Dec. 15, 1953 R. H. PARSONS 2,662,773

CONSTRUCTION OF INTERCHANGEABLE DIES, PUNCHES, ETC

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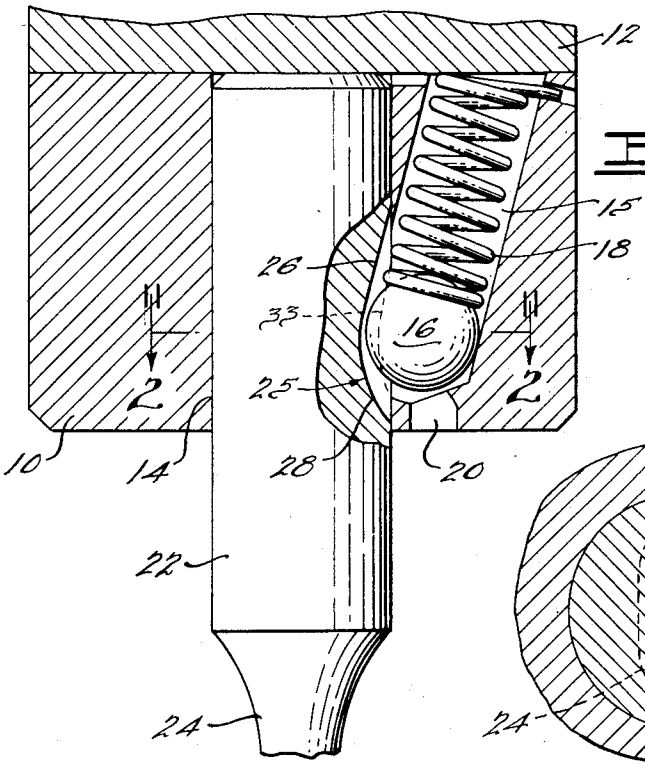


Fig. 1.

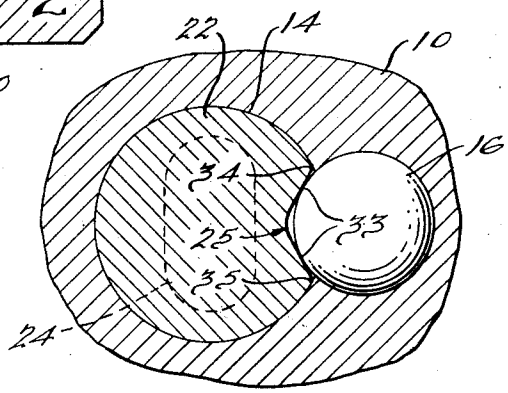


Fig. 2.

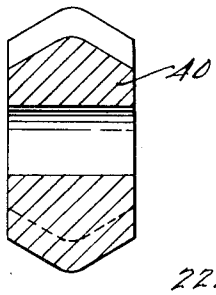


Fig. 3.

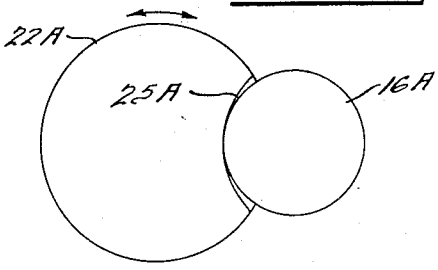


Fig. 4.

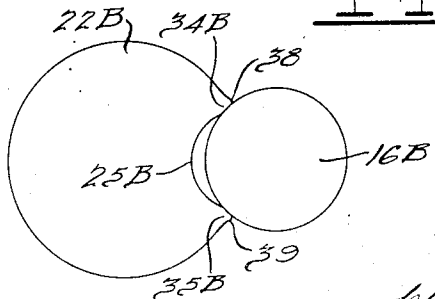


Fig. 5.

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CONSTRUCTION OF INTERCHANGEABLE DIES, PUNCHES, ETC.

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5 Claims. (Cl. 279—30)

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The present invention relates to the construction of metal punching and forming tools adapted for use upon punch presses and the like and is particularly concerned with improvement of such tools of the quickly interchangeable type.

An important object of the invention is to provide novel, simplified and improved means whereby punches, dies and the like may be mounted in a punch press in such manner as to be quickly and easily removable and interchangeable, yet are rigidly held at all times, when mounted in the press, against both axial movement and angular disalignment.

A widely used type of quickly releasable securing device for holding punches, dies and the like upon punch presses is the so-called ball retainer, consisting of a retainer block adapted to be secured to the press and having a cylindrical socket therein adapted to receive the punch or die, the punch or die having a pocket in its side, the pocket being generally of half teardrop shape and lying within the socket when the tool is inserted. An angular hole in the retainer block intersects the socket in the block at a position adjacent the larger end of the teardrop-shaped pocket of the inserted tool. In the angular hole is a spring-pressed ball, arranged to act in a manner analogous to a one-way clutch to hold the tool against removal from the socket when the ball is urged into the pocket by the spring means. Retainers of this type are well-known in the art. It is customary to form the teardrop-shaped pockets in the shanks of such tools by means of a spherical milling cutter. Some variation in the size of such pockets is unavoidable, as a practical matter, because the spherical cutters become smaller in use (or if they are sharpened) and because strict uniformity in cutter size, and in the depth to which the cutter is fed into the shank of the tool, cannot be attained. There is also some variation in the size of the retainer ball which serves as the clutching device. For the indicated reasons, the retainer balls do not engage uniformly in the pockets of held tools, and as a result difficulties are encountered in maintaining angular alignment of held tools, and difficulties are also encountered due to distortion of tools in such manner as to cause them to stick in their retainers. Sometimes a ball engages a pocket portion in the shank of a held tool which is of smaller diameter than the ball, and at other times the retainer ball engages a portion of a shank pocket which is of larger diameter than the ball. If the ball engages a pocket portion which is of larger diameter than the ball,

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the tool is not fully and rigidly locked against angular or rotary movement. While this entails no serious consequences where the operating portion of the tool is circular, as in the case of round punches and dies, it is most serious where the working portion of the tool is non-circular or non-concentric, as for example in the case of square or oblong punches and dies. Under such circumstances, the fact that the held punch and/or die portions can rotate slightly with relation to one another permits highly undesirable angular disalignment between the interengageable working portions of the punch and die set or other tools held by the retainers. If, on the other hand, the retainer ball engages a tool pocket which is of lesser diameter than the ball, the ball bridges a portion of the pocket, and bears inwardly against the relatively sharp side edges of the pocket. As a result of such engagement the ball, which is necessarily harder than the shank of the tool, deforms the shank of the tool by forcing such edges outwardly. Such deformation of the shank of the tool causes the tool to stick in the socket of the tool retainer, rendering removal of the tool difficult even when the retainer ball is released. Although attempts have been made to eliminate the latter difficulty by relieving a portion of the shank of the tool in the vicinity of the pocket portion engaged by the retainer ball, it has been found impossible as a practical matter to provide sufficient relief to prevent the deformed edges from being thrust outwardly by the ball far enough to engage the wall of the socket in the tool retainer block and cause sticking of the tool in the manner described.

The present invention overcomes the noted difficulties by changing the formation of the pocket in the shank of the tool in such manner that the retainer ball cannot engage the outer corners of the pocket to cause the undesirable deformation thereof mentioned previously. Furthermore, when the pocket is constructed in accordance with the present invention, the ball always engages two opposed and angularly spaced portions of the pocket in a manner which positively locks the tool against angular disalignment.

Another object of the invention is to provide such an improved tool construction having a pocket therein for a ball retainer of the indicated variety, which pocket is adapted to be formed in a manner which is simpler and more economical than the methods employed in the formation of the pockets of such tools of the va-

rieties now commonly used, and which is adapted to be formed by a milling cutter which can be repeatedly sharpened without alteration of the dimensions of the pockets which the milling cutter forms.

Other objects and advantages will become apparent upon consideration of the present disclosure in its entirety.

In the drawings:

Figure 1 is a substantially central, vertical, sectional view of a retainer block provided with a ball retainer and showing held therein a punch constructed in accordance with my present invention, portions of the punch being broken away;

Figure 2 is a cross-section taken substantially on the line 2—2 of Figure 1 and looking in the direction of the arrows;

Figure 3 is a somewhat diagrammatic sectional view of a milling cutter adapted to form my improved retainer pocket construction;

Figures 4 and 5 are diagrammatic views depicting certain conditions which obtain when tools provided with conventional teardrop-shaped pockets are held by ball retainers similar to the one illustrated in Figure 1.

Referring now to the drawings, reference character 10 designates a retainer block which, with a conformably shaped backing plate 12 is adapted to be secured to the head of a press (not shown). The retainer block is provided with a cylindrical tool socket 14 and with an angular cylindrical hole 15 which partially intersects the socket 14 and which contains therein a retainer ball 16, behind which is a helical compression spring 18 which urges the ball outwardly of the intersecting portion of hole 15 so that the ball tends to project into the socket 14, although, due to the shape of the hole 15, the ball cannot escape. A smaller hole 20 in the exposed face of the block 19 substantially parallel to the socket 14 intersects the hole 15 at the ball end, so that a drift or suitable tool (not shown) can be thrust through the hole 20 to push the ball 16 back, against the opposition of the spring 18, far enough to release the tool.

Although the tool illustrated comprises an oval punch, it will be appreciated that this is merely illustrative and that my invention is equally applicable to the retention of dies, tools and other devices which it may be desired to secure or connect in a positive but quickly releasable manner. The shank portion of the punch is designated 22, and the formed or operative end, illustrated as of oval form, is designated 24.

A pocket, generally designated 25, is formed in the shank of the tool upon a surface portion which lies across the exposed end of the hole 15 when the tool is inserted in the socket 14, as shown in Figure 1. The pocket 25, viewed in longitudinal section as in Figure 1, is substantially the form of a half teardrop having a straight section 26 which in effect forms a continuation of the hole 15, and a return section 28 which is curved upon a radius greater than the radius of the retainer ball 16 and which connects the deepest part of the pocket to the surface of the shank. The portion of the return section 28 closest to the straight section 26 is of gradual curvature and the ball passage formed by the complementary parts of the hole 15 and pocket 25 fits the ball 16 quite accurately, so that the parts of the ball which bear inwardly against the walls of the pocket 25 are always located above a horizontal line projected from the point

of engagement of the opposite side of the ball with the opposed face of the hole 15. Thus the reaction of the ball tends to urge the tool inwardly of the socket.

Viewed in transverse section all portions of the pocket 25 are of substantially V-section as shown in Figure 2. In the prior art constructions previously mentioned, an attempt is made to form the pocket in the tool shank of such shape and size, and to so locate it, that when the tool is in the socket, the straight part of pocket in the side of the tool mates with and forms in effect a continuation of the cylindrical hole 15 in the retainer body. My improved V-section pocket, however, is wider and deeper than the corresponding part of the cylindrical hole 15 would be if continued into the tool shank, and is proportioned so that those parts of the flattened side walls of the pocket engaged by the ball are tangent to the curved plane which the wall of hole 15 would define if projected into the pocket 25. Thus the ball 16, when in engagement with the tool pocket 25, may travel along lines, located as indicated at 33 in Figure 2, which constitute colinear extensions of the wall of hole 15, and the confinement of the ball between such lines and the rear face of the hole 15 is substantially the same as it would be if the pocket 25 were curved in horizontal section and were a simple continuation of the cylindrical hole 15 as in the prior art constructions. Further, as in the prior art constructions, the ball may move in a substantially straight path to and from engagement with pocket 25. There is this important difference, however, that as such lines follow the curvature of the return section 28 in extending toward the outer (lower) end of the pocket, they confine the ball at two horizontally angularly spaced positions only, and coact with the back wall of the hole 15 to define a triangular section of reducing size into which the ball is urged by the spring 18. Neither the extreme edges 34, 35, nor the extreme bottom of the pocket 25 can engage the ball. As also shown in Figure 2, the points of engagement 33 of the ball with the side walls of the pocket 25 are spaced inwardly from the extreme outer limits or side edges of the V-sectioned pocket. Such extreme edges are designated 34—35, and are never contacted by the ball. The shank of the punch or other held tool is thus effectively located at all times against rotation and against longitudinal movement. The retainer ball 16 never engages portions of the shank which could be harmfully distorted by the ball.

Figure 4 shows diagrammatically, and by way of comparison with Figure 2, a tool shank 22A, having a pocket therein, designated 25A, which is of the conventional curved cross-section currently in use. The cross-sectional contour of this pocket is such that its radius is somewhat greater than that of the retainer ball, which is indicated at 16A. (The difference in the radii of these parts is exaggerated in Figure 4.) Under such conditions, it is possible for the tool to rotate slightly in either direction from the position shown, and it is, therefore, impossible to maintain accurate angular alignment between non-circular punch and die parts.

Figure 5 is a diagrammatic and exaggerated cross-sectional representation similar to Figure 4, showing the condition which obtains when the pocket in the tool, here designated 25B, is of arcuate section and is of lesser radius than the radius of the retainer ball 16B. Here the ball engages the corner portions 34B—35B of the

pocket in the tool; and as high pressures are developed between the ball and the tool, the ball, being harder than the tool, in the course of time distorts the corner portions 34B—35B in the general manner indicated in Figure 5, causing a portion of the metal of the tool shank adjacent each side of the pocket to be forced radially outwardly, as indicated at 38—39. Such outwardly distorted portions interfere with insertion and removal of the tool.

The currently used pockets of arcuate cross-section are formed by milling cutters of spherical shape. As the cutter wears, or is sharpened, it cuts a correspondingly smaller pocket. My improved V-sectional pocket may be formed by a milling cutter such as is shown at 40 in Figure 3. This cutter has simple convex V-teeth and rotates on a transverse axis, so that sharpening the cutter does not change the dimensions of the pocket which the cutter forms in the tool.

Although in this specification the holding element of the retainer has been considered to be a ball, it will be appreciated by those skilled in the art that similar considerations obtain where the retainer is a set screw or the like having a rounded or partly spherical inner end for engagement with the pocket in the tool. The terms "V-shaped" or "substantially V-shaped" as used herein are of course not to be limited to a construction wherein the walls of the pocket are substantially straight in cross-section, but are intended to include any such shape which is near enough to a V-contour so that the ball-shaped retainer bears only at two laterally spaced points. It will also be apparent that the invention is susceptible to variation, modification and change within the spirit and scope of the appended claims.

What is claimed is:

1. Means for releasably retaining a tool in a retainer having a tool-receiving socket and a holding device including a portion movable to and from a position wherein it projects laterally into the socket, comprising a tool movable axially into the socket, and having a pocket therein which is movable, during insertion of the tool in the socket, to a position in alignment with the path of, and which is adapted to be interengaged by, the holding device, the interengageable part of the pocket having angularly disposed outwardly divergent walls which are of substantially V-section in a plane perpendicular to the direction of axial movement of the tool into and out of the socket, such V-section portion being wider than the portion of the holding device interengageable therewith, and being deeper and extending inwardly toward the axis farther than such holding device, whereby the holding device engages said walls of the pocket at two points spaced laterally from one another and spaced inwardly from the outer edges of said walls, and whereby the holding portion bridges the deepest part of the pocket.

2. Means as defined in claim 1 wherein said V-sectioned walls are curved in an axial direction but arranged in substantially uniform angular relation to one another throughout their length.

3. Means as defined in claim 1 wherein the holding device comprises a ball, said retainer having a cylindrical-walled angular passage in which the ball is movable to and from said position wherein it projects laterally into the socket, said walls of the pocket having portions alignable with the cylindrical-walled passage to define substantially tangentially continuing lines comprising track lines onto which the ball may ride, and which track lines contain said aforementioned points of engagement.

4. As a new article of manufacture, a tool having a shank and a working portion projecting from the shank, the shank being adapted to be held in a ball-type retainer, said shank having substantially flat reentrant walls converging inwardly toward one another toward the center of the shank and defining a ball pocket which is substantially V-shaped in cross section in a plane transverse to said shank, said walls being inclined longitudinally outwardly of the shank at an acute angle to the axis of the shank in a direction away from the working portion.

5. As a new article of manufacture, a tool having a shank adapted to be held in a ball-type retainer, said shank having reentrant walls inclined at an acute angle to the direction in which the shank extends and converging inwardly toward one another to define a ball pocket which is substantially V-shaped in cross section in a plane transverse to said shank, the maximum width of the pocket, in said plane, exceeding the length of a chord projected between the points at which a ball, which the pocket is designed to receive, will engage the walls of the pocket, and the depth of the pocket exceeding the depth of that portion of such a ball which enters the same, whereby the ball can only engage the pocket at two points and said points are spaced from both the bottom and edges of the pocket.

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