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H. C. GLITSCH
PUNCHING AND EXTRUSION UNIT
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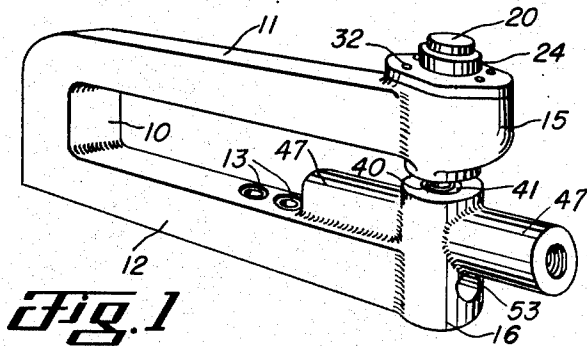


Fig. 1

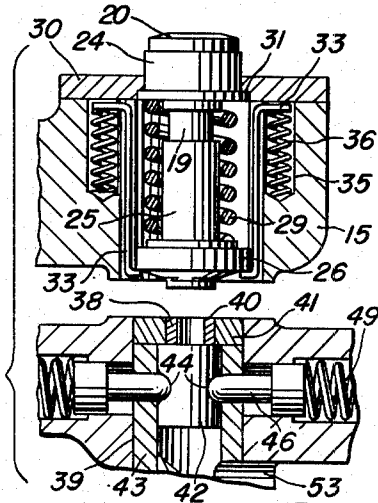


Fig. 2

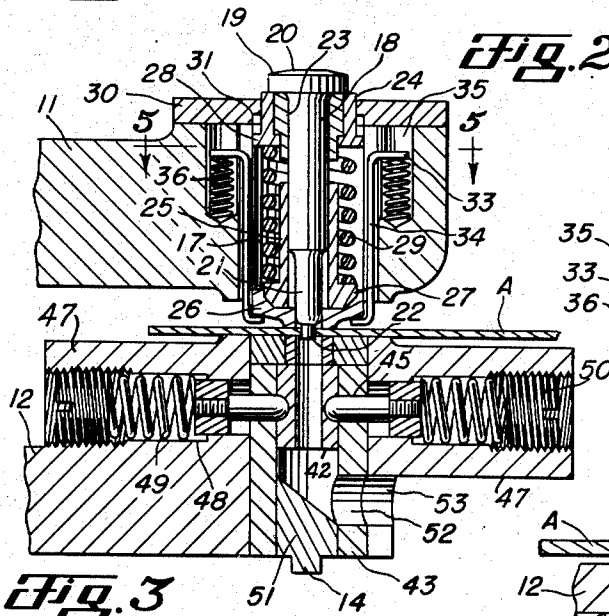


Fig. 3

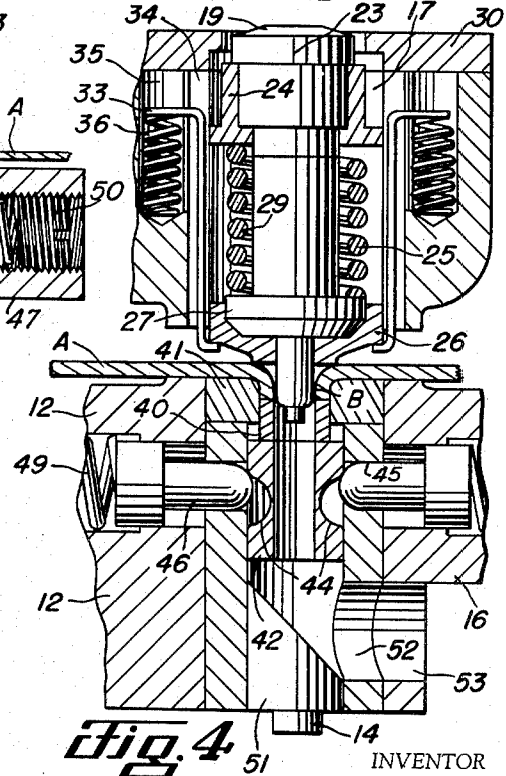


Fig. 4

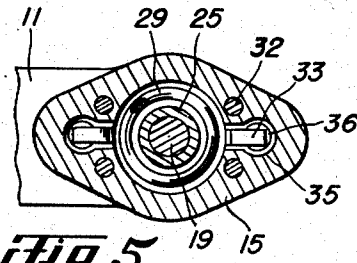


Fig. 5

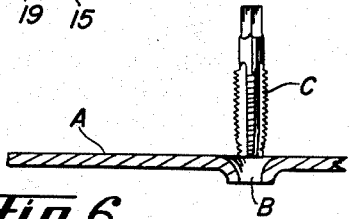


Fig. 6

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PUNCHING AND EXTRUSION UNIT

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7 Claims. (Cl. 164—86)

This invention relates to new and useful improvements in punching and extrusion units.

One object of the invention is to provide improved means for punching and extruding openings in sheet metal and thin plates which is particularly adapted for use in punch presses.

Another object of the invention is to provide improved means for punching and extruding openings in sheet metal and thin plates in one continuous operation to facilitate tapping of the extruded openings.

A further object of the invention is to provide an improved punching and extrusion unit having a coacting punch and die wherein the die is arranged and mounted so as to support the plate or sheet during punching thereof and so as to be movable out of supporting position to permit extrusion of the punched opening.

Still another object of the invention is to provide an improved punching and extrusion unit, of the character described, wherein the die includes an inner coacting member resiliently mounted in an outer member so as to be movable relative thereto with the punch to permit extrusion of the opening by said punch.

A construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more readily understood from a reading of the specification and by reference to the accompanying drawing, wherein an example of the invention is shown, and wherein:

Fig. 1 is a perspective view of a punching and extrusion unit constructed in accordance with the invention,

Fig. 2 is a longitudinal, vertical, sectional view of the head and shoe of the unit,

Fig. 3 is a transverse, vertical, sectional view, taken at a right angle to Fig. 2, showing the punching step,

Fig. 4 is an enlarged, transverse, vertical, sectional view showing the extrusion step,

Fig. 5 is a horizontal, cross-sectional view, taken on the line 5—5 of Fig. 3, and

Fig. 6 is a vertical, sectional view illustrating the tapping of a punched and extruded opening.

In the drawing, the numeral 10 designates the U-shaped body of a punching and extrusion unit having horizontal legs 11 and 12 disposed in vertical alinement and adapted to be mounted upon the bed of a punch press (not shown). Although not illustrated, the unit is particularly adapted for use in groups which are actuated simultaneously by a press bar or ram to punch a plurality of openings in sheet metal or thin plates, such as the sheet A. One or more openings 13 are formed in the underlying leg 12 to permit fastening of the unit to the press bed and a positioning pin 14 preferably depends from the outer or forward end portion of said leg. A punch holder or head 15 is provided at the outer end of the upper leg 11 in overlying relation to a die holder or shoe 16 at the outer end of the lower leg.

The head 15 has an upright, cylindrical bore 17 extending therethrough for receiving a punch assembly 18 which includes an axial punch pin or tool 19 having a flanged head 20, a reduced, intermediate shank or bit 21 and a further reduced lower extremity or tip 22 (Fig. 3), whereby the punch tool is shouldered and has a pair of work-engaging portions of different diameters. A pair of concentric, guide collars 23 and 24 encircle the upper end of the tool 19 below its flanged head 20, while a tubular guide or sleeve 25 and a stripper collar 26 concentrically surround the lower portion of said

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tool. The sleeve 25 is seated in the stripper collar 26 and has an external, radial flange 27 at its lower end coacting with a radial flange 28 on the lower end of the outer guide collar 24 for confining a coiled spring therebetween. It is noted that the flange 28 extends internally as well as externally and that the inner guide collar 23 is reduced in diameter so as to have shouldered supporting engagement with said flange and so as to project therethrough in spaced relation to the upper end of the sleeve 25. A cap plate 30, having a recessed or shouldered opening 31 for receiving and confining the outer guide collar in coaction with its flange, overlies the head 15 and is secured thereto by suitable recessed screws 32.

The external diameters of the stripper collar 26 and the collar flange 28 are substantially equal to the diameter of the bore 17, while the bores of the inner guide collar 23 and sleeve 25 are of substantially the same diameter as the tool 19, whereby said stripper and outer guide collars have a snug sliding fit in said bore 17 and said tool has a snug sliding fit in said inner guide collar and sleeve bores. Also, the internal diameter of the stripper collar is substantially equal to the diameter of the shank 21 so as to provide a guide for the lower portion of said tool. In order to assure joint movement of the guide collars and tool, the head 20 of said tool has a diameter greater than the internal diameter of the outer guide collar 24 and overlies said collar.

For supporting the punch assembly 18, a pair of angular lifter arms or elements 33 are disposed in coextensive slots 34 communicating with the bore 17 and preferably diametrically opposed. The lower ends of the lifter arms 33 are directed inwardly so as to engage the underside of the stripper collar, while the upper ends of said arms project outwardly into recesses or sumps 35 communicating with the slots 34 (Figs. 3 and 5). A coiled spring 36 is confined in each sump 35 beneath the outwardly projecting upper end of the lifter arm and is secured thereto preferably, whereby the lifter arms are resiliently suspended for supporting the stripper collar as well as the remainder of the punch assembly in the bore 17. The cap plate 30 closes the upper ends of the slots and sump and prevents displacement of the lifter arms. As shown in Fig. 2, the punch assembly is supported in a raised position and the spring 29 urges the collar 24 upwardly with its flange 28 in engagement with the shouldered opening 31 whereby the punch tool 19 and both guide collars project above the cap plate.

A die assembly 38 is mounted in an upright, cylindrical bore 39 extending through the shoe 16 in axial alinement with the bore 17. The die assembly 38 includes a two-piece die having a pair of annular, concentric, inner and outer members or dies 40 and 41 supported by a pair of inner and outer tubular barrels or sleeves 42 and 43, each barrel forming a part of its respective guide and being made separately for economy of manufacture. Since the external diameter of the inner barrel 42 is greater than the external diameter of the inner die 40, the latter is supported independently of the outer die 41. The outer barrel 43 is of greater length than the inner barrel and extends to the lower end of the shoe to provide a firm base for the outer die 41. It is noted that the bore of the inner die preferably is slightly greater than the diameter of the tip 22 of the punch tool to eliminate the forming of burs. A pair of radial recesses or sumps 44, preferably diametrically opposed, are formed in the exterior of the inner barrel and are adapted to register with complementary openings 45 in the outer barrel for engagement by spring-pressed pins or detents 46. The shoe 16 has lateral, tubular extensions 47 provided with bores 48 in communication with the openings 45 and in which the pins 46 are mounted. Coiled springs 49 are confined in the bores 48 by set screws 50 for resiliently urging the pins into engagement with the recesses 44 to thereby resiliently support the inner barrel and inner die. The lower end of the outer barrel has its bore closed by a cylindrical plug 51 which carries the depending positioning pin 14. Communicating openings 52 and 53 are formed in the side walls of the outer barrel and shoe immediately above the plug 51, and the upper end of said plug is inclined toward the openings for

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directing punched blanks therethrough so as to discharge the same.

In operation, the sheet or plate A to be punched and extruded is inserted between the head 15 and shoe 16 in the usual manner and the press bar or ram (not shown) is then lowered to force the punch assembly 18 downwardly into engagement with the sheet. As shown in Fig. 3, continued downward movement ejects the punch tool 19 whereby its tip 22 pierces or punches an opening in the sheet in cooperation with the inner die 40. Of course, the guide collars 23 and 24 move downwardly with the punch tool and the sleeve 25 and stripper collar 26 remains stationary after engagement of said stripper collar with the sheet, whereby the spring 29 is compressed. The force of the springs 49 is sufficient to maintain the pins 46 in engagement with the recesses 44 for supporting the inner barrel and inner die during the punching step. Continued downward movement, however, of the punch tool overcomes the resilient support provided by the spring-pressed pins and depresses the inner die and inner barrel as shown in Fig. 4. The shank 21 of the punch tool is now in engagement with the sheet and bends or breaks the same at the inner periphery of the outer die 41 so as to enlarge the opening punched in said sheet and extrude the metal surrounding said opening as shown by the letter B in Fig. 6. Obviously, depression of the inner die and inner barrel is caused by the extrusion of the opening and is permitted by the retraction of the spring-pressed pins.

Upon upward movement of the punch assembly, the pins are returned into engagement with their recesses so as to raise the inner barrel and inner die. Due to the compression of the spring 29, the guide collars and punch tools are retracted or forced upwardly relatively to the sleeve and stripper collar so as to strip the sheet from the shank of said tool. The force of the lifter springs 36, which are compressed by downward movement of the punch assembly, is sufficient to retract the sleeve and stripper collar. As shown in Fig. 6, the extruded opening B may be tapped by a suitable tool C and an appreciable surface for tapping is provided due to the extrusion of the metal surrounding said opening.

The foregoing description of the invention is explanatory thereof and various changes in the size, shape and materials, as well as in the details of the illustrated construction may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:

1. A punching and extrusion unit including, a punch having a reduced punching tip, a two-piece die in axial alinement with the punch, the die having an outer stationary member and an inner relatively movable member adapted to cooperate with the tip in punching an opening, and spring-pressed means extending transversely into positive engagement with the inner die member to resiliently support said member in cooperating relation to said tip and permit subsequent movement of said member with said tip relative to the outer die member, said outer die member cooperating with said punch to extrude material surrounding an opening punched by the aforesaid relative movement.

2. In a punching and extrusion unit having punch and die holders, a die resiliently mounted in one holder, a punch mounted in the other holder and having a reduced tip movable into cooperative engagement with the die for punching an opening, and spring-pressed means mounted transversely in the die holder and extending into positive engagement with the die to support said die during punching of the opening, the resilient mounting of the means permitting retraction thereof and movement of said die with the tip upon continued movement of the punch for extrusion of material surrounding the punched opening.

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3. In a punching and extrusion unit having punch and die holders, a two-piece die mounted in one holder and including an outer die member and an inner concentric die member, a punch mounted in the other holder in axial alinement with the die and having a reduced tip movable into cooperative relation with the inner die member for punching an opening, and spring-pressed means mounted in the die holder in transverse positive engagement with the inner die member to support said member during punching of the opening, the resilient mounting of the means permitting retraction thereof and movement of said inner die member with the tip upon continued movement of the punch, the outer die member cooperating with said punch to extrude material surrounding the punched opening.

4. In a punching and extrusion unit having punch and die holders, a two-piece die mounted in one holder and including an outer die member and an inner concentric die member, a punch mounted in the other holder in axial alinement with the die and having a reduced tip movable into cooperative relation with the inner die member for punching an opening, a sleeve mounted in the die holder below the inner die member, and a transverse element resiliently mounted in said die holder for transverse movement into positive engagement with the sleeve to support said sleeve and inner die member during punching of the opening, the resilient mounting of the element permitting retraction thereof and movement of said sleeve and member with the tip upon continued movement of the punch, the outer die member cooperating with said punch to extrude material surrounding the punched opening.

5. In a punching and extrusion unit as set forth in claim 4 wherein the sleeve has an exterior radial recess for receiving the element, the movement of said sleeve moving the recess out of registration and positive engagement with said element.

6. In a punching and extrusion unit having punch and die holders, a die assembly mounted in one of the holders and including a pair of annular concentric dies, a pair of concentric sleeves in said die holder supporting the dies, the inner die and inner sleeve being movable longitudinally relative to the outer die and outer sleeve, spring-pressed pins mounted transversely in said die holder and extending through the outer sleeve into positive engagement with said inner sleeve to resiliently support said inner die, and a punch assembly mounted in the other holder and including a punch supported in axial alinement with said dies, the punch having a reduced extremity movable into cooperative engagement with said inner die for punching an opening, said inner die and inner sleeve remaining stationary during punching of the opening and moving with said punch upon continued movement thereof, said outer die and punch cooperating to extrude material surrounding the punched opening upon relative movement of said inner die and inner sleeve.

7. In a punching and extrusion unit as set forth in claim 6 wherein the inner sleeve has a radial recess in its exterior for receiving the ends of the spring-pressed pins, the relative longitudinal movement of said inner sleeve moving the recess out of registration and positive engagement with said pins.

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