May 19, 1959 A. L. REHDORF 2,887,157

PUNCHING AND EXTRUDING DEVICE

Filed April 27, 1956

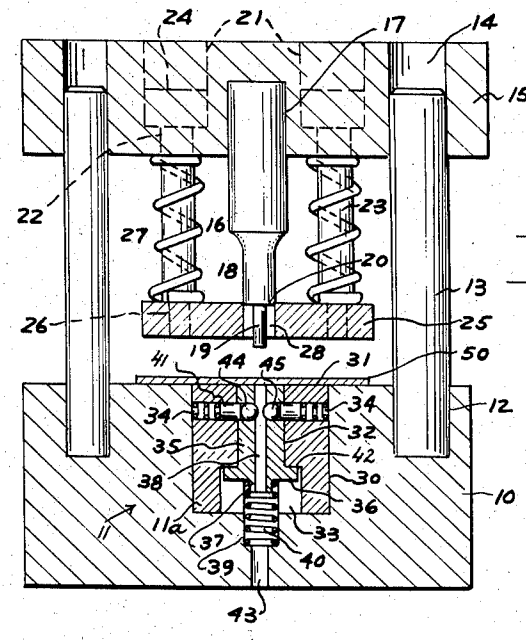



Fig. 1

Fig. 2

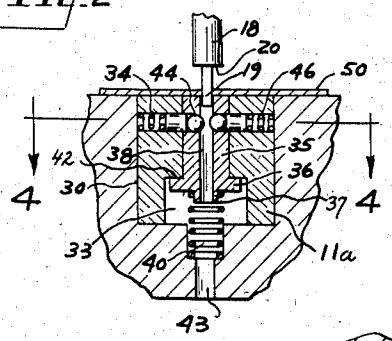
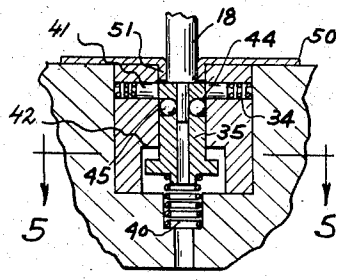



Fig. 3



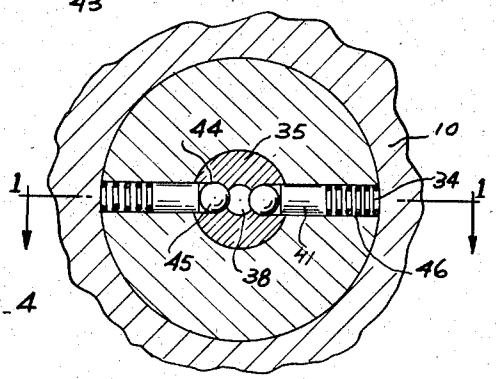




Fig. 4

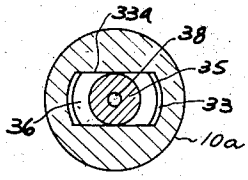



Fig. 5

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United States Patent Office 2,887,157 Patented May 19, 1959



2,887,157

# PUNCHING AND EXTRUDING DEVICE

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Application April 27, 1956, Serial No. 581,123

1 Claim. (Cl. 164—86)

My improvement pertains to a combination of a punch and a die for the purpose of first punching a hole of a restricted diameter in a sheet metal blank supported on the die and then, as a part of one continuous operation, extruding the marginal portion of the blank about the hole into the tubular member.

The object of the improvement is to provide a device of such efficiency that extrusions effected by means thereof will be free of any splits, cracks, or ragged and uneven rim portions.

Another object of the improvement is to provide a compact mechanism having but a few parts but fully practical for the purposes for which it has been designed.

I shall now describe my improvement with reference to the accompanying drawings in which:

Fig. 1 is a vertical cross section of the device in a plane passing through line 1—1 of Fig. 4, including a punch assembly and a complementary die assembly;

Figs. 2 and 3 disclose the same device in cross-section, the view disclosing parts thereof in two consecutive operative stages;

Fig. 4 is an enlarged sectional view on line 4—4 of Fig. 2;

Fig. 5 is a sectional view on line 5—5 of Fig. 3.

Similar numerals refer to similar parts throughout the several views.

The die assembly of the device includes a solid block 10 which contains a die generally identified by numeral 11 and which, by intermediate means, serves to support the punch designed to co-operate with the die. Held within wells 12 in block 10, and rising from its upper surface, are two upright columns 13 which will be referred to herein as guiding columns. The upper portion of each column fits into a cylindrical aperture 14 in a horizontally-disposed block 15 which will be referred to herein as the upper block and which at its mid-portion is provided with a vertical, downwardly-opening socket 17. Secured within the socket is a punch 16. The operative end of the punch includes a bit 18 which is of a reduced diameter as compared with that of the shank with a tip 19 which is still further reduced in diameter, so that as a result thereof a shoulder is formed at the junction of the tip with said bit.

The mid-portion of said upper block 15 contains a plurality of vertical sockets 21, each of which opens downwardly into a bore 22 of relatively reduced diameter. Located in each socket and the bore extending therefrom is a rod 23. The top portion of each rod is provided with a head 24 expanded radially to a size to fit into the socket, while the lower ends of the rods are connected to a horizontally-disposed presser plate 25 which for the purpose of said connections is provided with a plurality of bores 26. As shown in the drawings, the lower ends of said rods are held within said bores. Bearing against the presser plate from above, and coiled about each rod, is a spring 27 which at the upper end bears against the underside of said upper block 15. The



central portion of the presser plate is provided with a vertical aperture 28 which is axially alined with the axis of the punch and which is of a sufficient diameter to permit vertical sliding movement of the bit through said aperture.

The die 11 includes a cylinder 11*a* seated in a well 30 in the block 10 in such a manner that its top is flush with the top surface of said block. The cylinder is provided with an axial bore 32 which extends from the top of the cylinder to a diametrically-expanded socket 33 within the lower portion of the cylinder, the socket being defined, in part, by two parallel sides 33*a*, as shown in Fig. 5. A shoulder, formed at the junction of the socket with said bore 32 is marked 42. The bore 32 opens into a plurality of radially-extending apertures 34 to which I shall presently refer. Slidably disposed within said bore is a cylindrical member 35 which at its lower end includes a laterally-extending flange 36 defined, in part, by two parallel sides 36*a*, the flange bearing normally against said shoulder 42. Integrally formed with the flange is a downwardly-projecting nipple 37, and partly coiled about the nipple, and extending downwardly into a recess 39 in the lower portion of the die 11, is a coiled spring 40 which bears against said flange 36. A vertical outlet 43 leads from the recess outwardly. The inner diameter of the coiled spring 40 is equal to or somewhat larger than the diameter of the outlet 43 which has the form of a smooth vertical bore.

The sliding cylinder 35 is provided with a plurality of radial holes 44 which are normally alined with the apertures 34 in the cylinder 11*a*. Located in each hole is a ball 45 which extends partly into the bore 38 but is restrained from fully entering said bore by a constriction of the inner end of said hole. Each ball is backed up by a sliding pin 41 which is partly disposed within a respective hole 44 but mainly within an aperture 34 alined therewith. A coiled spring 46 bears against one end of the pin 41, urging it inwardly towards the ball.

The manner in which the device operates is as follows:

It will be assumed that the punch assembly, including the upper block 15 which carries the punch 16, will be secured to the underside of a power-operated ram which will be capable of lowering the punch assembly into its operative engagement with the die. It will be further assumed that prior to the operation of the device the punch assembly will be in a spaced relation to the top of block 10 so that a sheet metal blank 50 may be placed over the top of the die, as shown in Figs. 1 to 3.

On lowering of the punch assembly along the guiding columns 13, the presser plate 25 will clamp the blank 50 against the upper surface of the die 11, while the tip of the punch will penetrate the blank and enter into the bore 38 within the sliding cylinder 35, as shown in Fig. 2. When the punch is moved downwardly, the sliding cylinder 35 is, at first, held against movement downwardly by said pins 41 which extend from apertures 34 in the cylinder 11*a* into the holes 44 in the cylinders 35. However, when the tip 19 of the punch will have encountered the balls 45, it will spread them apart, causing each ball to move each pin 41 out of the respective hole. This outward movement of the pins will permit the cylinder 35 to be depressed into the bore 32. This is effected by the shoulder portion 20 of the bit 18 which, bearing from above against the marginal portion of blank 50 which adjoins the aperture therein by the tip 19, will force said marginal portion of the blank into said bore 32, drawing it downwardly and forming it into a tubular form 51, as shown in Fig. 3. It will be understood that bits of metal punched out of plate 50 will fall by gravity through the bore 30, then

through the interior space within the coiled spring 40 into the outlet 43, and thence downwardly and outwardly.

On release of the pressure upon said upper block, the springs 27 will spread the upper block 15 and the presser plate 25 to their original spacing, causing the punch to be withdrawn from the engagement with the die and permitting the spring 40 under the flange 36 to push the cylinder 35 back to its initial position within the bore 32. Once the cylinder 35 has returned to said initial position, springs 46 will push each pin 41 back into a respective hole 44 in the cylinder 35, as best shown in Fig. 4.

It will be understood that some changes may be made in the structural design of the elements shown by me without departing from the inventive concept of my improvement.

What I, therefore, wish to claim is as follows:

In a punch and die assembly in which the punch includes a bit terminating with an elongated tip of reduced diameter, a die comprising an outer member having a flat upper surface and being provided with a vertical bore of a diameter to receive the bit of the punch, the bore leading to an expanded chamber within the lower portion of the die, said outer member being also provided with a plurality of radial ducts leading



from the bore at a level below said upper surface of the die, a sliding cylinder axially disposed within said bore, the cylinder including at its lower end means in engagement with the wall of the chamber to prevent rotary movement of the cylinder about its axis and to limit its vertical movement, the cylinder having an axial bore of a diameter to receive the tip of the punch, the wall of the cylinder being provided with a plurality of openings leading radially from its bore and being normally in register with said ducts, a ball disposed in each opening and partly projecting into the bore, a spring biased pin in each duct, the pin projecting partly into a respective opening to prevent vertical movement of the cylinder and bearing against the ball therein, the balls being adapted to be reached by the tip of the punch and to be pushed outwardly from the bore to move the pins out of said openings, and spring means bearing within the chamber and urging the cylinder upwardly.

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