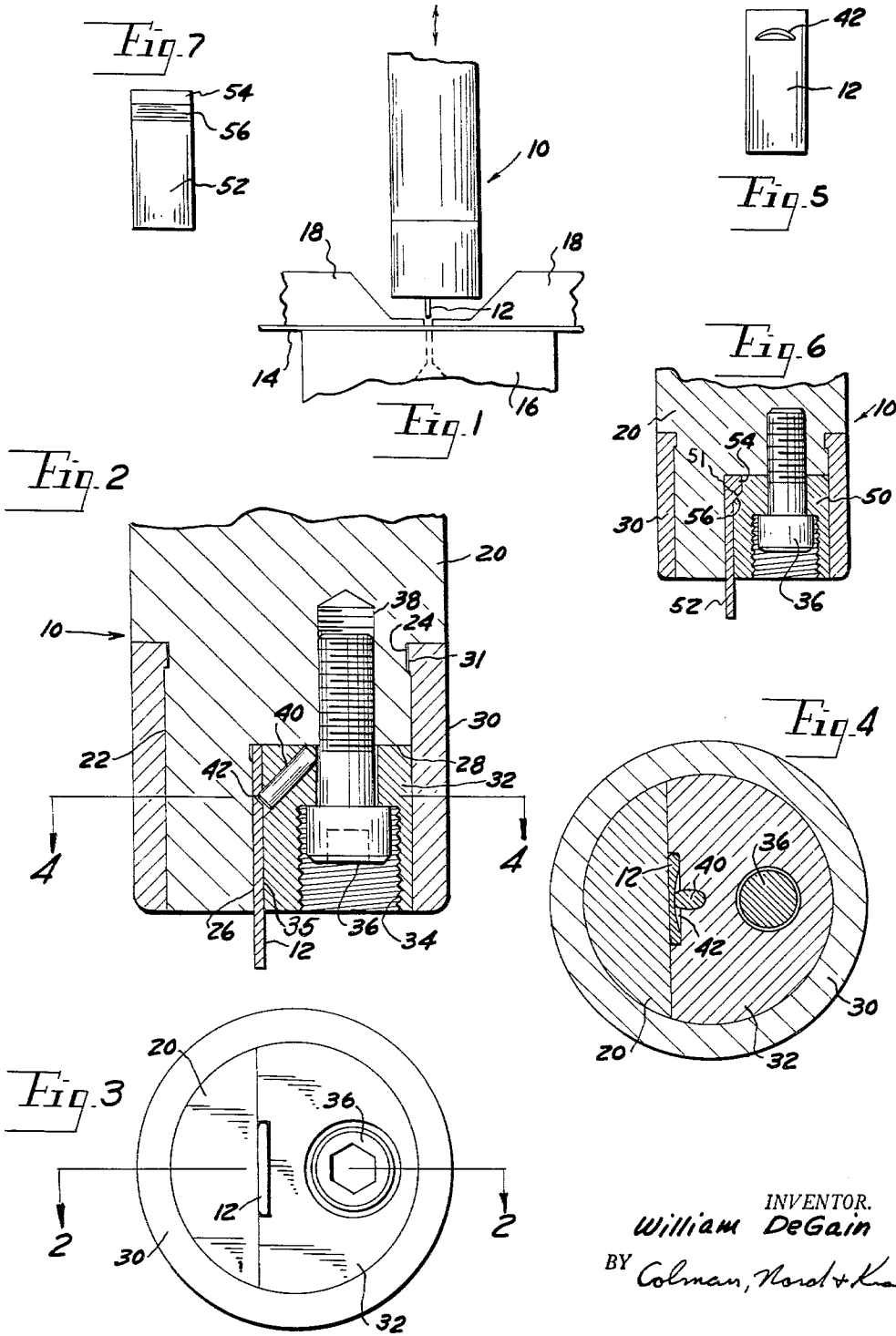


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PUNCH AND RETAINER THEREFOR

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PUNCH AND RETAINER THEREFOR

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This invention relates to punches which are used to perforate metal and to retainers for rigidly and accurately supporting the punches in tools such as metal-working presses.

Punches must frequently be removed from their retainers for purposes of sharpening and replacement. Yet, to produce a highly-accurate perforations, they must be supported within their retainer with high degrees of rigidity and accuracy. Any variation between the punch dimensions and the retainer dimensions will produce a cocking or movement of the punch and consequent inaccurate perforations. In order to absorb forces exerted on the punch in any direction, it is common practice to make a retainer by forming a dead-ended slot of an appropriate size in one end of a solid member and to support the punch in the slot with its cutting edge projecting therefrom. This slot must be formed with an accuracy which is commensurate with the desired accuracy of the perforation. All of the surfaces of the slot must be finely finished in order to provide a high degree of accuracy of punch retention. When punches of small diameter are employed, it is difficult to provide the desired finishes on the retainer's surface since techniques for forming a highly accurate dead-ended slot in a solid part are limited.

The present invention therefore contemplates a retainer which is assembled from several parts in such a manner as to allow the retainer's surfaces which contact the punch to be highly finished prior to assembly. The assembly is so conceived and designed as to provide strengths which equal that of retainers formed from a single metallic section. Additionally, the retainer assembly is simple so as to be low in cost.

In a preferred embodiment of the present invention, which will subsequently be described in detail, the retainer is formed of three major sections. The retainer stem, which communicates with the guiding and driving assembly, comprises a metal cylinder with a section of diminished diameter at its extreme end. A groove of slightly smaller diameter than the diminished section is formed adjacent the shoulder which occurs between the basic stem section and the diminished section. A sector of the diminished section of the stem is cut away leaving the extreme end in the form of a half-moon section. Two of the walls of the stem bordering on this removed section are then finished and act as part of the supporting surfaces for the punch.

The reduced section is next shrink-fitted with a tubular collar having a shoulder which mates with the groove.

A retainer section, somewhat in the shape of the removed section, is attached to the half-moon section, within the collar by a removable fastener. An open-sided slot is formed in the walls of the retaining section and acts in co-operation with the other finished surfaces as the support for the punch.

A unique retention arrangement allows the punch to be easily removed from the retainer and yet restrained against longitudinal movement with respect thereto. It consists of a retaining pin movable in an angular slot in the retainer and operative to fit into a fitted slot in one wall of the punch. This indentation does not limit the strength thereof.

It is therefore seen to be the primary object of the pres-

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ent invention to provide a punch and retainer assembly wherein the punch may be easily removed, yet which provides highly rigid and accurate retention for the punch.

A further object is to provide such an assembly which is low in cost and of simple, solid construction.

Other advantages and applications of the present invention will be made apparent by the following detailed description of two preferred embodiments of the invention. The description makes reference to the accompanying drawings in which:

FIGURE 1 is a side view of a punch and retainer formed in accordance with the present invention used to pierce a sheet supported on a die block;

FIGURE 2 is a cross-sectional view of the retainer and punch of FIGURE 1 taken along lines 2-2 of FIGURE 3;

FIGURE 3 is an end view of the retainer and punch of FIGURE 1;

FIGURE 4 is a transverse cross-sectional view of the retainers and punch taken along lines 4-4 of FIGURE 2;

FIGURE 5 is a side view of a punch which forms part of the combination of the embodiment of FIGURES 1-4;

FIGURE 6 is a longitudinal sectional view through a second embodiment of the invention which is similar to that of FIGURES 1-5 but employs a different form of punch and punch retention; and

FIGURE 7 is a side view of the punch used in the assembly of FIGURE 6.

A typical application and environment for the punch and retainer are illustrated in FIGURE 1. The retainer proper, generally indicated at 10, is driven from its upper end by any suitable form of apparatus such as a fluid ram or mechanical press which is not shown and does not form part of the present invention. A punch 12 projects from the lower end of the retainer 10 in a direction parallel to the driving motion of the retainer. The punch may be used to form a perforation in a metal sheet 14 which is retained over a die block 16 by a stripper pad 18. The die 16 is designed to receive the slug formed by the punch in the sheet 14 and the stripper 18 prevents the sheet 14 from moving upwardly with the returning punch as a result of their close engagement with one another. The present invention resides in the specific construction of the retainer 10 and the punch 12 and may be employed in numerous situations other than that shown.

The retainer is formed with a stem 20 which is cylindrical in shape. At its lower end a reduced diameter section 22 is formed on the stem 20. A narrow groove 24 of slightly smaller diameter than the section 22 is also formed at the shoulder between the main stem section and the reduced section 22. The stem configuration is completed by removing a section bounded by a longitudinal plane 26 formed parallel to the stem axis and joining transverse cut 28, so as to leave an extending half-moon section at the extreme end of the stem. The planes 26 and 28 are highly finished by a process such as grinding which may be easily accomplished because of their ready accessibility.

The end of the stem is fitted with a tubular collar 30 which has an internal shoulder 31 at one end of its diameter which is of the depth as the groove 24. The collar 30 is fitted over the reduced section 22 of the stem 20 by a process of heat-shrinking, in accordance with common metal working practice, which produces a pre-stressed condition of the stem end. The shoulder 31 mates into the groove 24 in this process and acts to retain the collar 30 against axial motion with respect to the stem.

A retainer 32 fits within the space between the plane 26 and the collar 30. It is formed of a cylindrical section having an outer diameter approximately equal to the inner diameter of the collar 30 and one face is flattened to accommodate the extension of the stem 20. A groove 35

of a suitable configuration to receive the punch 12 is formed in the flattened face of the insert 32 finished by a suitable process such as grinding. A threaded hole 34 is formed in the insert 32 and is large enough to receive the head of a cap screw 36 which retains the insert in a threaded hole 38 formed in the stem 20. The threaded hole 34 allows the insert to be removed with an external threaded pulling tool (not shown).

The punch 12 is itself formed of an appropriate tool steel. While a thin rectangular form is shown, other desirable punch configurations may be utilized in connection with the retainer. The punch 12 has an angular cylindrical cut 42 formed on one of its faces. It is operative to receive the end of a pin 40 which is disposed in an angular hole formed in the insert 32 between the planes 26 and 28. The pin is of such length that when one end is disposed within the formation 42 in the punch 12, the other end abuts the surface 28 of the stem.

The punch 12 is assembled to the retainer by disposing it in proximity to the face of the insert 32 and inserting the pin 40. The insert and punch are then affixed to the stem by the screw 36. The pin 40 acts to secure and retain the punch 12 against longitudinal movement with respect to the retainer.

FIGURES 6 and 7 disclose an alternative form of retainer and punch construction. A retainer 10 is formed with a stem 20 and collar 30 which are identical to those employed with the first embodiment. The insert 50 used in connection with the second embodiment does not employ a pin to secure the punch but rather has a relieved groove 51 along the top edge of its punch slot. The punch used in connection with this embodiment, 52, employs an extending ridge 54 along its upper edge which communicates with the main punch face by an inclined section 56. The insert and punch are assembled to the retainer in the same manner as the earlier embodiment.

An advantage of the configuration of the punch 12 over that of the punch 52 is the possibility of forming slots 42 at opposite ends of opposed surfaces so as to make the punch reversible.

Having thus described my invention, I claim:

1. A punch and retainer, comprising:

- an elongated stem having one end formed with a pair of finished intersecting planes;
- a tubular collar fitted about the finished end of said stem so as to abut the stem along a portion of the collar's interior and to form a fitted space having two edges defined by said plane sections and the remainder of the interior diameter of the collar;
- a retainer shaped to fit into the space defined by the collar and the intersecting plane sections of the stem;
- fastener means for removably securing the retainer to the stem;
- a punch operative to be disposed between said retainer and the finished plane surfaces of said stem, and to project beyond the end of the stem;
- and mating projections formed on the punch and retainer assembly operative to fixedly attach said punch to the stem when the retainer is fastened to the stem.

2. A punch and retainer assembly, comprising:

- an elongated stem having one end defined by a pair of finished intersecting planes;
- a collar adapted to surround the finished end of the stem so that a portion of the interior surface of the collar contacts the stem and the remainder of the interior surface bounds a space having two of its sides defined by said plane sections;
- a retainer adapted to be fitted within the space defined

by the finished plane sections and the collar and having a finished plane surface adapted to be disposed in opposition to the plane surfaces of the stem;

a fastener for removably securing the retainer to the stem;

and a punch having one end shaped so as to fit within the space defined by the plane finished surfaces of the stem and the retainer, having securing means formed thereon adapted to mate with the finished surfaces of the stem and the retainer so as to secure the punch thereto when the retainer is fastened to the stem, and adapted to project beyond the termination of the stem.

3. The structure of claim 2 wherein the pair of intersecting planes are perpendicular to one another, one of said planes lying parallel to the elongate axis of the stem and the finished plane surface of the retainer is also disposed parallel to the elongate axis of the stem.

4. The structure of claim 2 wherein the pair of finished intersecting planes formed on the stem are disposed perpendicular to one another, one being parallel to the elongate axis on the stem, the finished plane surface of the retainer is disposed parallel to the elongate axis of the stem, and the securing means formed on the punch comprises a section extending perpendicularly to the elongate axis of the stem.

5. A punch and retainer assembly, comprising:

an elongated stem having one end defined by a pair of finished planes disposed at right angles to one another, one being parallel to the elongate axis of the stem;

a collar adapted to surround the finished end of the stem so that a portion of the interior surface of the collar contacts the stem and the remainder of the interior surface bounds a space having two of its sides defined by said plane sections;

a retainer adapted to be fitted within the space defined by the finished plane sections and the collar, having a finished plane surface adapted to lie parallel to the elongate axis of the stem when so disposed within the space, and having a central aperture therein terminating on said plane surface;

a fastener for removably securing the retainer to the stem;

a punch having one end shaped so as to fit within the space defined by the plane finished surfaces of the stem and the retainer, and having an indentation formed in the surface operative to be disposed in abutment to the plane finished surface of the retainer adjacent the aperture in such plane finished surface; and a pin operative to be disposed within the aperture and the retainer with one edge thereof extending into the indentation in the punch so as to retain the punch against movement in the direction of the elongate axis of the stem.

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