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COMPOSITE PUNCHING AND DIMPLING TOOL

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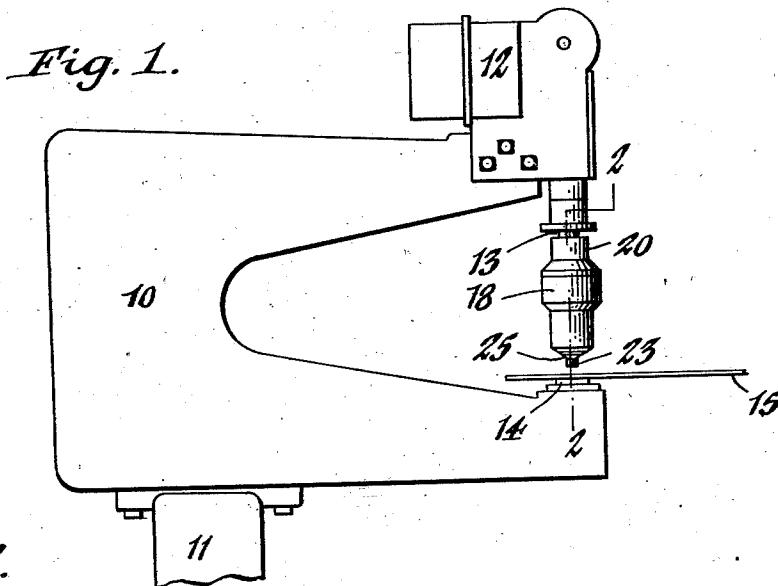


Fig. 2.

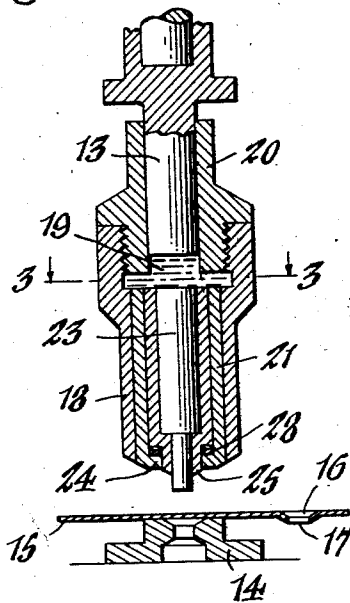


Fig. 4. Fig. 5.

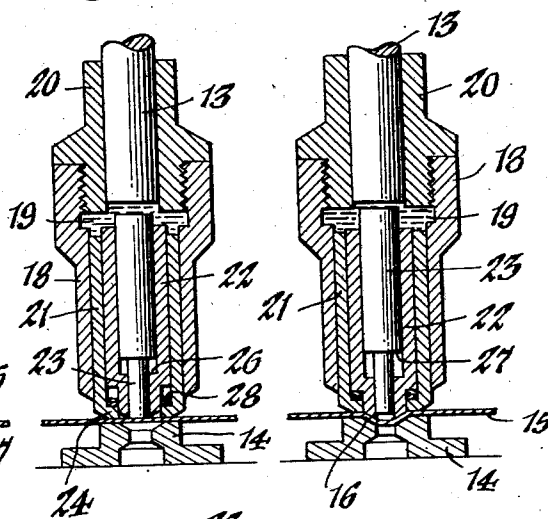


Fig. 3.

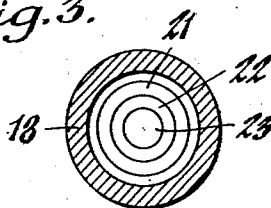
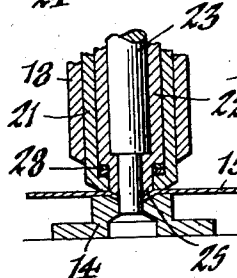


Fig. 6.



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COMPOSITE PUNCHING AND DIMPLING TOOL

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5 Claims. (Cl. 153-2)

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This invention relates generally to certain new and useful improvements in punch apparatus but more particularly to a device or apparatus for both punching and dimpling sheet metal and the like for riveting purposes.

It has for one of its objects to provide an apparatus of this character which is so designed and constructed as to effectually accomplish in a single operative stroke the clamping of the work as well as the dimpling and punching thereof.

Another object of the invention is to provide a novel arrangement of clamping, dimpling and punching dies which is simple, compact and inexpensive in construction, efficient and reliable in operation, and which is not liable to get out of order.

A further object is to provide a unitary clamping, dimpling and punching die assembly which employs hydraulic pressure for controlling the sequential operations of clamping, dimpling and punching.

Other features of the invention reside in the construction and arrangement of parts herein-after described and particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is a fragmentary side view of a punch press showing my improved tool installed thereon. Figure 2 is an enlarged vertical section taken on line 2-2, Figure 1. Figure 3 is a horizontal section on line 3-3, Figure 2. Figures 4, 5 and 6 are fragmentary vertical sections showing the sequence operation of the tool elements for clamping the work in place, for dimpling, and for punching, respectively.

Similar characters of reference indicate corresponding parts throughout the several views.

By way of example, my composite tool has been shown as installed on a punch press or like machine, wherein 10 indicates the machine-yoke, 11 the pedestal for supporting it, and 12 the power unit to which the actuating plunger 13 for transmitting the operative strokes to the tool is connected. Mounted on the lower portion of the yoke is the anvil or die 15 on which the work 15 to be punched and dimpled is supported.

The improved tool, which has been designed to efficiently perform in one sequential operation the clamping of the work to the anvil, the dimpling of the work to provide a counter-seat 16 for a rivet or the like, and the punching of a hole 17 in the work axially of such seat, consists of a retaining body or cylinder 18 open at its lower end and having a counter-bored portion in its upper end forming a pocket or chamber 19 for receiving

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oil or a like fluid medium which is adapted to be subjected to pressure by the actuating plunger 13 for transmitting operative strokes to the various tool elements. Screwed or otherwise fitted in the upper end of this cylinder is a guide 20 for the plunger, the lower ends of the guide and the plunger forming the top wall of the chamber 19. It will be noted in Figure 2 that the level of the oil in this chamber is such that it extends partly into the bore of the plunger-guide and in the elevated position of the plunger there is a small air or vacuum space.

Fitted in the cylinder 18 for actuation by the hydraulic ram effect produced by the plunger and oil are the tool elements 21, 22 and 23 which are disposed in concentric or telescoped relation for relative movement in response to the strokes of the plunger. The outermost element 21, which is the work-engaging or clamping element, is in the form of a sleeve in direct bearing engagement with the cylinder, being exposed at its upper end to the oil in the chamber 19 while its lower end normally extends slightly below the corresponding end of the cylinder and terminates in an inwardly-facing annular flange 24 constituting a stop shoulder for limiting the downward or operative displacement of the next adjoining or dimpling element 22. The latter is likewise sleeve-like in form, being guided on the clamping element 21, and terminates at its lower end in a dimpling stud or projection 25 which normally extends slightly below the work-engaging face of the clamping element 21. This dimpling element also is provided adjacent its lower end with an inwardly-facing annular flange 26 constituting a stop shoulder for limiting the downward or operative displacement of the innermost tool element 23. This latter element is the punching die and is in the form of a rod terminating at its lower end in a downwardly-facing shoulder 27 adapted to abut the shoulder 26 for limiting its downward displacement relative to the dimpling element. Normally the lower end of this punching element extends somewhat below that of the dimpling element while the upper ends of the several tool elements 21, 22 and 23 are substantially flush and severally form the floor or bottom of the oil chamber 19. One or more shims 28 are disposed between the shouldered ends of the tool elements 21 and 22 to obtain the required accuracy of operation of such elements. The cross-sectional areas of these tool elements are such that the outer or clamping element 21 has the largest area, the intermediate or dimpling element 22 the next largest area, and the innermost or

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punching element 23 the least area, so that when the hydraulic pressure exerted by the plunger is transmitted to these elements they will respond in the sequence named.

In operation, assuming a sheet of material to be placed on the anvil 14, the power unit 12 is operated to lower the plunger 13 and accordingly the tool element 21 is lowered to clamp the sheet firmly to the anvil, after which the dimpling and punching elements 22 and 23, respectively, are lowered to produce the dimple or counter-seat 16 and the rivet hole 17 in the sheet. On the return stroke of the plunger, the tool elements are automatically retracted to their normal position by the resulting vacuum which also serves to retain the tools in such position in readiness for the next operative stroke.

I claim as my invention:

1. A tool of the character described, comprising a punch and die for forming an opening in a sheet of material, a dimpler disposed in correlation with said punch and die for movement relative thereto for forming a dimple in the material about the punch-formed opening, a pressure member disposed in correlation with said dimpler for clamping the material between it and the die during the punching and dimpling operation, said punch, dimpler and pressure plate being disposed in telescopic relation for independent relative movement, and fluid-pressure means including a cylinder housing said parts and a plunger in operative endwise relation to and for actuating said parts, through the medium of the fluid, in sequence as determined by the relative areas thereof exposed to such fluid pressure.

2. A tool for punching and dimpling, comprising a punch, a dimpler and a pressure plate, said parts being disposed in axial relation for relative movement, a retaining cylinder for housing such parts and including an oil chamber in the upper end thereof, the upper ends of such parts being exposed to and forming the floor of said oil chamber, and a plunger operable in said chamber for exerting a pressure on the oil therein for transmitting operative strokes to said punch, dimpler and pressure plate in sequence.

3. A tool of the character described, comprising a cylinder open at its lower end and having a piston guide at its upper end, said cylinder and guide being disposed to provide an oil chamber in the upper end of the cylinder, a piston operable in the guide and said chamber, and punch, dimpling, and work-clamping elements disposed in concentric relation axially of said cylinder for relative movement toward and from the work

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to be operated upon and exposed at their upper ends to said oil chamber for actuation by hydraulic pressure in response to an operative stroke of the piston, said work-clamping element being rendered operative first and said dimpling and punch elements being successively operative thereafter.

4. A tool of the character described, comprising a cylinder open at its lower end, punch, dimpling and clamping elements disposed in concentric relation axially of said cylinder for movement toward and from the work to be operated upon, a piston guide applied to the upper end of said cylinder and providing an oil chamber between such parts and the upper ends of the punch, dimpling and clamping elements, and a piston operable in said guide and said chamber for transmitting operative strokes to said elements by hydraulic pressure to successively bring the clamping element, the dimpling element and the punch element into operative engagement with the work.

5. A tool of the character described, comprising a cylinder open at its lower end and having a piston guide at its upper end, said cylinder and guide being disposed to provide an oil chamber in the upper end of the cylinder, a piston operable in the guide and said chamber and punch, dimpling and work-clamping elements disposed in telescopic relation within said cylinder for axial movement relative thereto and exposed at their upper ends to and constituting the floor of the oil chamber for actuation, in predetermined sequence according to their respective end areas, by hydraulic pressure in response to an operative stroke of the piston, the work-clamping element terminating at its lower end in a stop shoulder for limiting the downward displacement of the dimpling element and the dimpling element having a stop shoulder adjacent its lower end for limiting the downward displacement of the punching element.

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