United States Patent

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[54] RETAINER FOR PUNCH AND DIE SETS

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[21] Appl. No.: 882,608

[52] U.S. Cl. 83/698

[51] Int. Cl. B26d 7/26

[58] Field of Search 83/698, 685, 686, 690

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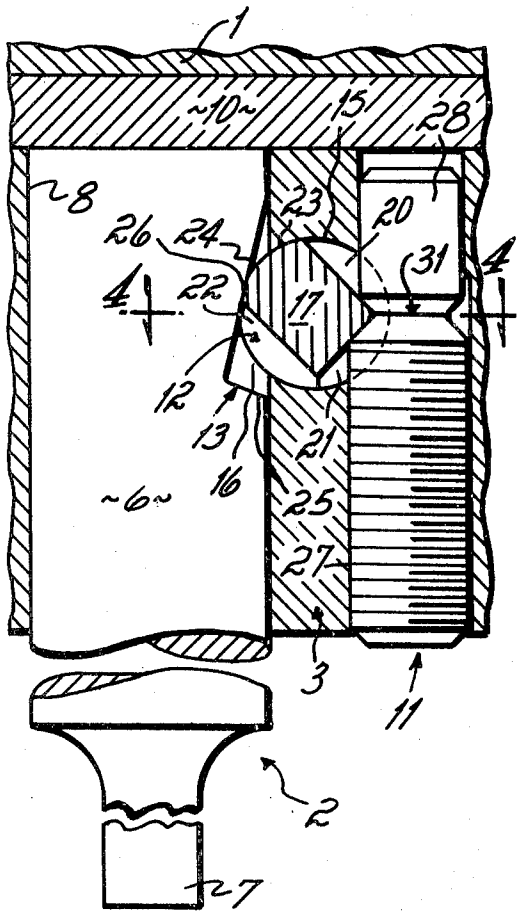
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[57] ABSTRACT

A retainer mechanism for a headless piercing punch (or the die button) comprising a cylindrical roll pin rotatably journaled in the punch-retainer block and extending at right angles to the longitudinal axis of the punch. The roll pin includes a locking portion intermediate its length which establishes a wedging engagement with an angular cross recess machined in the cylindrical shank of the punch to prevent displacement as the punch is stripped or withdrawn from the workpiece. An actuating screw is threaded into the retainer block parallel to the axis of the punch and has a necked portion in driving engagement with the locking portion of the roll pin so as to impart rotary motion to the roll pin in locking and unlocking directions upon rotation of the actuating screw with a suitable tool. When in the unlocked position the headless shank of the punch is free to be withdrawn outwardly from its bore in the retainer block. As applied to a coacting punch and die set, the angulation of the cross recess of the punch and die button is reversed so that both elements are capable of resisting the withdrawal forces as the piercing end of the punch is withdrawn from the aperture of the die button and workpiece.

9 Claims, 10 Drawing Figures



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SHEET 1 OF 2

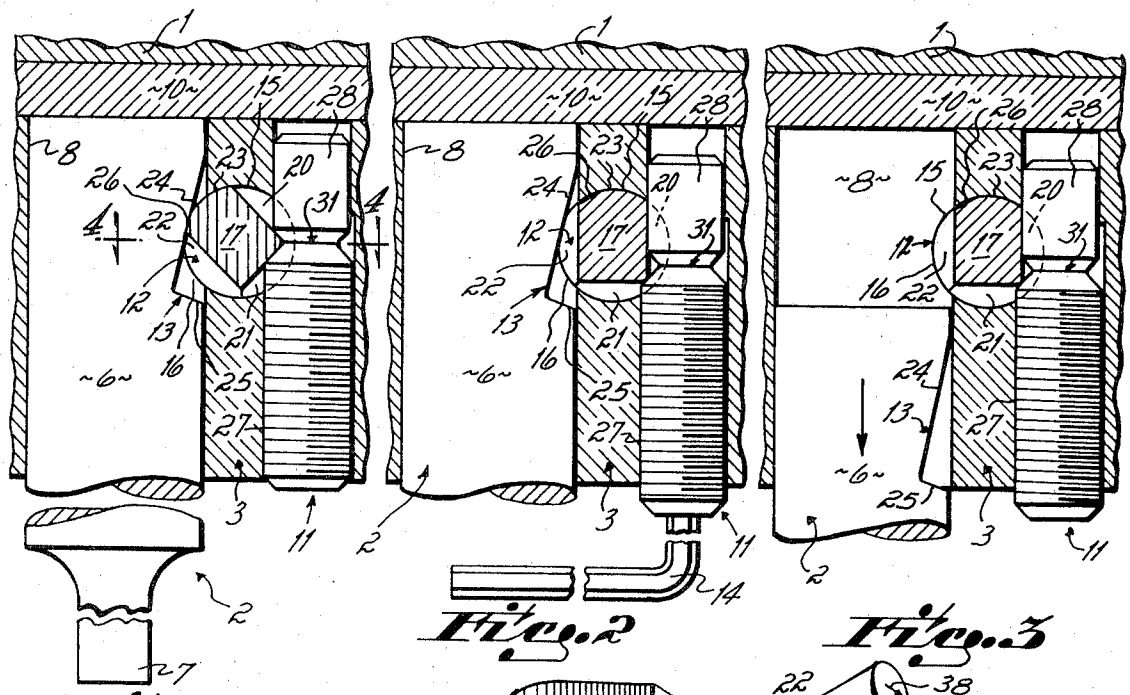


Fig. 1

Fig. 2

Fig. 3

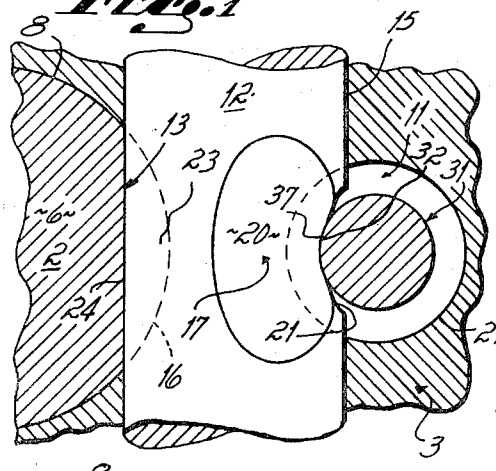


Fig. 4

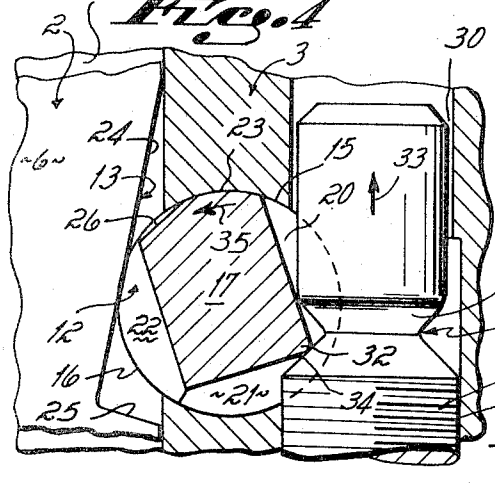


Fig. 5

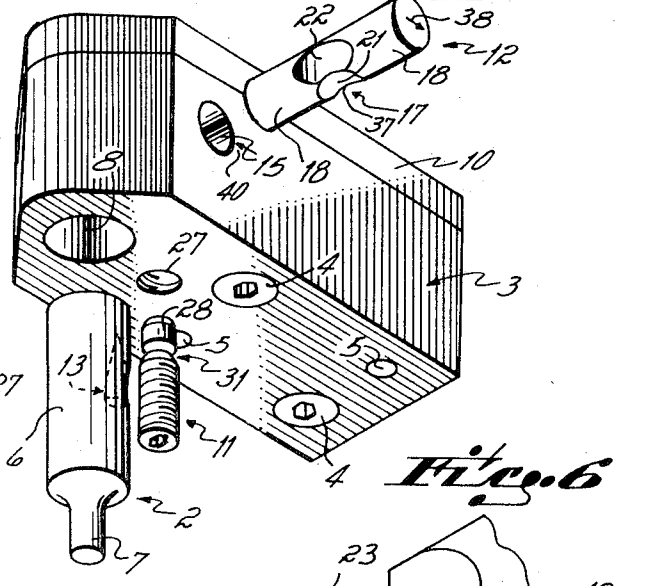


Fig. 6

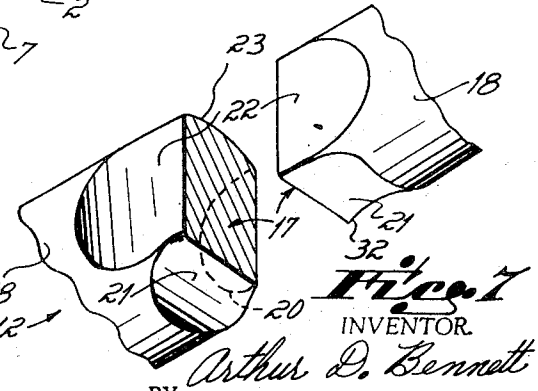


Fig. 7

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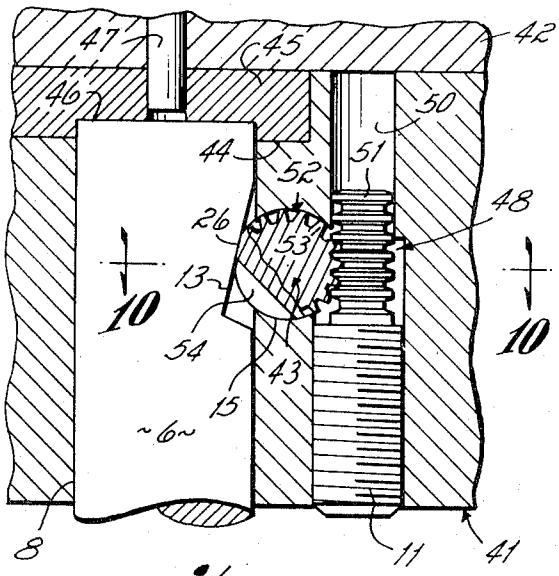


Fig. 8

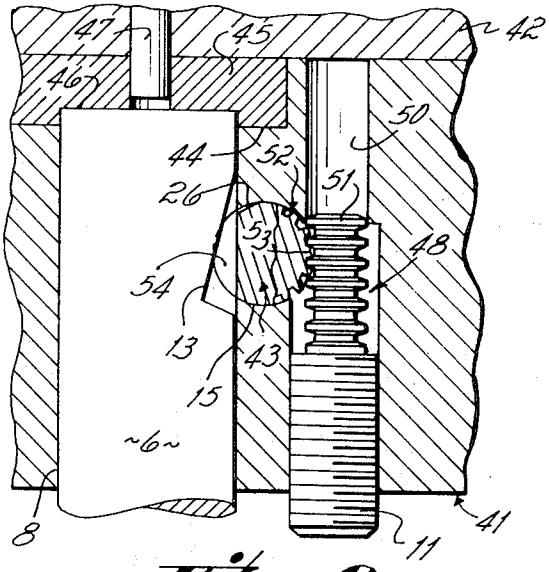


Fig. 9

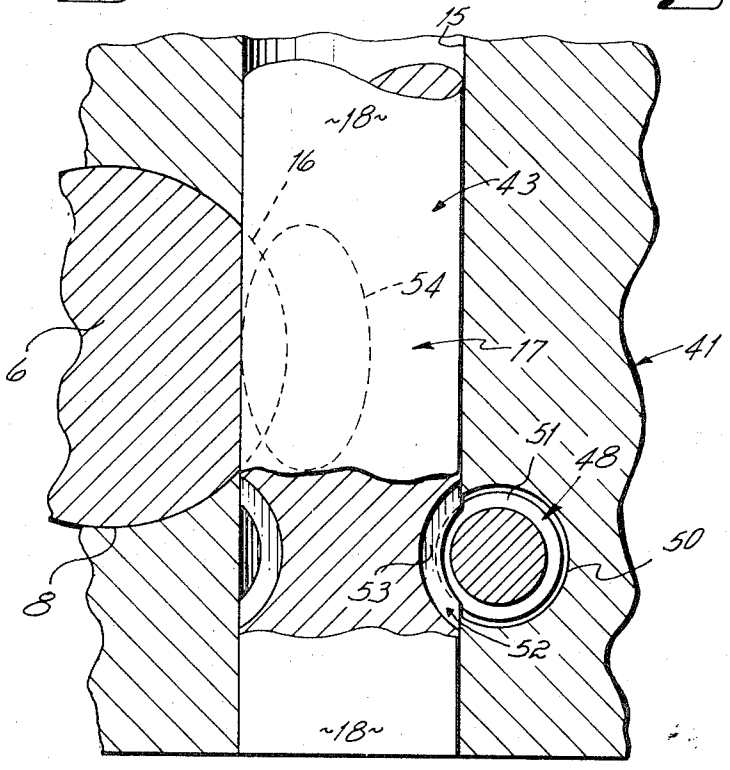


Fig. 10

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RETAINER FOR PUNCH AND DIE SETS

BACKGROUND OF THE INVENTION

Punches and dies have been used for a great many years in punching holes in sheet metal stock and involve the use of a punch press having a movable ram which usually carries one or more punches operating in conjunction with a die or dies mounted upon the stationary platen of the punch press. In passing through the workpiece, the piercing end of the punch shears the hole in the workpiece and forces the slug of metal through the die aperture for discharge.

The piercing end of the punch and the corresponding aperture of the die may be cylindrical or may have an irregular configuration, for example the punch and die may be shaped to form square, rectangular or oblong holes. The piercing end of the punch, and the die aperture are closely fitted and the registration between the piercing end of the punch and the die aperture, when mounted in the press, must be accurate. In the event of irregularly shaped holes, the punch and die must be precisely oriented with respect to one another, otherwise the piercing end of the punch will be broken due to interference between the two parts.

In modern die practice, the shank portion of the punch usually is mounted within a retainer block which includes a borehole to receive the shank of the punch. A backup plate mounted between the retainer block and the shoe or ram of the punch absorbs the thrust which is developed as the punch is forced through the workpiece and die. As the punch is withdrawn or stripped from the work, a withdrawal force in the opposite direction tends to pull the punch from the retainer block. Similar forces are developed with respect to the die button, which must withstand the force exerted downwardly during the punching stroke and also resist the force tending to pull the die button from its mounting element as the punch is withdrawn after the working stroke.

Two types of punches are in general use, one being the head-type and the other being the headless punch. While the head-type punch has certain advantages, it is necessary to shut down the machine for an extended period in order to remove the retainer block before a broken punch can be replaced. This is particularly difficult in die sets in which a number of retainer blocks are mounted closely adjacent one another.

The headless punch has the advantage over the head-type, in that it is not necessary to disturb the retainer block; instead the headless punch is simply withdrawn from the exposed face of the retainer block. The headless punch presents no particular problem in relation to the forces developed during the piercing stroke since its upper end simply seats against the backup plate or other surface. However, the headless punch does present a problem in resisting the stripping or withdrawal force which is exerted as the punch is withdrawn from the die button and workpiece after the piercing stroke.

One widely used retainer for the headless punch is in the form of a spring-loaded ball mounted within the retainer block and seated in a recess machined in the shank of the punch. For punch removal, the ball is disengaged from the recess by forcing the ball upwardly. However, this structure is not entirely satisfactory, since the ball tends to provide a line engagement with the opposite side edges of the recess, leading to wear and jamming of the ball. Moreover, dirt and metallic particles tend to accumulate within the ball area so that it becomes difficult to release the ball.

Another problem in relation to the ball-type retainer arises from the fact that it is not entirely positive, being dependent upon the spring-loaded ball for its clamping action. Moreover, due to the wear, the punch may not be accurately oriented with respect to the die aperture after prolonged usage.

One of the primary objectives of the invention has been to provide a positive retaining mechanism for a headless punch which eliminates the use of the spring-loaded ball; which locks the punch positively within the punch-receiving bore of the retainer block; and which releases the punch in a positive manner.

According to this aspect of the invention, the shank of the punch is provided with a flat cross recess which is disposed at an angle sloping downwardly and inwardly along the axis of the punch toward its piercing nib. The recess is engaged by a roll pin which establishes a positive wedging engagement against the flat surface of the recess. The roll pin is journaled in a bore disposed at right angles to the axis of the punch and the bore includes a portion intersecting the bore of the punch. The central portion of the roll pin is machined to provide a locking section which is presented to the opening formed at the intersection for engagement with the angular recess of the punch which is located in this area.

The roll pin is rotated from its camming or wedging position to an unlocking position, by an actuating screw threaded into a bore spaced outwardly from the bore of the punch and parallel with it, with its head exposed for tool engagement. In the event of failure, the punch may be withdrawn from the retainer block simply by backing off the actuating screw so as to rotate the roll pin to the unlocking position.

Another objective has been to provide a punch retaining or locking mechanism which provides positive and precise radial orientation between the piercing end of the punch and the die aperture where these elements are shaped to pierce holes of irregular shape, such as square, rectangular or oblong in configuration.

According to this concept, the longitudinally sloping, transversely flat surface of the punch recess is machined accurately with respect to the irregular configuration of the piercing end of the punch. The locking section of the roll pin, which establishes the wedging engagement with the recess, presents a tangential line engagement with the flat surface of the recess. Thus, if the punch is not accurately oriented when placed in its bore, the roll pin, during its rotary locking motion, will rotate the punch precisely to its correct position with respect to the die aperture. It will be understood that the die button has a cylindrical exterior surface and is provided with a similar flat recess, roll pin and actuating screw, such that both elements may be brought into precise registry upon tightening of the actuating screws. For this reason, both the punch and die are referred to as "die elements" in the claims.

A further object has been to provide a punch-locking mechanism which is simple to manufacture and assemble and which provides improved distribution of forces within the retaining block to prevent any failure of parts after prolonged service.

As noted above, the locking mechanism essentially comprises two elements, constituting the actuating screw and the roll pin which act upon the longitudinally sloping recess of the punch shank. For simplicity of manufacture, the locking portion of the roll pin is formed simply by machining three cross grooves within the central portion of the roll pin, the grooves delineating a rectangular section, the forth side of which forms an arc which constitutes the cylindrical wedging profile of the pin and which is presented to the sloping surface of the shank recess.

The actuating screw is standard and its inner end is turned down to the root of the threads to provide a pilot which interfits a pilot bore within the retainer block. A generally V-shaped peripheral groove is machined at the juncture between the pilot and threaded portion of the screw and engages one corner of the locking portion of the roll pin to impart rotary motion to the pin for locking and unlocking the punch. One of the cross grooves loosely embraces the pilot of the actuating screw and the opposed cross groove loosely embraces the cylindrical shank of the punch. When the actuating screw is turned inwardly, its peripheral groove rotates the locking portion in wedging direction and when the screw is threaded in the opposite direction, the groove engages the corner of the locking portion and rotates the roll pin back to its unlocking position. In this position, the cross groove adjacent the pilot loosely embraces the pilot while the opposed cross groove loosely embraces the punch shank, permitting its removal.

In assembling the blocking mechanism, the roll pin is inserted within its cross bore and rotated so as to bring the cross groove, which interfits the pilot, into alignment with the pilot bore. The actuating screw is then inserted into its threaded hole and is threaded in until the pilot loosely embraces the cross groove of the roll pin, thus locking the roll pin in position against endwise displacement. At the same time, the opposed cross groove is aligned with the borehole of the punch shank, permitting the punch shank to be inserted into the retainer block.

The parallel, longitudinal bores for the punch and actuating screw and the roll pin cross bore, which intersects both bores, are located within the retainer block so that the wedging forces are resisted by block sections which have substantial thickness so as to avoid breakage or failure of the parts. It will be understood that the loading of the actuating screw is not great since the load is distributed along the threads which have a substantial length in engagement with the threaded bore.

As applied to a die button, the arrangement is identical, the actuating screw being presented for tool engagement at the exterior of the die block or other element adjacent the die button for insertion and removal of the die button. The locking structure orients the die button with respect to the piercing end of the punch in the same manner as disclosed above with respect to the punch nib.

In a modified arrangement employing the principles of the invention, the inner end portion of the actuating screw is provided with a cylindrical rack, the teeth of which engage the teeth of a pinion formed in the roll pin. When the actuating screw is threaded relative to its bore, the rack teeth (comprising circular teeth parallel with one another, as distinguished from screw threads) impart rotary motion to the roll pin in locking or unlocking directions due to the longitudinal motion of the screw and rack teeth.

The various features and advantages of the invention are disclosed in greater detail in the following specification and drawing.

In the drawings:

FIG. 1 is a fragmentary sectional view of a punch assembly showing the punch locked within the retainer block by the punch-locking mechanism of the present invention.

FIG. 2 is a sectional view similar to FIG. 1, showing the locking mechanism in its disengaged position with respect to the punch.

FIG. 3 is a view similar to FIG. 2, showing the punch being withdrawn from the retainer block after release of the locking mechanism.

FIG. 4 is an enlarged fragmentary sectional view, taken along the line 4—4 of FIG. 1, further detailing the locking mechanism in its punch-engaging position.

FIG. 5 is an enlarged fragmentary view taken from FIG. 1, showing the motion of the roll pin as it is rotated in punch-locking direction by its actuating screw.

FIG. 6 is an exploded perspective view showing the retainer lock and the several components of the locking mechanism.

FIG. 7 is a fragmentary perspective view of the roll pin with its locking portion in cross section and separated to illustrate its configuration. In this view, the position of the locking portion corresponds to the orientation of the pin as shown in FIG. 6.

MODIFIED ARRANGEMENT

FIG. 8 is a fragmentary sectional view similar to FIG. 1, showing a rack-and-pinion roll pin drive with the mechanism in locking position and also showing a modified backup plate arrangement.

FIG. 9 is a view similar to FIG. 8, showing the parts in the unlocked position.

FIG. 10 is an enlarged sectional view taken along the line 10—10 of FIG. 8, further detailing the rack-and-pinion mechanism with the roll pin in its locking position.

PUNCH ASSEMBLY

The principles of the invention are disclosed in relation to a punch-retainer block which is mounted upon the ram of a punch press for detachably mounting a piercing punch within the retainer block. It will be understood however, that the locking mechanism, in accordance with the invention, may be utilized in locking the die buttons which coact with the piercing punches, and also in other fields which involve locking the end portion of an element within a mounting block or equivalent element.

The present locking structure is of particular utility in mounting headless punches used for multiple hole patterns involving a group of retainer blocks mounted closely adjacent one another upon a mounting plate. In such die sets, the headless punch may be withdrawn from the exposed end of the retainer block, in the event of a punch failure, simply by releasing the actuating screw, the end of which is presented for tool engagement at the exposed face of the retainer block. In this manner, a broken punch may be easily removed without disturbing the adjacent retainer blocks or without special tools.

Referring to FIGS. 1–3, there is disclosed in part, a mounting plate 1 adapted to be carried by a shoe (not shown), which in turn, mounted upon the ram of a punch press in a conventional way, the ram being omitted from the drawings. The punch 2 is carried in the bore of a retainer block or holder 3 which, in turn, is secured by mounting screws 4 (FIG. 6) to the mounting plate 1. The retainer block 3 is located with reference to the mounting plate by several dowel pins as indicated at 5 in FIG. 6.

It will be understood that the piercing punch assembly shown in FIG. 1 is reciprocated by the ram of the press with respect to a die plate (not shown) which is mounted upon the stationary platen of the press. The die plate may comprise a die-mounting element, generally similar to the punch-mounting plate 1 with die buttons mounted in die-retainer blocks (generally similar to the punch-retainer blocks) secured to the die plate. Each die button includes a die aperture dimensioned to receive the piercing end of the punch 2 and the die button-retainer element may be provided with a locking mechanism similar to that disclosed in relation to the punch to facilitate demounting of the button.

As noted above, the punch 1 is of the headless type, comprising a cylindrical shank 6 having a piercing nib 7 (FIGS. 1 and 6) projecting downwardly from the end of the shank 6. The piercing nib interfits the die button, as noted above, and may be cylindrical in cross section. However, the nib may be configurated to punch holes other than circular, for instance, holes which are square, rectangular or oblong in outline configuration. It will be understood that the aperture of the die button must correspond in configuration precisely with the piercing nib 7 of the punch. During a punching operation, the end of piercing nib 7 pierces the sheet metal workpiece and enters the die aperture, thus severing a plug from the workpiece and forcing it through the die aperture before retracting. The shank 6 of the punch is precisely fitted within the borehole 8 (FIG. 3) of the retainer block so as to provide accurate alignment and orientation (if necessary) with the aperture of the die button, while at the same time providing a slip fit for removal of the punch if removal becomes necessary.

In the present example, there is provided a backup plate 10 interposed between the retainer block 3 and the mounting plate 1, with the upper end of the punch shank 6 seated against the surface of the backup plate (FIG. 1). The backup plate 10 preferably is formed from hard steel and absorbs the thrust which acts upon the punch during its piercing stroke. The backup plate 10 preferably is shaped to correspond with the configuration of the retainer block 3, as shown in FIG. 6.

The retainer block 3 is located precisely in position upon the mounting plate by the dowel pins from 5—5 which usually are press fitted into bores formed in the mounting plate 1 (not

shown) and passing through bores formed in the backup plate 10 and retainer block 3. In the form selected for illustration (FIG. 6), the dowel pins 5—5 are located at diagonally opposite sides of the retainer block 3 and the cap screws 4—4 are located opposite the dowel pins, also in diagonally opposite relationship. The cap screws 4—4 pass upwardly through bores formed in the retainer block 3 and backup plate 10 and their upper ends (not shown) are threaded into the mounting plate 1 to hold the retainer block 3 firmly in position and in clamping engagement with the backup plate 10. The retainer block 3 and punch 2 are thus accurately located with reference to the mounting plate and die buttons by the dowel pins 5—5 and clamped in position by the cap screws 4—4.

PUNCH LOCKING MECHANISM

Generally speaking, the locking mechanism for the punch, which is located within the retainer block 3 comprises an actuating screw 11 threaded into block 3 in driving connection with a generally cylindrical roll pin 12 which establishes a wedging engagement with an angular recess 13 milled in the shank 6 of the punch to lock the punch with respect to the retainer block 3. In the present example, the actuating screw is of the socket type, the socket being presented at the outer or exposed face of the retainer block for convenient tool engagement by a socket-engaging wrench 14 (FIG. 2) for locking or unlocking the punch. The arrangement is such that one turn of the actuating screw 11 rotates the roll pin 12 through an angle of approximately 45° from a punch-release position to a locking position.

As best shown in FIGS. 4 and 6, the roll pin 12 is rotatably confined in a cross bore 15 extending through the retainer block 3 at right angles to the axis of the bore 8 in which the punch is confined. It will be noted particularly in FIGS. 4 and 5 that the centers of the bores 8 and 15 are spaced apart a distance less than the combined radii of the two bores. As a consequence, the roll pin cross bore 15 intersects the punch bore 8 as at 16, thereby providing a partially cylindrical recess presenting the locking portion 17 of the roll pin 12 to the shank 6 of the punch. It will be noted that the recess 13 of the punch also resides in the intersecting portion 16 for engagement by the locking portion 17 of the roll pin 12. As best shown in FIG. 6, the roll pin 12 is provided with cylindrical bearing portions 18—18 projecting outwardly from opposite sides of the locking portion 17. The cross bore 15 intersects the longitudinal bore 8 of screw 11 to present the locking portion 17 of the roll pin to the screw for rotating the pin. The bearing portions 18—18 are rotatably confined within the cross bore 15, permitting rotary motion to be imparted to the roll pin by operation of the actuating screw 11, as described later.

As best shown in FIGS. 1, 5 and 7, the locking portion 17 of roll pin 12 is generally rectangular in cross section and its three straight sides are delineated by three circular grooves 20, 21 and 22 machined in the center portion of the roll pin at right angles to its axis. The fourth side of the locking portion 17 is constituted by the cylindrical profile of the pin as indicated at 23. As best shown in FIGS. 1 and 5, the cylindrical portion 23 is forced into wedging engagement with the flat angular surface 24 of the recess 13 to provide a wedging engagement therewith in locking the shank 6 within its bore 8. The angular surface 24 terminates in a ledge 25 (FIGS. 1 and 5) disposed at right angles to flat 24. The cylindrical surface 23 preferably includes a flat 26 amounting to a few thousandths of an inch and shown on an exaggerated scale in FIG. 5.

The actuating screw 11 preferably is of standard size, in the present example being a quarter-inch diameter screw having 28 threads per inch and engaged in a threaded bore 27 opening to the outer face of the retainer block (FIGS. 1 and 6). The screw 11 is modified by turning down its inner end portion to the root diameter of the thread, thereby providing the pilot section 28 which is disposed in the pilot bore (FIGS. 1 and 5). The pilot bore preferably is larger than the diameter of the pilot section 27, providing the clearance indicated at 30 in FIG. 5.

At the juncture between the threaded portion of the screw 11 and pilot section 28, there is provided a peripheral groove 31 which is generally V-shaped in profile, and providing a driving engagement between the screw 11 and the roll pin 12, as explained later. It will be understood at this point, that the longitudinal axis of screw 11 is parallel with the longitudinal axis of the punch 2, with the axis of the roll pin 12 extending at right angles to the axes of the punch and screw.

The driving connection between screw 11 and roll pin 12 is established by engagement of the corner portion 32 of locking portion 17 with the peripheral groove 31 of the actuating screw 11. It will be understood at this point that the flat angular surface 24 of recess 13 is disposed at an angle with respect to the axis of the punch to provide the desired pressure angle with respect to the cylindrical profile 23 of the roll pin. Thus, in locking the punch in place, the screw 11 is rotated in a direction to be threaded inwardly, as indicated by the arrow 33 (FIG. 5), whereby the corner portion 32 of the roll pin is engaged by the rotating upwardly facing thrust shoulder 34 of the peripheral groove 31. This force imparts rotary motion to the pin in the direction indicated by the arrows 35 (FIG. 5), such that the cylindrical profile 23 of the pin, which is tangent to the angular surface 24 of recess 13, provides a camming or wedging action with respect to the surface 24 of recess 13. At the final locking position, the flat 26 of profile 23 seats in parallel relationship with the angular surface 24 of the recess 13. It will be understood, at this point, that the corner 32 is slightly rounded to prevent any binding with respect to the thrust surface 34 of groove 31.

When the punch is to be unlocked, the screw 11 is rotated in the unscrewing direction (FIG. 2), such that the upper section 36 of groove 31 moves downwardly into engagement with the corner 32 of the roll pin. This rotates the roll pin in the reverse direction to the unlocked position, bringing the flat surface delineated by groove 20 into alignment with the periphery of pilot 28. The pilot 28 thus provides a positive stop to hold the roll pin in its release position with its opposite flat surface, which is delineated by groove 22, parallel with the surface of punch shank 6. This permits the punch to be withdrawn from its bore 8, as shown in FIG. 3.

The roll pin is locked in the release position, until a new punch is inserted, at which point the roll pin is forced back to its locking position, as indicated by the arrows in FIG. 5. In the example illustrated (28 threads per inch as noted), the pitch of the threads provides rotation of the roll pin through an angle of 45°, that is, from the locking to the unlocking position, with approximately one complete turn of the screw. It will be understood however, that various other sizes of screws, with the appropriate number of threads per inch may also be utilized.

It will be noted that in forcing the roll pin to its locking position, the loading of the screw 11 is not great and moreover, the complete load is distributed over the length of the screw which is engaged in the threaded bore. The structure also provides improved distribution of the load forces, since the thrust forces between screw 11 and shank 6 are transmitted directly in compression through the locking portion 17. These forces are resisted by the sections of the retainer block 3, which are of ample thickness.

As applied to a punch having a shaped piercing nib 7, that is, one having a periphery other than circular, the locking mechanism provides positive orientation of the piercing nib 7 with reference to the aperture of the die. In other words, the angular surface 24 of recess 13 is flat and it is machined accurately with reference to the irregular shape of the nib. Since the cylindrical profile 23 of the roll pin presents a tangential line contact with the transversely flat surface 24, the punch is automatically rotated to its oriented position as the wedging force is applied to it by the cylindrical profile 23. It will be apparent from the slope of the recess surface 24, that forces tending to withdraw the punch from its borehole 8 will tend to draw the locking profile 23 of the pin in its wedging direction,

thereby making it impossible to withdraw or even slightly displace the punch from its locked-in position.

In the preferred structural arrangement the cross groove **20** (FIG. 5), which is aligned with the periphery of the pilot **28**, has a radius at least equal to the radius of the pilot **28** such that it loosely embraces the pilot in the unlocked position shown in FIG. 2. The cross groove **21** partially embraces the threaded shank portion of the actuating screw **11** (FIGS. 1 and 5), and has a radius at least equal to the radius of the threaded shank. The radius **37** (FIG. 4), which is developed by the radii **20** and **21**, interfits the peripheral groove or necked portion **31** (FIG. 4) of the actuating screw. In addition, the cross groove **22**, which embraces the cylindrical shank **6** of the punch also has a radius at least as great as the punch radius to permit withdrawal of the punch, as indicated in FIG. **3**. It will be understood, that since the groove **20** embraces the pilot **28** when the roll pin is in its unlocked position (FIG. 2), the roll pin **12** is locked in place within its bore **15** against endwise displacement.

In assembling the locking mechanism, the roll pin **12** is slipped endwisely into its cross bore **15** of the retainer block, with the locking portion turned approximately to the position shown in FIGS. **2, 6** and **7**. In this position, the groove **20** is approximately in alignment with the pilot **27**. Thereafter, the actuating screw **11** is slipped into its bore **27** (FIG. **6**) and screwed inwardly so that the pilot **28** embraces the groove **20** to lock the roll pin **12** against endwise displacement within its bore **15**. In order to properly orient the roll pin during assembly, its end may include a pointed reference line **38** (FIG. **6**) and the side of the retainer block **3** may include a similar mark **40**. When these marks are aligned and pointed toward one another, the groove **20** will register with the pilot **28** of the actuating screw, permitting the screw to be threaded in.

As applied to a die button (not shown) the locking mechanism is identical to that disclosed. In this case the roll pin **12** is confined in a cross bore formed in the die plate or in the die retainer in which the button is seated. The die button has a cylindrical outside diameter and is provided with a recess **13** similar to that disclosed except that its slope is in the opposite direction. The actuating screw is threaded in preferably from the upper surface of the die plate retainer (whichever is used) and thus locks the die button in position against upward withdrawal in the same manner as the punch is locked against withdrawal in the downward direction. It will be understood, that with the recesses **13** of the punch and die button properly located, the punch and die will be properly oriented with respect to one another when the punch and die button are locked in position.

MODIFIED STRUCTURE

The arrangement shown in FIGS. **8, 9** and **10** employs the same principles as described above but includes a modified actuating mechanism for the roll pin and also a slightly modified backup plate. As shown in these views, one portion of the retainer block **41** seats directly against the mounting plate **42** which is carried by the shoe or ram of the press (not shown). The retainer block has a longitudinal bore **8** to receive the shank **6** of the punch which includes the angular recess **13**, to provide a locking engagement with the modified roll pin **43**.

In this structure, the backup plate, previously indicated at **10** does not extend across the full upper surface of the retainer block. Instead, the end portion of the retainer block includes a flat inset **44**. The upper surface of the inset **44** is flat and parallel with the upper face of the retainer block to receive a circular backup plate **45**. The backup plate **45** has a thickness equal to the depth of the inset portion **44** and is concentric with the shank **6** of the punch. The punch-engaging face of backup plate **45** includes a circular recess **46** to receive the upper end portion of the punch shank. The circular backup plate **45** is located and held in position by a dowel pin **47** located on the central axis of the punch shank and recess and passing upwardly into the mounting plate **42**. The circular backup **45** and its recess **46**, which embraces the punch, thus locates the punch accurately with respect to the mounting plate. The retainer block is secured to the mounting plate **42** by means of dowel pins and screws in the usual way (not shown).

The roll pin **43** is rotatably mounted in a cross bore **15** of retainer block **41**, the bore **15** intersecting the bore **8** as at **16** to provide the partially cylindrical recess noted earlier. As best shown in FIG. **10**, the opposite end portions **18—18** of the roll pin are cylindrical to permit rotary motion of the pin within its cross bore **15**.

In order to impart rotary motion to the roll pin, the upper end portion of the actuating screw **11** has been modified to provide the circular rack portion **48** which is rotatably confined in the counterbore **50**. The circular rack is formed by counter turning the end portion of screw **11** to form the circular teeth **51** which are parallel with one another, as distinguished from the pitch of the screw threads. The parallel teeth **51** mesh with a pinion section **52** machined in the roll pin, to one side of its locking portion **17** (FIG. **10**). The teeth **53** of the pinion section **52** are of concave formation to interfit the circular teeth **51** of rack **48**. It will be apparent that turning the actuating screw **11** will impart longitudinal motion to it, thus causing the rack **48** to move longitudinally with respect to the pinion **52** so as to rotate the roll pin to its locking or unlocking position.

In the present example, the locking section **17** comprises a single cross groove **54** (similar to groove **22**) machined in the periphery of roll pin **43** in registry with the bore **8** of punch shank **6**. The radius of cross groove **54** is somewhat larger than the radius of shank **6** to permit withdrawal of the shank from its bore **8**. The locking action is similar to that previously described and the roll pin may be provided the flat **26**, as previously described. Thus, when the roll pin **43** is rotated to the locking position (FIG. **8**) a wedging engagement is established between the cylindrical wedging profile of the roll pin combined with its flat **26**, thus locking the shank securely in position. When the roll pin is rotated in the opposite direction (FIG. **9**) the cross groove **54** is presented to the shank **6**, permitting withdrawal of the punch shank from the bore **8**.

I claim:

1. A retainer mechanism for locking and unlocking the working element of a punch and die set with respect to a relatively movable support member of a punch press, said retainer mechanism comprising:

a retainer block having one face arranged to be secured to the member of the punch press and having an opposite exposed face;

said retainer block having a longitudinal bore extending inwardly from the exposed face thereof for slidably receiving the working element;

said retainer block having a cross bore formed therein and disposed generally at right angles to the said longitudinal bore, said cross bore partially intersecting the longitudinal bore and thereby providing a recess interconnecting said bores;

a retainer mechanism for locking and unlocking the working element of a punch and die set;

locking means rotatably journaled in said cross bore and extending across the recess formed at the intersection of said longitudinal bore and cross bore for engaging and holding the working element against withdrawal from the retainer block;

said locking means comprising a cylindrical roll pin rotatably mounted in the cross bore of the retainer block;

said roll pin having a cross groove formed therein and residing adjacent the recess formed at the intersecting portion of the longitudinal bore and cross bore;

said working element having a longitudinally inclined flat formed in the periphery thereof, the cylindrical profile of the roll pin adjacent the said cross groove adapted to engage the said inclined flat of the working element upon rotation in one direction, thereby to lock the working ele-

ment in said longitudinal bore by a wedging force developed between the said inclined flat and cylindrical profile of roll pin;

said cylindrical profile adapted to disengage the said flat and to release the working element upon being rotated in the opposite direction;

and means for imparting rotary motion in forward or reverse directions to said rotatable cylindrical roll pin, thereby to lock and unlock the working element with respect to the said longitudinal bore.

2. A retainer mechanism for locking and unlocking a working element of a punch and die set as set forth in claim 1 in which the rotatable locking means comprises a cylindrical roll pin rotatably mounted in the cross bore of the retainer block, said roll pin having a cross groove formed therein and residing adjacent the recess formed at the intersecting portion of the longitudinal bore and cross bore, and in which there is provided a working element having a flat formed in the periphery thereof, the cylindrical profile of the roll pin adjacent the said cross groove adapted to engage the said flat upon rotation in one direction, thereby to lock the working element in said longitudinal bore, said cylindrical profile adapted to disengage the said flat and to release the working element upon being rotated in the opposite direction, the means for imparting rotary motion in forward and reverse directions comprising a screw in threaded engagement in the retainer block and in driving connection with the roll pin, whereby longitudinal movement of the screw as a consequence of its rotary motion imparts rotary motion to the roll pin.

3. A retainer mechanism for locking and unlocking a working element of a punch and die set as set forth in claim 1 in which the rotatable locking means comprises a cylindrical roll pin rotatably mounted in the cross bore of the retainer block, said roll pin having a locking portion formed intermediate the length thereof, said locking portion being generally rectangular in cross section having three sides provided by cross grooves, formed in the cylindrical roll pin, the fourth side of said locking portion comprising the cylindrical profile of the roll pin which extends across two of said opposed cross grooves, said cylindrical profile constituting a wedging section, said cylindrical wedging section residing adjacent the recess formed at the intersecting portion of the longitudinal bore and cross bore, and in which there is provided a working element having a flat formed in the periphery thereof and disposed in said recess, said cylindrical wedging section of the roll pin adapted to engage the said flat upon rotation in one direction, thereby to lock the working element in said bore and adapted to disengage the said flat and to release the working element upon being rotated in the opposite direction.

4. A retainer mechanism for locking and unlocking a working element of a punch and die set as set forth in claim 1 in which there is provided a working element and in which the rotatable locking means comprises a cylindrical roll pin having end portions rotatably journaled in the cross bore of the retainer block, said roll pin having a locking portion formed therein and presented to the recess delineated by the intersection of the said cross bore and longitudinal bore, said locking portion having a plurality of sides and a cylindrical wedging profile, said locking portion delineating a corner, the means for imparting rotary motion comprising an actuating screw in threaded engagement within a bore formed in the retainer block, said locking screw having a necked portion engaging the said corner of the locking portion of the roll pin, whereby rotation of said locking screw in locking direction rotates the roll pin, forcing the said cylindrical profile into wedging engagement with the said working element and rotation of the screw in the opposite direction disengages the wedging profile relative to the working element.

5. A retainer mechanism for locking and unlocking a working element of a punch and die set as set forth in claim 1 in which the rotatable locking means comprises a roll pin rotatably mounted in the cross bore of the retainer block, said roll pin having a wedging area adapted to provide a wedging engagement with a working element in the longitudinal bore, said roll pin having a pinion formed therein, the means for imparting rotary motion comprising a rack having teeth engaged with the pinion of the roll pin, and means for shifting said rack longitudinally for rotating the roll pin in locking and unlocking direction.

6. A retainer mechanism for locking and unlocking a working element of a punch and die set as set forth in claim 1 in which the rotatable locking means comprises a roll pin rotatably mounted in the cross bore of the retainer block, said roll pin having at least one cross groove formed therein and disposed within the recess at the intersection of the cross bore and longitudinal bore, the roll pin having a wedging area adjacent said cross groove adapted to provide a wedging engagement with a working element in the longitudinal bore, said roll pin having a pinion formed therein, the means for imparting rotary motion comprising an actuating screw threaded in said retainer block, said screw having a cylindrical rack formed therein the teeth of which are parallel with one another and engaged with the pinion of the roll pin, whereby rotation of the screw and consequent longitudinal movement thereof rotates the roll pin in locking and unlocking directions.

7. A retainer mechanism for locking and unlocking a working element of a punch and die set as set forth in claim 1 in which there is provided a working element and in which the locking means comprises a roll pin rotatably mounted in the cross bore of the retainer block, said roll pin having at least one cross groove formed therein the radius of which is at least equal to the radius of the working element, the roll pin adjacent said cross groove comprising a wedging area adapted to provide a locking engagement with said working element upon rotation of the roll pin in the locking direction, said roll pin having a pinion formed therein, the means for imparting rotary motion to the locking means comprising an actuating screw threaded in said retainer block, a portion of said locking screw having a cylindrical rack formed therein the teeth of which are parallel with one another and engaged with the pinion of the roll pin, whereby rotation of the screw and consequent longitudinal movement thereof rotates the roll pin in locking and unlocking directions for retaining or releasing the working element with respect to the longitudinal bore.

8. A retainer mechanism for locking and unlocking a working element of a punch and die set as set forth in claim 1 in which there is provided a working element and in which the face of the retainer block, which is arranged to be secured to the support member of the punch press, includes an inset in the area of the working element, a backup plate seated within said inset and having an upper surface flush with the face of the retainer block, an aperture formed in the backup plate and in the support member of the punch press on an axis common to the central axis of the said working element, and a locating element passing through said aperture and into the support member of the punch press for locating the backup plate and working element relative to the support member of the punch press.

9. A retainer mechanism for locking and unlocking a working element of a punch and die set as set forth in claim 1 in which there is provided a working element and in which the face of the retainer block, which is arranged to be secured to the support member of the punch press, includes an inset in the area of the working element, a backup plate seated within said inset and having an upper surface flush with the face of the retainer block, the opposite face of the backup plate having a cylindrical recess formed therein, the diameter of which is substantially equal to the diameter of the working element with the end portion of the working element seated within said recess, a bore extending through said recess on an axis common to the central axis of the working element and recess and into the support member of punch press, and a locating element passing through said bore and into the element of the punch press for locating the backup plate and die element relative to the support member of the punch press.

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