be in correct axial alignment with the dies 61 of the die mounting plate 60.

In Fig. 10, I have shown the same die set having different mounting plates secured thereto. In this case, a mounting plate 75 is provided having a blanking punch 76 secured thereto and the die mounting plate 77 has a blanking die 78 mounted thereon. The holes in the two mounting plates for receiving the locating and securing bolts connecting them to the die set are spaced identically as in the case of the mounting plates 55 and 60 shown in Fig. 9, and consequently, when it is desired to mount the blanking dies on the same die set, it is merely necessary to remove the bolts that secure the mounting plate 55 to the spacer member 69 and remove the punch mounting plate 55 and put in its place the plate 75. Since the distance between these plates will be less than in the case of the plates 55 and 60, spacer members 80 of any suitable kind, such for example as the spacing members 69 shown in Fig. 9, or the sleeves 50 shown in Fig. 3, may be used to position the die mounting plate 77 in spaced relation to the die shoe 62. These spacing members are preferably employed so that the blanks 84 punched out by the die may be readily removed. If desired, the spacer members used in connection with the mounting plates may be made of such height that any set of mounting plates may operate with the same shut-height of the press, thereby further simplifying the changes over from one set of mounting plates to another by eliminating the need for adjusting the bed of the press.

The blanking punch 76 and the die 78 are, of course, correctly mounted on the plates 75 and 77 with respect to the locating holes in these plates and the blanking punch and die may be secured to their mounting plates in any usual or suitable manner, for example, by means of rivets 82 as shown in the drawing. In the case of any of the mounting plates, if strains are placed on the plates, such as might cause them to deflect, additional spacing members 83, such as rails or blocks may be placed between the die mounting plate 77 and the die shoe 62 and similar spacing members 84 may also be interposed between the punch mounting plate 75 and the punch holder 39 of the die set.

In Fig. 11, the same die set is shown used in connection with perforating apparatus such as disclosed in the patents issued to George F. Wales, Nos. 2,168,377 and 2,275,706, the apparatus shown in the drawing being similar to that shown

in the later patent in which templates 86 and 87 are provided, the punch units 88 being mounted on the template 86 and the die units 89 being mounted on the template 87. These templates may be secured to the punch holder 39 and die shoe 62 of the die set by means of bolts similar to those shown in Figs. 2 and 3, but shorter, since no spacing members are employed in this case between the templates and the parts of the die set.

Figs. 12 and 13 show a complete die set with perforating apparatus mounted thereon and ready for operation in a press. In this die set, the punch holder 92, Fig. 12, is secured to the ram 93 of the press by means of bolts 94 which extend through flanges of the punch holder of the set, and the die shoe 95 is secured to the bolster plate 96 which in turn is secured to the bed 97 of the press. The punch mounting plate 100 having punch units mounted thereon similar to those shown in Fig. 9 is secured to the punch holder 92 of the die set in the same manner as heretofore described, by means of bolts 99, and the die mounting plate 101 is secured to the bolster plate 96 by means of shorter bolts 102, these bolts of both plates cooperating with locating bushings and securing bushings arranged in holes of the die shoe. The die mounting plate 101 on which the die units are mounted may also support a pair of posts 104 having locating pins 105 thereon which are adapted to enter into preformed holes in the work for locating the work with reference to the punches and dies.

In Figs. 9 to 12, the additional holes in the die set for accommodating mounting plates of other sizes are omitted for the sake of clarity, but it will be understood that the die sets shown in these figures are provided with holes for accommodating mounting plates of various sizes. Additional holes 107 for a smaller die plate are shown in broken lines in Fig. 13.

It may happen that with a plurality of locating holes in the die set, some of the punch or die units may be located under or over these locating holes and thus interfere with the proper operation of these punch and die units. For this purpose, I provide plugs for the holes, such for example as are shown in Fig. 14. These plugs 108 have body portions or shanks which are preferably of the same length as the locating bushings 41 and have threaded portions 109 of reduced diameter which engage the threads of the bushings 42. The ends of these plugs preferably terminate flush with the surfaces of the punch holder or die shoe of the die set and these ends may be provided with slots for a screwdriver. Any other means for temporarily plugging any of the locating holes in the die set may be provided.

By means of the foregoing method and apparatus, it will be obvious that the securing of mounting plates on the die sets is greatly facilitated so that the work of an expert die setter is entirely eliminated. Furthermore, by providing the mounting plates with locating holes therein arranged according to a certain predetermined spacing, various sizes of plates may be mounted on the die sets without requiring any changes in the die sets themselves. Furthermore, the mounting plates may be used in connection with any die set that is provided with the locating holes in predetermined spaced relation to each other, regardless of where such die sets may be located. Consequently, the mounting plates may be interchangeably used, not only on any die set of a particular shop, but on die sets of different

shops, providing that they have the same spacing of locating holes therein. Furthermore, by means of the construction described, the mounting plates may be so spaced relatively to the die sets that a standard shut-height may be adopted, or a series of standard shut-heights for different jobs, so that it even becomes unnecessary to adjust the bed of the press when changing from one set of mounting plates to another. Furthermore, the same die sets may be used for various types of dies, regardless of whether they are punching dies, blanking dies, or any other type of dies.

I claim as my invention:

1. A method of mounting pairs of punch and die plates of various sizes on a die set, which includes accurately forming in the punch holder and die shoe of a die set a plurality of groups of round locating holes, the holes of each group of a pattern being spaced at accurate uniform distances from each other, forming in each of said punch and die plates locating holes spaced from each other in identical spaced relationship with at least one group of locating holes in said die set and arranged so that when said holes of the punch plate are in axial alinement with the holes in the die plate, the punches and dies on said plates will also be in axial alinement, and mounting said plates on said die set with the holes of said plates in axial alinement with the selected group of holes of said die set.

2. A method of mounting pairs of punch and die plates of various sizes on a die set, which includes accurately forming in the punch holder and die shoe of a die set a plurality of groups of round locating holes, the holes in each group of a pattern being spaced at accurate uniform distances from each other, forming in each of said punch and die plates locating holes spaced from each other in identical spaced relationship with at least one group of locating holes in said die set and arranged so that when said holes of the punch plate are in axial alinement with the holes in the die plate, the punches and dies on said plates will also be in axial alinement, passing accurately formed pins through the holes of said punch plate and into the selected group of cooperating holes of said punch holder, passing other accurately formed pins through the holes of said die plate and into the corresponding selected group of cooperating holes of said die shoe, and then securing said punch and die plates to said punch holder and die shoe respectively.

3. A method of mounting pairs of punch and die carrying plates of various sizes interchangeably on a plurality of die sets which comprises accurately forming like groups of locating holes in the punch holders and die shoes of said die sets, forming locating holes in each pair of plates accurately spaced to match one or more groups of holes in said punch holder and die shoe, mounting punch and die implements on a pair of said mounting plates for cooperation with each other while the locating holes thereof are in coaxial alinement, and then securing said mounting plates on any one of said die sets with said locating holes of said mounting plates coaxial with the selected group of locating holes in the chosen die set whereby said punch implements on one of said mounting plates will be positioned for cooperation with the die implements on the other mounting plate of the same pair.

4. A method of mounting pairs of punch and die carrying plates of various sizes interchangeably on a plurality of die sets which includes accurately forming like groups of round locating

holes in the punch holders and die shoes of said die sets, forming locating holes in each pair of plates accurately spaced to match one or more groups of holes in said punch holder and die shoe, mounting punch and die implements on a pair of said mounting plates for cooperation with each other while the locating holes thereof are in coaxial alinement, and then securing said mounting plates on any one of said die sets with said locating holes of said mounting plates coaxial with the selected group of locating holes in the chosen die set whereby said punch implements on one of said mounting plates will be positioned for cooperation with the die implements on the other mounting plate of the same pair, and spacing said mounting plates relatively to the punch holder and die shoe of the die set so that each set of mounting plates with their punch and die implements requires the same shut-height of the press.

5. Means for punching sheet material, including a plurality of die sets each having a series of groups of round locating holes accurately formed in the punch holders and die shoes thereof in predetermined spaced relation to each other, each hole in a punch holder being in axial alinement with a hole in the die shoe of a die set, a plurality of pairs of mounting plates having locating holes accurately formed therein and spaced from each other in accordance with the spacing of at least one group of said locating holes of said die sets, securing punch and die units on said mounting plates with the punch units of one plate of each pair arranged for cooperation with the die units of the other plate of the pair when the locating holes of the pair are in axial alinement, and means for alining the locating holes of any pair of mounting plates with any corresponding group of holes of any of said die sets.

6. Means for punching sheet material, including a plurality of die sets each having a series of groups of round locating holes accurately formed in the punch holders and die shoes thereof in predetermined spaced relation to each other, each hole in a punch holder being in axial alinement with a hole in the die shoe of a die set, a plurality of pairs of mounting plates having locating holes accurately formed therein and spaced from each other in accordance with the spacing of at least one group of said locating holes of said die sets, securing punch and die units on said mounting plates with the punch units of one plate of each pair arranged for cooperation with the die units of the other plate of the pair when the locating holes of the pair are in axial alinement, and combined means for alining the locating holes of any pair of mounting plates with any corresponding group of holes in any of said die sets and for securing said plates on a die set in their alined positions.

7. Means for punching sheet material, including a plurality of die sets each having a series of locating holes accurately formed in the punch holders and die shoes thereof in predetermined spaced relation to each other, each hole in a punch holder being in axial alinement with a hole in the die shoe of a die set, a plurality of pairs of mounting plates having locating holes accurately formed therein and spaced from each other in accordance with the spacing of at least some of said locating holes of said die sets, securing punch and die units on said mounting plates with the punch units of one plate of each pair arranged for cooperation with the die units of the other plate of the pair when the locating

holes of the pair are in axial alignment, and bolts having accurately formed shank portions for aligning the locating holes of any pair of mounting plates with corresponding holes in any of said die sets and having threaded end portions for securing said plates to said die set with the locating holes of said plates and die set in alignment.

8. A die set for use with mounting plates of various sizes having punch and die units mounted thereon, said die set having a plurality of groups of accurately formed aligned pairs of round holes arranged in the punch holder and in the die shoe of said die set, which groups of holes are arranged in accurate predetermined spaced relation to each other and the holes of each group being in accurate predetermined spaced relation to other holes of the same group and, corresponding to the spacing of locating holes in said mounting plates, and accurately formed cylindrical parts formed to fit into a group of holes of a die set and of a mounting plate to align said holes and means on said cylindrical parts to secure same in said holes.

9. A die set for use with mounting plates having punch and die units mounted thereon, said die set having a plurality of groups of accurately formed aligned pairs of holes arranged in the punch holder and in the die shoe of said die set, which groups of holes are arranged in accurate predetermined spaced relation to each other and the holes of each group being in accurate predetermined spaced relation to other holes of the same group, each of said holes having a pair of bushings therein, one bushing having a cylindrical bore therein for aligning a hole in a mounting plate therewith, and the other bushing being formed to cooperate with means for securing a mounting plate to the die set.

10. A die set for use with mounting plates having punch and die units mounted thereon, said die set having a plurality of accurately formed aligned pairs of holes arranged one in the punch holder and one in the die shoe of said die set, which pairs of holes are arranged in accurate predetermined spaced relation to each other, each of said holes having a pair of bushings therein, one bushing having a cylindrical bore therein for aligning a hole in a mounting plate therewith, and the other bushing being formed to cooperate with means for securing a mounting plate to the die set, being provided with a smaller internal diameter and screw threaded.

11. A die set for use with mounting plates having punch and die units mounted thereon, said die set having a plurality of accurately formed aligned pairs of holes arranged one in the punch holder and one in the die shoe of said die set, which pairs of holes are arranged in accurate predetermined spaced relation to each other, each of said holes of said die set having a pair of bushings therein, one bushing having a cylindrical bore and being arranged in the portion of the hole nearest to the mounting plate to be secured thereto, and the other bushing having an internal screw thread, means for holding said other bushing against rotation in said hole, and means for holding said other bushing from endwise movement in said hole toward said first mentioned bushing.

12. The combination of a die set for use with mounting plates having punch and die units mounted thereon, said die set having a plurality of accurately formed aligned pairs of holes arranged one in the punch holder and one in the

die shoe of a die set, which pairs of holes are arranged in accurate predetermined spaced relation to each other, corresponding to the spacing of locating holes in said mounting plates, each of said holes in said die set having a pair of bushings therein, the bushing adjacent to the mounting plate having a cylindrical bore therein for aligning a hole in a mounting plate therewith, and the other bushing being of smaller diameter and having an internal screw thread, and bolts for aligning the holes of said mounting plates with said first mentioned bushings and for securing said mounting plates to said second mentioned bushings, said bolts having accurately formed cylindrical shank portions, each formed to extend through a hole of a mounting plate and said first mentioned bushing for aligning said hole with the bore of said bushing, said bolt also having an outer screw-threaded end for cooperation with said screw-threaded bushing.

13. A die set mounting according to claim 12 and having spacing members interposed between a mounting plate and the die set.

14. A die set mounting according to claim 12 and having spacing sleeves arranged about said bolts for spacing said mounting plate from the part of the die set to which it is secured.

15. A die set having a locating hole therein provided with a pair of bushings, one of said bushings having a cylindrical inner surface and the other bushing being of smaller diameter and having an internal screw thread, a spacing member having a cylindrical portion adapted to fit into the cylindrical bore of said first mentioned bushing and a threaded portion adapted to engage the internal thread of said other bushing, said spacing member having a cylindrical bore in the opposite end portion thereof and having a cylindrical bore of smaller diameter with an internal screw thread arranged inwardly with reference to said cylindrical bore, and a bolt adapted to cooperate with said spacing member and having a cylindrical shank portion for cooperation with the cylindrical portion of the bore of said spacing member and a threaded end portion for engagement with the threaded bore of said spacing member.

16. A die set for use with mounting plates having punch and die units mounted thereon, said die set having a plurality of accurately formed aligned pairs of holes arranged one in the punch holder and one in the die shoe of said die set, said pairs of holes being arranged in accurate predetermined spaced relation to each other for cooperation with corresponding locating holes of a plurality of mounting plates of different sizes, each hole having the portion thereof adjacent to the mounting plate provided with a cylindrical bore and the portion thereof remote from the mounting plate provided with a bore of smaller diameter and internally screw-threaded.

17. A die set for use with mounting plates having punch and die units mounted thereon, said die set having a plurality of accurately formed aligned pairs of holes arranged one in the punch holder and one in the die shoe of said die set, said pairs of holes being arranged in accurate predetermined spaced relation to each other for cooperation with corresponding locating holes of a plurality of mounting plates of different sizes, each hole having the portion thereof adjacent to the mounting plate provided with a cylindrical bore and the portion thereof remote from the mounting plate provided with a bore of smaller diameter and internally screw-threaded.

and a plug for said hole including a body portion formed to fit into the cylindrical portion of said hole and coextensive in length therewith and having a threaded end portion adapted to cooperate with the threaded portion of said hole.

18. A method of mounting pairs of punch and die carrying plates of various sizes interchangeable on a plurality of die sets which accurately forming like groups of round locating holes, according to a standard pattern, in the punch holders and die shoes of said die sets, forming locating holes in each pair of plates accurately spaced to match one or more groups of holes of said standard pattern in said punch holder and die shoe, mounting punch and die implements on a pair of said mounting plates for cooperation with each other while the locating holes thereof are in coaxial alignment, and then securing said mounting plates on any one of said die sets with said locating holes of said mounting plates coaxial with the selected group of locating holes in the chosen die set whereby said punch implements on one of said mounting plates will be positioned for cooperation with the die implements on the other mounting plate of the same pair.

19. A method of mounting multiple pairs of punch and die carrying plates of various sizes interchangeably on a plurality of die sets which includes accurately forming like groups of round locating holes in the punch holders and die shoes of said die sets, forming locating holes in each pair of plates accurately spaced to match one or more groups of holes in said punch holders and die shoes, mounting punch and die implements on two or more pairs of said mounting plates for cooperation with each other while the locating holes of each pair are in coaxial alignment, and then securing two or more pairs of said mounting plates on a die set with said holes of said mounting plates coaxial with the selected group of holes in said die set whereby said punch implements of each pair of mounting plates will be positioned for cooperation with the die implements of the other mounting plate of the same pair.

20. A method of mounting pairs of punch and die carrying plates of various sizes on a die set, which includes accurately forming in the punch holder and die shoe of a die set a plurality of groups of locating holes, the holes in each group of a pattern being spaced at accurate uniform distances from each other, forming in each of said punch and die plates locating holes spaced from each other in identical spaced relationship with at least one group of locating holes in said die set and arranged so that when said holes of the punch plate are in axial alignment with the holes in the die plate the punches and dies on said plates will also be in axial alignment, and mounting said plates on said die set with the holes of said plates in axial alignment with the selected group of holes of said die set, and means for plugging, in said punch holder and die shoe, the unused holes covered by said plates to provide a substantially solid base for backing up said punch or die implements when they extend through one or both of said plates.

21. In a die set for use in a stamping press, a punch plate mounting, comprising a plurality of holes in the punch holder of said die set, pairs of bushings in each of said holes, one of said bushings accommodating the locating element of a plate supporting post and the other bushing accommodating the fastening element of said

post, said post projecting away from the face of said punch holder and at its outer end being provided with bearing, locating and fastening means by which said plate may be located and secured in spaced relation to said punch holder face.

22. In a die set for use in a stamping press a punch plate mounting, comprising a plurality of holes in the punch holder of said die set, each of said holes being arranged to accommodate the locating and fastening elements of a plate supporting post which projects away from the face of said punch holder and is provided with bearing locating and fastening means by which said plate may be located and secured in spaced relation to said punch holder face.

23. In a die set for use in a stamping press a punch plate mounting, comprising a plurality of holes in the punch holder of said die set, each of said holes being arranged to accommodate the locating and fastening elements of a plate supporting post which projects away from the face of said punch holder and is provided with bearing locating and fastening means by which said plate may be located and secured in spaced relation to said punch holder face, and means for plugging, in said punch holder, the unused holes covered by said plates, to provide a substantially solid base for backing up punch implements carried by said plate.

24. A method of mounting punch and die carrying plates on a die set, which comprises accurately forming locating and fastening holes in the punch holder and die shoe of said die set, mounting locating and supporting means, by said holes, to said punch holder and die shoe and then mounting said punch and die carrying plates on said supporting means, in spaced relation to the faces of said punch holder and said die shoe, in such manner that the punch implements on the one plate cooperate with the die implements on the other plate.

25. A method of mounting punch and die carrying plates on a die set, which comprises accurately forming locating and fastening holes in the punch holder and die shoe of said die set, mounting locating and supporting means, by said holes, to said punch holder and die shoe and then mounting said punch and die carrying plates on said supporting means, in spaced relation to the faces of said punch holder and said die shoe and inserting additional supporting means between said plates and said faces as desired, in such manner that the punch implements on the one plate cooperate with the die implements on the other plate, said additional supporting means preventing said plates from deflecting.

26. A method of mounting punch and die carrying plates on a die set at variable spacings from the faces of the punch holder and die shoe of said die set which includes accurately forming locating and fastening holes in said punch holder and die shoe in such manner that said plates having identically spaced holes are located and secured directly to said faces by means cooperating with said holes, with the punch and die elements in proper position to cooperate, and when these plates are removed, spacer and supporting elements are interposed between said faces and other punch and die carrying plates, and the holes in said punch holder and die shoe used to accommodate means for locating and securing said plates to said spacer and supporting elements, and said spacer and supporting elements to said punch holder and said shoe.

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