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PUNCH CONSTRUCTION AND GUIDE THEREFOR

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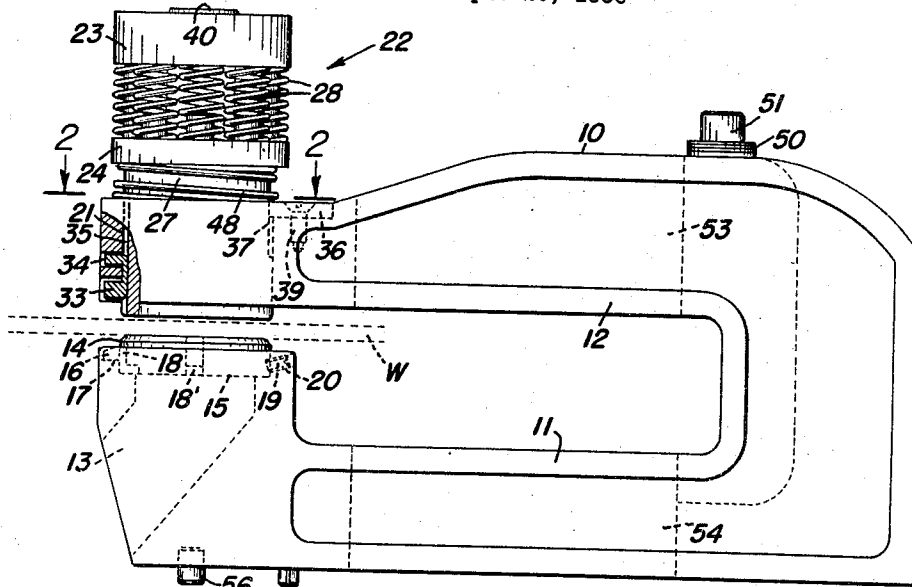


FIG. 1.

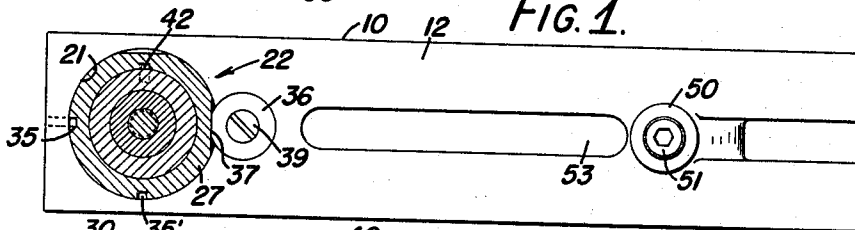


FIG. 2.

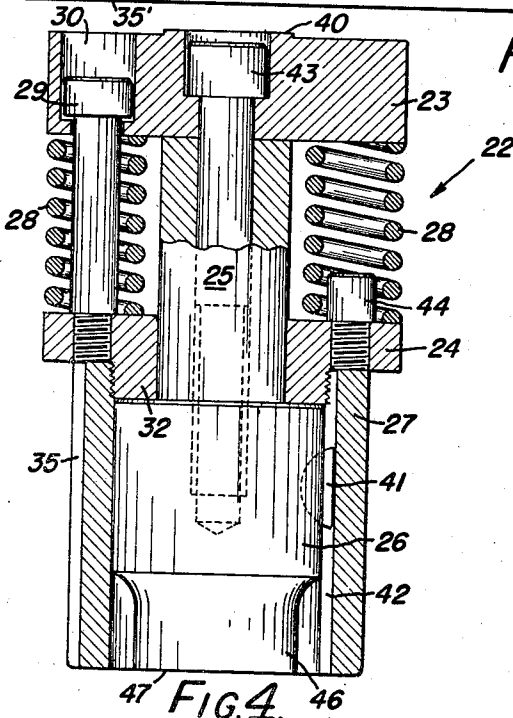


FIG. 3.

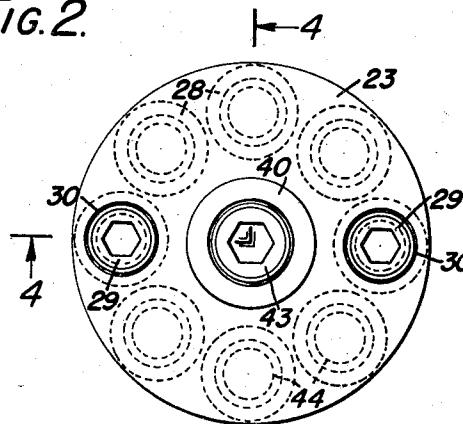


FIG. 4.

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PUNCH CONSTRUCTION AND GUIDE THEREFOR

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4 Claims. (Cl. 164—94)

This invention relates to a punching device for perforating sheet metal and other sheet material. More particularly, the invention relates to an improved punching and stripping unit for use in a self-contained punching device for perforating heavy sheet stock, where high perforating forces and high stripping pressures are required.

Self-contained perforating implements have come into widespread use because they permit punching a plurality of holes in a metal sheet simultaneously and in practically any desired relationship. A plurality of these devices can be mounted between the bed and the ram of a press, so that upon actuation of the ram, the workpiece is punched in a plurality of places simultaneously. Each unit comprises a manually transportable support, a punch and a die mounted in axially aligned relation in the support, and resilient stripping means.

When perforating metal sheets of great thickness, to provide adequate stripping force, it has been customary to build into each perforating implement a stripping unit comprising a plurality of stripping springs. Because of the tremendous perforating force required, and the consequent large stripping force involved, the springs sometimes break and require replacement. With the perforating implements heretofore used, if the springs break, or if they will not satisfactorily strip, or if there is any other dissatisfaction with the performance of the stripping assembly, the entire stripping assembly, including all its springs, had to be replaced.

When holes of other than circular cross-section have to be punched, the punch has to be of a shape to correspond to the shape of the hole. The angular positions at which the self-contained perforating implements can be secured to the bed of the punch are limited; and therefore the angular positions at which holes of rectangular or other non-circular shape can be punched in a sheet are limited, in the case of conventional perforating implements, unless a large stock of punch bits of different shapes is provided. This, however, means a large and expensive inventory.

Another difficulty encountered in punching heavy sheet stock is the rapid dulling of the punch. This may be remedied by frequent grinding, but this changes the overall dimension of the punch and necessitates adjustment. With devices available in the past, adjustment of the punch lengthwise has been difficult or impossible. The useful life of the punch has, therefore, been limited.

An object of the invention is to provide a punching and stripping assembly for heavy-duty work, of simple and inexpensive design, and which may be readily disassembled for replacement or removal of springs and other parts.

Another object of the invention is to provide an improved punching and stripping assembly of the type described, wherein individual stripping springs are readily removable for replacement.

A further object of the invention is to provide a punching and stripping assembly incorporating therein a punch

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of simple design, low initial cost, and of a construction facilitating lengthwise adjustment of the punch in the assembly to compensate for wear.

Still another object of the invention is to provide an improved punching and stripping assembly and a corresponding die for a self-contained perforating implement, in which both the punching and stripping assembly and the die are selectively angularly positionable in the implement, whereby a punch and a die may be properly oriented for punching holes of other than circular shape at desired positions in a workpiece.

In the illustrated embodiment of the invention, the perforating implement includes a holder of the C-frame type, having a lower arm and an upper arm, a die mounted on the lower arm, and a punching and stripping assembly mounted in alignment with the die in a guide bore in the upper arm. The punching and stripping assembly includes a sleeve reciprocable in the guide bore, an upper collar, a lower collar that has a portion of reduced diameter that is threaded into the upper end of the sleeve, a punch bit mounted in the sleeve for guided reciprocation therein and having its upper face abutted against the lower face of the reduced diameter portion of the lower collar, a spacer that is interposed between the upper collar and the punch bit and that passes through a bore in the lower collar, a bolt securing together the upper collar and the punch bit and passing through the spacer, and a plurality of springs disposed in equi-angular spaced relation about the punch between the two collars. The springs are seated on pilot pins secured in the lower collar.

The punch bit is secured against rotation relative to the sleeve by a feather key interposed between the two. The sleeve has a pair of keyways on its external surface, extending axially thereof, and angularly spaced 90° apart. A key seated in the upper arm of the C-frame is selectively engageable in one of the keyways to hold the sleeve against rotation relative to the C-frame. Thus, the punching and stripping assembly may be oriented relative to the C-frame and the work. A pair of correspondingly angularly spaced keyways are also provided in the die for engagement with the key in the lower arm of the C-frame holder. Thus, the die is correspondingly selectively positionable on the lower arm of the C-frame holder.

In order to adjust the punch lengthwise when necessary, one or more shims may be interposed between the punch bit and the spacer, around the bolt. For convenience, the shims which may be required during the life of any punching implement are secured on the holder by a cap screw.

The invention may be best understood by consideration of the following description, taken with the drawing.

In the drawing:

Fig. 1 is a side elevation in partial section of a punching implement constructed according to one embodiment of this invention;

Fig. 2 is a top plan view thereof, the stripping and punching assembly being shown in a section taken on the line 2—2 of Fig. 1 looking in the direction of the arrows;

Fig. 3 is a top plan view on an enlarged scale of the stripping and punching assembly; and

Fig. 4 is a section on the same scale as Fig. 3, taken on the line 4—4 of Fig. 3 looking in the direction of the arrows.

Referring now in detail to the drawing, the self-contained perforating implement shown includes a C-frame holder 10 having a lower arm 11 and an upper arm 12. A die 14 is supported on the lower arm and is seated in a recess therein. A key 16 which seats in a slot 17 in the lower arm, is selectively engageable in keyways 18

and 18' angularly spaced 90° apart. Thereby the die 14 may be held against rotation in either of two positions spaced 90° apart. A set-screw 19 is threaded through an aperture 20 in the lower arm diametrically opposite the key 16, to secure the die on the holder. A chute 13 extends downwardly through the lower arm from the die 14 for discharge of slugs punched out of the work.

The stripping and punching assembly is indicated generally in the drawing by the numeral 22. As best shown in Fig. 4, this assembly includes an upper collar 23, a lower collar 24, a sleeve 27, a tubular spacer 25, a punch bit 26, a bolt 43, stripper springs 28, and a pair of bolts 29. The lower collar 24 has a reduced diameter portion 32 that is threaded into the upper end of the sleeve 27. The punch bit 26 is slidably mounted in the sleeve 27 and is spaced from the upper collar by the spacer 25 that seats against the upper collar 23 and that passes through the bore of the lower collar 24. The punch bit 26 is secured to the upper collar 23 by the bolt 43 that passes through the spacer. The upper collar 23 has a central boss 40 which provides a striking surface for the ram of the press in which the implement is used; and the upper collar is counterbored to receive the head of the bolt 43. A plurality of springs 28 is disposed in equi-angularly spaced relation about the spacer.

The upper and lower collars are secured together by a pair of stripper bolts 29 which are diametrically opposed and whose heads are received in countersunk apertures 30 in the upper collar. A spring 28 is mounted around each of the two bolts 29, and each of the remaining springs 28 is seated at one end thereof on a pilot pin 44 that is secured in the lower collar. All the springs 28 abut at their upper ends against the lower face of the upper collar 23.

A Woodruff key 41 is seated in the punch bit 26 and slides in a keyway 42 in the sleeve to prevent rotation of the punch bit relative to the sleeve. The punch bit 26 has its lower end shaped and sharpened to provide an operating portion 46 having an end face 47.

Referring now to Figs. 1 and 2 in particular, a C-shaped key 33 is disposed in a seat indicated generally by the numeral 34 located in the upper arm of the holder. Seat 34 comprises two axially spaced openings in the upper arm 12 which receive, respectively, the upper and lower arms of the key. The key 33 is selectively engageable in one of two axially-extending keyways 35, 35', spaced 90° apart in the sleeve 27.

A retainer disc 36 is secured to an upper surface of the upper arm by a screw 39. The retainer disc 36 engages in a slanted-off slot 37 formed on the periphery of sleeve 27, to prevent the punching and stripping assembly 22 from being expelled from the upper arm by the stripping force.

To restore the punching and stripping assembly 22 to the normal inoperative position after each operation, a mechanical lifter spring 48 is provided. This spring surrounds the sleeve 27 and is interposed between the lower collar 24 and the upper arm 12 of the holder.

In order to remove the punching and stripping assembly 22 from the holder, it is merely necessary to remove the screw 39 which secures the retainer disc 36 in place. The assembly may then be freely removed from the holder. To remove the punch bit 26 from the assembly, remove the bolt 43. To disassemble the springs 28 from the assembly it is only necessary to remove the two bolts 29.

To compensate for wear of the punch bit, such as occurs during normal usage and through grinding, the punch may be adjusted lengthwise in the punching and stripping assembly. This adjustment is accomplished by use of shims 50 of different thicknesses which may be interposed between the punch bit 26 and the spacer 25, around the bolt 43. For convenience, those shims 50, which are not in use, are stored by securing them to the holder by a cap screw 51.

The lower arm 11 and the upper arm 12 are slotted in

conventional manner, as indicated generally by the numerals 53 and 54, to allow the implement to be secured for use on the bed of a press brake, or other machine, by a bolt passed through the slot 54 in the lower arm 11 of the implement. A conventional pilot pin 56 is provided which is axially aligned with the punch and the die. The pilot pin is adapted to be placed in a properly located aperture in a template or other positioning device on the bed of the press brake, in order to locate the punching implement.

In the use of the punching implement, as for example in a press brake, the ram of the press brake is lowered and makes contact with the boss 40 on the upper collar 23 of the implement. This forces the whole punching-stripping assembly down in the bore 21 until the sleeve 27 engages the surface of the work W. The stripping springs 28 are then compressed as the upper collar 23 is moved toward the lower collar 24, and the punch is forced into the work. When the ram is raised, the stripping springs 28 force the upper collar 23 away from the lower collar 24 and strip the punch bit 26 from the work. Thereafter, the lifter spring 48 returns the punching and stripping assembly 22 to its normal inoperative position.

In punching shaped holes in a sheet of work material, the holes are frequently disposed at different angles. Orientation of the shaped punch bits relative to the work can be accomplished within limits by positioning the punching implement on the base of the press brake. However, with the implement of this invention, such orientation is facilitated and its scope enlarged, since both the punching and stripping assembly 22 and the die 14 may be selectively positioned in the holder in either of two positions which are angularly spaced 90° apart. In order to move the punching-stripping assembly from one position to another, it is merely necessary to remove the screw 39 and the retainer disc 36, to lift the assembly out of the bore 21 of the upper arm, and to rotate the assembly 90°, and to replace it in the bore 21 with the C-shaped key 33 engaged in the proper keyway 35 or 35' of the sleeve 27.

The bore of the die is shaped to correspond to the contour of the punch bit. Therefore, it is positioned in the holder correspondingly, with the key 16 seated in its seat 17 and engaging selectively either of the keyways 18 or 18', respectively. The term "shaped" as used herein to apply to the punch bit, the die, or a hole formed thereby, means "non-circular."

From the foregoing description, it will be evident that a novel structure has been provided which has several advantages. In punching implements of this general type which have been previously available, replacement of the punching and stripping assembly has been expensive since the lower collar was made integral with the sleeve, and replacement of one required the replacement of the other. Since the sleeve is a precisely machined part, and since labor charges involved in replacing the sleeve were a considerable factor, the present invention offers economies in manufacturing and in maintenance. The punch bit is a separate component of the punching and stripping assembly and is of a simple, inexpensive design. It can be replaced easily with a new punch bit at very low cost. The punch is easily adjusted lengthwise through the use of shims. The stripping springs are easily replaced by removal of the bolts which secure together the upper collar and the lower collar. Thus, for large production jobs, where the total force available and the resistance of the stripping springs must be carefully controlled, removal and placement of any selected number of stripping springs is simplified.

While the invention has been described in connection with a specific embodiment thereof, it will be understood that it is capable of further modification, and this application is intended to cover any variations, uses, or adaptations of the invention following, in general, the principles of the invention and including such departures

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from the present disclosure as come within known or customary practice in the art to which the invention pertains and as may be applied to the essential features hereinbefore set forth, and as fall within the scope of the invention or the limits of the appended claims.

Having thus described our invention, what we claim is:

1. A hole-punching device comprising a holder having a lower arm and an upper arm, and a punching and stripping assembly reciprocally mounted in a bore in said upper arm, said punching and stripping assembly comprising a sleeve slidably mounted in said bore, a lower collar having a portion of reduced diameter removably threaded to the upper end of said sleeve and having a central bore smaller than that of said sleeve, an upper collar axially spaced from the lower collar, stripping spring means releasably interposed between said collars, a punch bit slidably mounted in said sleeve, a separate spacer interposed between said punch bit and upper collar and passing through the bore in said lower collar, and means removably and operably securing said punch bit to said upper collar to move upon movement of said upper collar, whereby said punch and said sleeve may be removed from said assembly without release of said stripping spring means.

2. A hole-punching device comprising a holder having a lower arm and an upper arm, and a punching and stripping assembly reciprocally mounted in a bore in said upper arm, said punching and stripping assembly comprising a sleeve slidably mounted in said bore, a lower collar having a portion of reduced diameter removably threaded to the upper end of said sleeve and having a bore smaller than that of said sleeve, an upper collar axially spaced from the lower collar, stripping spring means releasably interposed between said collars, a punch bit slidably mounted in said sleeve, a separate spacer of smaller transverse size than said punch bit and interposed between said upper collar and punch bit and passing through the bore of said lower collar, means removably securing together said upper collar, punch bit and spacer, and means for adjusting said punch bit lengthwise, whereby said punch and said sleeve may be removed from said assembly without release of said stripping spring means.

3. A hole-punching device comprising a holder having a lower arm and an upper arm, a shaped die mounted on said lower arm, and a punching and stripping assembly mounted and guided for reciprocal movement in a bore in said upper arm, said punching and stripping assembly comprising a sleeve slidably mounted in said bore, key means seated in said upper arm and slidable selectively in one of at least two keyways angularly spaced apart on said sleeve to prevent rotation of said sleeve relative to said holder in different angularly displaced positions relative to said holder, a lower collar threaded into the upper end of said sleeve, an upper collar axially spaced from said lower collar, a plurality of stripping spring pilot pins secured on the upper face of said lower collar, at least two diametrically opposed bolts interconnecting said collars for movement together and for limited movement apart, said bolts and pins being disposed in equi-angular spaced relation about the upper face of said lower collar, stripping springs interposed between said

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collars and mounted around said bolts and on said pilot pins, a shaped punch bit slidably mounted in said sleeve in alignment with said die, key means seated in said punch bit and slidable in a keyway in said sleeve to prevent rotation of said punch bit relative to said sleeve, a tubular spacer interposed between said punch bit and upper collar and passing through said lower collar, and a bolt passing through said spacer and securing together said upper collar and punch bit.

4. A hole-punching device comprising a holder having a lower arm and an upper arm, and a punching and stripping assembly disposed for reciprocation as a unit in a bore in said upper arm, a lifting spring disposed to act between said upper arm and said assembly and biasing said assembly away from said arm, said punching and stripping assembly comprising a sleeve having larger and smaller internal substantially concentric diameters slidably mounted in said bore, a cylindrical punch bit directly slidably mounted in said sleeve and guided at its largest diameter by said sleeve at said larger internal sleeve diameter, said punch bit being of less overall length than said sleeve, a tubular spacer of smaller outside diameter than said largest diameter on said punch bit, said spacer being directly slidably mounted in said sleeve and having a portion guided by said sleeve at said smaller internal sleeve diameter, means extending axially through said tubular spacer and removably securing said spacer against said punch bit for reciprocation of said punch bit, said spacer having a radially enlarged head disposed in fixed axial relation to said guided portion and axially remote from said sleeve, said head having a distal end surface for being engaged by the ram of a press, and a plurality of compression springs interposed between and engaging said radially enlarged head and said sleeve for stripping said punch bit from a workpiece.

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