Sept. 17, 1963 W. G. PORTER ET AL 3,103,845

DEMOUNTABLE RETAINER FOR PUNCH AND DIE SETS

Filed April 7, 1959 3 Sheets-Sheet 1

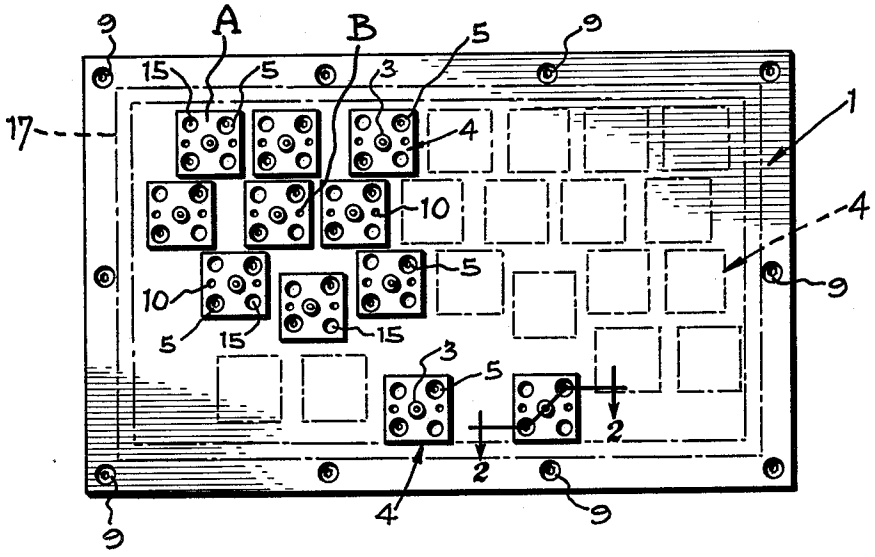


Fig. 1

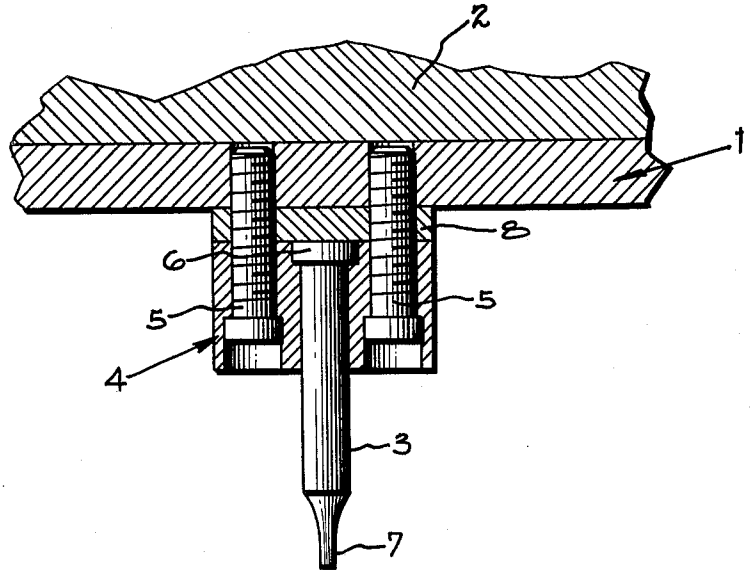


Fig. 2

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DEMOUNTABLE RETAINER FOR PUNCH AND DIE SETS

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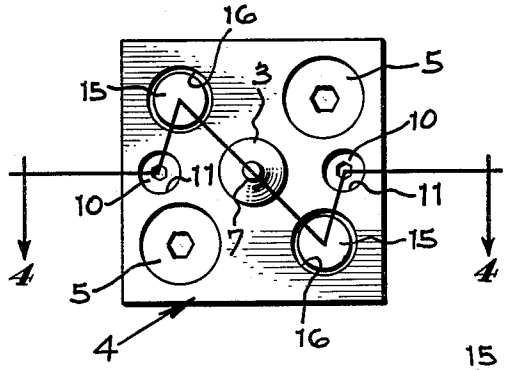


Fig. 3

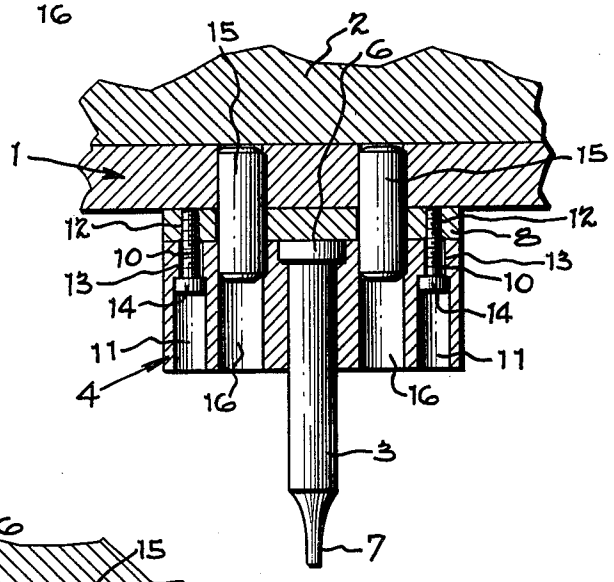


Fig. 4

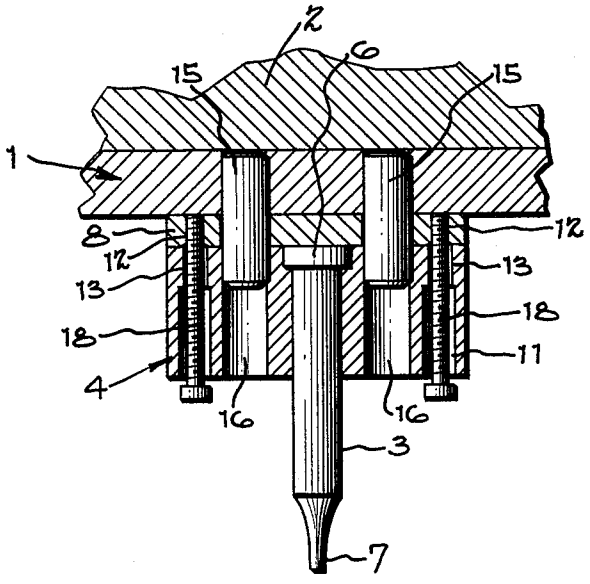


Fig. 5

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DEMOUNTABLE RETAINER FOR PUNCH AND DIE SETS

Filed April 7, 1959 3 Sheets-Sheet 3

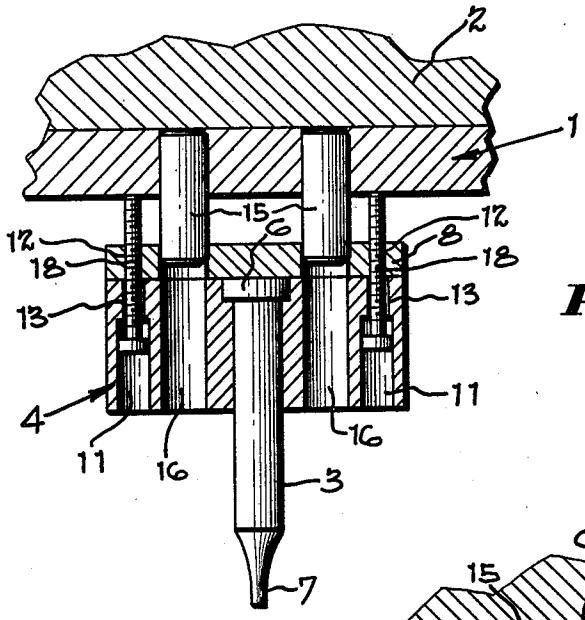


Fig. 6

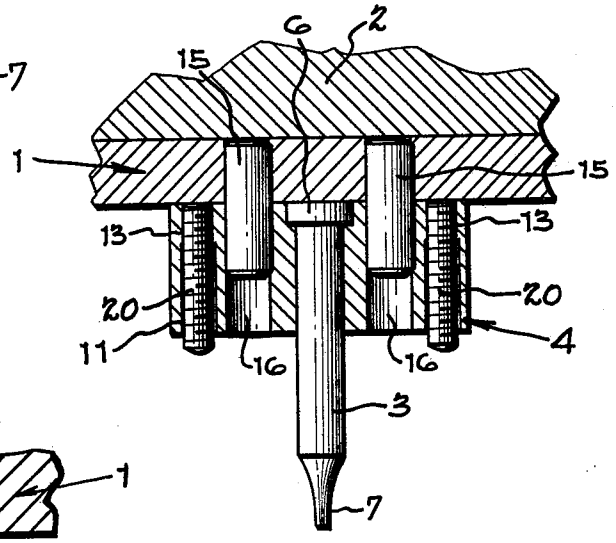


Fig. 7

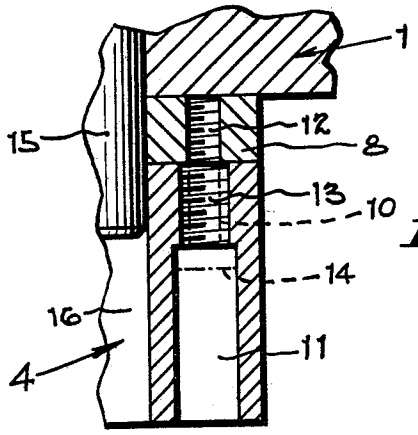


Fig. 8

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DEMOUNTABLE RETAINER FOR PUNCH AND DIE SETS

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5 Claims. (Cl. 83—698)

This invention relates to retainers for piercing punches and die buttons, and is particularly directed to a structure for forcibly dislodging the retainer from the plate or shoe upon which it is mounted.

In the construction of punch and die sets for piercing holes in workpieces, the piercing punch usually is carried in a mounting plate which is attached to a shoe or the ram of a punch press, while the die through which the punch passes during the punching stroke, is mounted upon the stationary platen of the press. In one typical structure, the punch is provided with an enlarged head which interfits a counter-bore formed in the mounting plate, with the upper surface of the head seated against a back-up surface to resist the thrust during the piercing stroke. This arrangement is entirely satisfactory where the number of punches is relatively limited, or in punching operations where punch breakage or damage does not occur frequently. However, in piercing multiple hole patterns, or under operating conditions where punch failure is apt to be more prevalent, the arrangement is very unsatisfactory because it is necessary to remove the entire mounting plate from the press in order to replace a single defective punch. Since the components of a die set must be precisely aligned and rigidly secured with respect to the press, the removal and resetting of the mounting plate is a tedious operation and requires shutting down the press for a prolonged period of time.

In an effort to overcome this problem, manufacturers of punch and die equipment have developed an arrangement wherein the punches are mounted in separate retainer blocks or holders, which in turn, are attached by screws to the exposed surface of the mounting plate. The retainers are intended to be detached individually from the mounting plate without removing the plate from the press or disturbing the other components when it is necessary to replace a broken punch. According to the present practice, the retainer block for mounting a single punch is known as a "standard" retainer, while one which is intended for mounting several punches is known as a "special" retainer. In constructing the punch and die sets with the use of retainers, the die maker establishes the position of each retainer by press fitting two or more dowel pins in the punch plate. These pins create a light press fit with bore holes formed in the retainer blocks to locate the retainer blocks accurately with respect to one another. The retainer blocks are attached to the mounting plate by means of mounting screws which pass through the exposed side of the blocks and into threaded engagement with holes tapped into the mounting plate.

The die buttons, which coact with the punches, may be carried in similar retainers which are mounted in the same fashion upon a die mounting plate, each die button having an aperture which registers with one of the punches. The retainers for the punches and dies are identical and the term "punching element," as used in the specification and claims, refers either to the punch or to the die button which is mounted in the retainer block. For simplicity, the invention is described herein primarily in relation to the retainer blocks for mounting the piercing punch or punches.

After the retainer blocks are thus mounted upon their

respective mounting plates, with the punching elements in place, the two plates are mounted in the press, and are usually guided in alignment by suitable means so that the punches register with the die apertures.

It will be understood that in a die set for punching a complex hole pattern, the retainer blocks necessarily are grouped in adjacent or contiguous relationship upon their mounting plates. However, while it is relatively easy to mount the conventional retainer blocks upon their mounting plates, it is quite another matter to remove a given block, particularly if the blocks are closely grouped relative to one another.

In order to demount the conventional retainer block, the mounting screws, which attach the block to the mounting plate, are removed from the exposed side of the block, and if the block is in an accessible position, a suitable wedging tool is driven between the block and mounting plate to drive or forcibly extract the block from its dowel pins. However, if the blocks are closely grouped, then only a small portion of the blocks, that is, only those located around the margin of the hole pattern, will be accessible to the wedging tool. In such cases, it is virtually impossible to demount a selected block without first demounting a considerable number of adjacent blocks as may be necessary to obtain access to the individual block which requires demounting.

It is therefore a primary objective of the present invention to provide a demounting structure wherein the retainer block may be demounted from its dowel pins without the use of a wedging tool and which makes it possible to demount a block which resides in an otherwise inaccessible position.

According to this aspect of the invention, the retainer block is provided with jack screws which are threaded through the block along an axis parallel with the dowel pins, the screws having inner ends abutting against the surface of the mounting plate and outer ends which are accessible from the exposed surface of the retainer block. In order to demount the retainer block, the mounting screws are first removed, then the jack screws are screwed in with a suitable tool, thus forcing the retainer block outwardly with respect to the dowel pins until it is finally disengaged. Since the jack screws are readily accessible from the exposed face of the retainer block, they provide a convenient and rapid means for removing any retainer block from the mounting plate. In order to prevent binding of the retainer block with respect to its dowel pins, it is preferable to utilize at least two jack screws which are spaced apart from one another and located in symmetrical relationship to the dowel pins. In demounting the retainer block, the jack screws are screwed in concurrently, so as to hold the block generally in a level plane as it is being extracted from its dowel pins.

The retainer blocks are generally used with a back-up plate attached to the rearward surface of the retainer block so as to provide a seat for the upper end of the punch which is mounted in the block. However, in other instances the back-up plate is not used, allowing the upper end of the punch (or the bottom end of the die button) to seat or bear against the surface of the mounting plate.

It has been a further objective of the invention to provide a simple jack screw arrangement which may be used interchangeably in demounting the retainer block whether it is mounted with or without the back-up plate.

According to one feature of the invention, the back-up plate is attached to the retainer block by means of small screws which are inserted through bore holes extending from the exposed face of the retainer block, with the inner ends of the screws engaged in threaded holes formed in the back-up plate. These screws are left in place when the retainer block is mounted with the back-up plate in

place, and are accessible from the exposed face of the block for removal. According to the invention, the tapped holes of the back-up plate in this type of installation are also utilized for the jack screws, the small attachment screws of the back-up plate simply being removed and replaced with jackscrews of the same size when it is desirable to demount the retainer block from its mounting plate. The back-up plate thus performs its conventional function and in addition, serves as a component of the demounting structure.

On the other hand, when the retainer block is mounted without a back-up plate, the invention contemplates other means for demounting the retainer block. In order to accomplish this, the inner end of each bore hole of the retainer block is screw threaded, and a second set of jack screws of a diameter to interfit the threaded bores of the retainer block, are then used. Therefore, when the unit is mounted without the back-up plate, these jack screws are simply threaded into the retainer block and screwed in to force the block from its dowel pins.

The various features and advantages of the present invention will be more fully apparent to those skilled in the art from the following detailed description made with reference to the attached drawings.

In the drawings:

FIGURE 1 is a plan view showing a punch plate or shoe with a group of punch retainer blocks mounted thereon to illustrate the utility of the demounting structure of the present invention.

FIGURE 2 is an enlarged sectional view taken along line **2—2** of FIGURE 1, detailing the retainer block and its attachment to the punch plate.

FIGURE 3 is an enlarged plan view of one of the retainer blocks taken from FIGURE 1.

FIG. 4 is a sectional view of the die block, developed on a smaller scale along line **4—4** of FIGURE 3, and showing the arrangement of the dowel pins which locate the retainer block upon the punch plate. This view also shows the back-up plate with which the retainer block is furnished to the user.

FIGURE 5 is a developed view similar to FIGURE 4, showing the screws removed from the back-up plate and replaced with jack screws in preparation for forcing the retainer block and backing plate outwardly from its dowel pins.

FIGURE 6 is a view similar to FIGURE 5, showing the retainer block and backing plate completely demounted by operation of the jack screws.

FIGURE 7 is a view similar to FIGURE 5, showing the retainer block mounted without the back-up plate and showing the alternative arrangement of jack screws for demounting the block.

FIGURE 8 is an enlarged fragmentary view of the retainer block and back-up plate, with the screws removed to illustrate the threaded bores thereof.

In order to disclose the principles of the invention, the drawings illustrate the retainer blocks which are utilized in mounting piercing punches, as distinguished from die buttons. Therefore, the following description is made primarily with reference to the piercing punches as shown in the drawings, with the understanding that the retainer blocks for the die buttons are identical to the structure shown.

Referring to FIGURE 1, the punch mounting plate indicated at **1** is of the type used in a die set for punching multiple hole patterns. As shown in FIGURE 2, the mounting plate **1** is adapted to be carried by a shoe **2**, which in turn is mounted upon the ram of a punch press (not shown) in a conventional way. The punches **3** are carried in the demountable retainer blocks or holders indicated generally at **4**, which in turn are secured to the mounting plate **1** by mounting screws **5** (FIGURE 2), which preferably are of the socket-head type. For simplicity, the retainers **4** shown in the drawings are of the type known as standard retainers, each providing a mounting for a single punch **3**, as distinguished from special retainers which are designed for multiple punches. In the example shown in FIGURE 1, substantially the entire area of the mounting plate **1** is utilized for mounting the retainers **4**; for convenience, a limited cluster of retainers is illustrated in full lines in FIGURE 1 and the remaining units are indicated diagrammatically in broken lines.

It will be understood that the piercing punch assembly shown in FIGURE 1 is operated in conjunction with a mating die plate which is mounted with respect to the stationary platen of the press and having apertures which register with the punches. The die assembly (not shown) may comprise a die mounting plate similar to the punch mounting plate **1**; the die apertures may be formed in die buttons which are mounted in retainer blocks attached to the die plate. The die button retainers are similar to the punch retainers in size and shape and are equipped with jack screws to facilitate demounting, as explained with reference to the punch retainers.

The punch **3** selected to illustrate the invention includes an enlarged head **6** at its inner end and a small diameter piercing nib **7** at its outer end. The retainer **4** is suitably bored and counter-bored to receive the punch **3** and its enlarged head, with the head seated against a back-up plate **8** which preferably is formed of hardened steel to absorb the thrust which acts through the punch during its punching strokes. When the retainer is attached to the mounting plate **1** (FIGURE 2), the punch is clamped securely in position against the back-up plate **8** by the cap screws **5**. It will be understood that the retainer block is intended for mounting the various other types of punches which are presently in use.

As shown in FIGURES 3 and 4, the retainer preferably is installed on the mounting plate **1** with the punch mounted in working position and held in place by the back-up plate **8** which is attached by small attachment screws **10**, preferably of the socket-head type. To receive the heads of these screws, the retainer block is provided with a pair of boreholes **11—11**, and the backing plate **8** is provided with a pair of tapped holes **12—12** for threaded engagement with the screws **10**. As detailed in FIGURE 8, the inner portion of each bore hole **11** includes a threaded bore **13** delineating a shoulder for seating the head **14** of the screw **10**. The threaded bores **13** are larger than the attachment screws **10** to permit the screws to pass freely into threaded engagement with the back-up plate. The threaded bores **13** provide engagement for a pair of jack screws which are used when the backing plate is omitted, as explained later.

Each retainer block **4** is located precisely in position upon the mounting plate **1** by a pair of dowel pins **15—15** which are press fitted rigidly into the plate and project outwardly from its surface, as shown in FIGURE 4. The retainer block is provided with a pair of bore holes **16—16** which interfit the dowel pins **15**. In order to provide a precision fit, the dowel pins **15** establish a light press fit with the bore holes **16** of the retainer. This permits the retainer to be demounted from the mounting plate by applying sufficient withdrawal force to pull the retainer block from the pins, leaving the mounting plate attached to the shoe or ram of the press.

In the form selected for illustration (FIGURE 3) the dowel pins **15** are located at opposite sides of the punch **3** at the corner portions of the retainer block (FIGURE 3) and the large cap screws **5** which secure the retainer block to the mounting plate, are located in adjacent corner portions of the retainer block. The small cap screw **10** are also located on opposite sides of the punch and are symmetrically related to the dowel pins as shown in FIGURE 3. However, in other types of retainers, the cap screws **5**, dowel pins **15**, and small screws **10** are located in various ways which are best suited to the design of that particular retainer block.

In making up the die set, the die maker usually locates

each retainer on the mounting plate according to the location of the holes to be punched, drills and taps in the plate 1 the holes for the large mounting screws 5, and applies the screws 5 to hold the retainer firmly in position. Holes are then drilled and reamed in plate 1 for the dowel pins 15, using the bore holes 16 of the retainer as guides for the drill and reamer, then the dowel pins are driven in. The screws 5 thus hold the retainer block firmly in place to withstand the pulling or stripping force which is generated as the punch is withdrawn from the die, while the dowel pins 15 hold the retainer and its punch in proper location relative to the mounting plate. The mounting plate itself is securely attached to the shoe 2 of the press ram by the screws 9, as shown in FIGURE 1.

As outlined earlier, the use of retainer blocks permits selected punches to be removed from the mounting plate without disturbing the other punches and without removing the mounting plate from the press. However, in using conventional retainer blocks, the customary way of demounting the selected retainer is to remove the mounting screws 5 and to use a screwdriver or some other wedge-shaped tool to drive the block from its dowel pins. Referring to FIGURE 1, it would not be too difficult to remove the outermost retainers, as indicated at A, by this method since the tool can readily be driven in place between the mounting plate and retainer. However, it will be observed that it would be practically impossible to dismount the innermost retainers, as indicated at B, with the use of a wedging tool unless the mechanic were to first remove the outermost retainers to provide access to the one to be removed.

The problem of removing individual retainers from a drawing and piercing die set is even more difficult. In this case, the mounting plate 1 includes a drawing element in the form of a marginal flange surrounding the punches and arranged to form a marginal wall about the sheet metal workpiece as an incident to the piercing operation. The marginal drawing flange necessarily projects beyond the surface of the retainer blocks, thus making it impossible to demount the blocks with the use of a wedging tool. A drawing flange of this type is indicated diagrammatically at 17 by the broken lines in FIGURE 1.

According to the present invention, any selected retainer may be conveniently demounted from the mounting plate with the use of the jack screws noted earlier, which provided an axial pulling force to withdraw the retainer from its dowel pins 15. For this purpose, the large mounting screws 5 and retainer screws 10 of the backing plate 8 are removed with appropriate socket-type wrenches. The jack screws 18—18 (FIGURE 5) are then screwed into the threaded bores 12 of the back-up plate, passing loosely through the threaded bores 13 of the retainer block. The jack screws 18 are then progressively tightened and bear against the mounting plate 1 to force the back-up plate 8 and retainer block outwardly with respect to the dowel pins (FIGURE 6) until the retainer can be removed. The jack screws thereafter are removed to release the back-up plate for replacement of the broken punch. After the new punch is inserted, the back-up plate is replaced so that the unit may be remounted on the punch plate.

In some cases, the retainer unit is installed directly upon the mounting plate, as in FIGURE 7, without the use of the back-up plate 8. In this case, the head end of the punch seats directly against the mounting plate 1 and the retainer is attached as in FIGURE 2, by the mounting screws 5. In the event of punch failure or other causes requiring a given retainer to be demounted, a second pair of jack screws, as indicated at 20 in FIGURE 7, is utilized. The jack screws 20 have a larger diameter than the jack screws 18 and provide a threaded engagement in the threaded bore 13 of the retainer block. These screws also bear directly against the mounting plate and serve to force the retainer outwardly for removal in the manner shown in FIGURE 6.

Referring to FIGURE 3, it will be noted that the bore holes 11—11 for the jack screws 18 and 20 are symmetrically located with respect to the dowels 15, so as to balance the force which acts upon the retainer. As the retainer is forced outwardly along the dowels, both jack screws are screwed in concurrently so that the retainer block remains substantially parallel with the mounting plate to avoid any wedging action with respect to the dowel pins.

As noted earlier, the retainers are furnished in various shapes and sizes in accordance with the number of punches and other factors, but in each instance the same demounting problem exists. In most cases, the retainer is provided with two dowel pins for locating purposes, although under special conditions, more dowels may be required. In these special cases, one jack screw is usually provided for each dowel pin to provide balanced forces; however, in some cases, a single jack screw coacting with several dowel pins is sufficient for demounting the retainer. A single jack screw is used primarily where space will not permit the use of multiple jack screws.

As pointed out earlier, the head type punch has been selected for purposes of illustration since the demounting structure is intended to be used with retainers for various other types for use with retainers for the widely used ball lock punch which comprises a headless shank having a recess which is engaged by a spring-loaded ball confined in the retainer block. After prolonged usage in the punch press, the punch often becomes rigidly wedged in the retainer; as a consequence, the jack screws are threaded into the retainer to demount the unit. The retainer blocks for die buttons preferably are identical to the punch retainers including the large and small bore holes 13 and 12. However, in this instance, the back-up plate 8 usually is omitted; hence the large jack screws 20 are used in pulling the block from its dowel pins.

Having described our invention, we claim:

1. A demountable retainer for supporting an element of a punch and die set relative to a mounting plate assembly which is adapted to be mounted in a punch press, said mounting plate assembly including a mounting plate and a plurality of dowel pins projecting outwardly therefrom, said retainer comprising, a retainer block assembly adapted to support the element of the punch and die sets, said retainer block assembly having a plurality of bore holes adapted to establish a friction fit with the dowel pins of the mounting plate, thereby to locate the retainer block assembly in a fixed position relative to the plane of the mounting plate assembly, a plurality of jack screws extending into said retainer block assembly in threaded engagement relative to the retainer block assembly, said jack screws residing along axes generally perpendicular to the plane of the mounting plate, said jack screws having outer ends presented for tool engagement at the exposed face of the retainer block assembly, said jack screws having inner ends adapted to engage the mounting plate assembly, said jack screws adapted to be screwed inwardly relative to the retainer block assembly and thereby adapted to force the retainer block assembly outwardly relative to the dowel pins for dislodgment of the retainer block assembly from the dowel pins of the mounting plate assembly, said jack screws being spaced apart from one another and positioned in operative relationship to the dowel pins, said jack screws adapted to maintain the retainer block assembly substantially in parallelism with the mounting plate, thereby to eliminate binding angular forces between the dowel pins and retainer block assembly during withdrawal thereof from the dowel pins.

2. A demountable retainer for supporting an element of a punch and die set relative to a mounting plate assembly which is adapted to be mounted in a punch press,

said mounting plate assembly including a mounting plate and a plurality of dowel pins projecting outwardly therefrom along axes perpendicular to the mounting plate, said retainer comprising, a retainer block assembly adapted to support said element of the punch and die set, said retainer block assembly having a plurality of bore holes adapted to establish a friction fit with respect to the dowel pins projecting outwardly from the mounting plate assembly, thereby to locate the retainer block assembly in a fixed position relative to the plane of the mounting plate assembly, and a plurality of jack screws extending into said retainer block assembly along axes generally perpendicular to the plane of the mounting plate and in threaded engagement relative to the retainer block assembly, said jack screws having outer ends presented for tool engagement at the exposed face of the retainer block assembly, said jack screws each having an inner end adapted to engage the mounting plate assembly, said jack screws adapted to be screwed inwardly substantially in unison with one another relative to the retainer block assembly and adapted to force the retainer block assembly outwardly relative to the dowel pins, said jack screws being spaced apart from one another in substantially identical operative relationship to the dowel pins, said jack screws thereby adapted to maintain the retainer block assembly substantially in parallelism with the mounting plate, thereby to eliminate angular binding forces between the dowel pins and retainer block assembly during withdrawal of the retainer block assembly from said dowel pins.

3. A demountable retainer for supporting an element of a punch and die set relative to a mounting plate assembly which is adapted to be mounted in a punch press, said mounting plate assembly including a mounting plate and a plurality of dowel pins projecting outwardly therefrom, said dowel pins providing a friction fit with respect to the retainer, said retainer comprising, a retainer block assembly having said die set element mounted therein, a back-up plate residing at the rearward face of said retainer block assembly, said back-up plate adapted to seat against said mounting plate assembly, said retainer block having a plurality of bore holes extending therethrough from the forward face to said rearward face thereof along an axis generally perpendicular to the plane of the back-up plate, said back-up plate having a plurality of tapped holes therein in registry with the bore holes of the retainer block and coaxal therewith, and a plurality of jack screws passing through the bore holes of the retainer block and threaded through the tapped holes of said back up plate, said jack screws having outer portions projecting through said bore holes and presented for tool engagement at the exposed face of the retainer block assembly, said jack screws having inner ends adapted to engage said mounting plate assembly, said jack screws adapted to be screwed inwardly relative to the retainer block assembly and adapted to force the back-up plate and retainer block assembly outwardly relative to said dowel pins, said jack screws being spaced apart from one another and from said dowel pins and being positioned in symmetrical relationship to the dowel pins, said jack screws adapted to maintain the back-up plate and retainer block assembly substantially in parallelism with the mounting plate, thereby to eliminate angular binding forces between the dowel pins and retainer block assembly during withdrawal thereof from said dowel pins.

4. In a die set which includes a mounting plate assembly and a plurality of demountable retainer block assemblies mounted in contiguous relationship to one another upon said mounting plate, said mounting plate assembly adapted to be mounted in a punch press, said mounting plate assembly including a plurality of dowel pins projecting outwardly therefrom and frictionally engaging said retainer block assemblies, the improvement which comprises a plurality of jack screws extending into each retainer block assembly and residing along axes generally perpendicular to the plane of the mounting plate and in threaded engagement relative to the retainer block assembly said jack screws having outer ends presented for tool engagement at the exposed face of the retainer block assembly, said jack screws having inner ends adapted to engage the mounting plate assembly, said jack screws adapted to be screwed inwardly relative to the retainer block assembly and thereby adapted to force the retainer block assembly outwardly with respect to the dowel pins of the mounting plate assembly, said jack screws being spaced apart from one another and positioned in operative relationship to the dowel pins, said jack screws adapted to maintain the retainer block assembly substantially in parallelism with the mounting plate while withdrawing the retainer block assembly from the dowel pins, thereby to eliminate angular binding forces between the dowel pins and retainer block assembly, said jack screws adapted to dislodge the retainer block assembly from the mounting plate assembly without disturbing the retainer block assemblies which are contiguous thereto.

5. In a die set which includes a mounting plate assembly and a plurality of demountable retainer block assemblies mounted in contiguous relationship to one another upon said mounting plate, said mounting plate assembly adapted to be mounted in a punch press, said mounting plate assembly including a plurality of dowel pins projecting outwardly therefrom along axes generally perpendicular to the plane of the mounting plate, said dowel pins frictionally engaging said retainer block assemblies and locating the same in fixed relationship to one another, the improvement which comprises a plurality of jack screws extending through each of said retainer blocks and residing along axes generally perpendicular to the plane of the mounting plate, each of said jack screws being in threaded engagement relative to the retainer block assembly and having outer ends presented for tool engagement at the exposed face of the retainer block assembly, said jack screws each having an inner end adapted to engage the mounting plate assembly, said jack screws adapted to be screwed inwardly substantially in unison with one another relative to the retainer block assembly and adapted to force the retainer block assembly outwardly relative to said dowel pins, said jack screws being spaced apart from one another and positioned in operative relationship to the dowel pins, said jack screws adapted to maintain the retainer block assembly substantially in parallelism with the mounting plate, thereby to eliminate angular binding forces between the dowel pins and retainer block assembly during withdrawal thereof from said dowel pins, said jack screws adapted to dislodge the retainer block assembly from the mounting plate assembly without disturbing the retainer block assemblies which are contiguous thereto.

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