Nov. 6, 1945. A. C. JACKSON 2,388,546

PUNCH AND DIE SETTING

Filed June 10, 1944

FIG. 1.

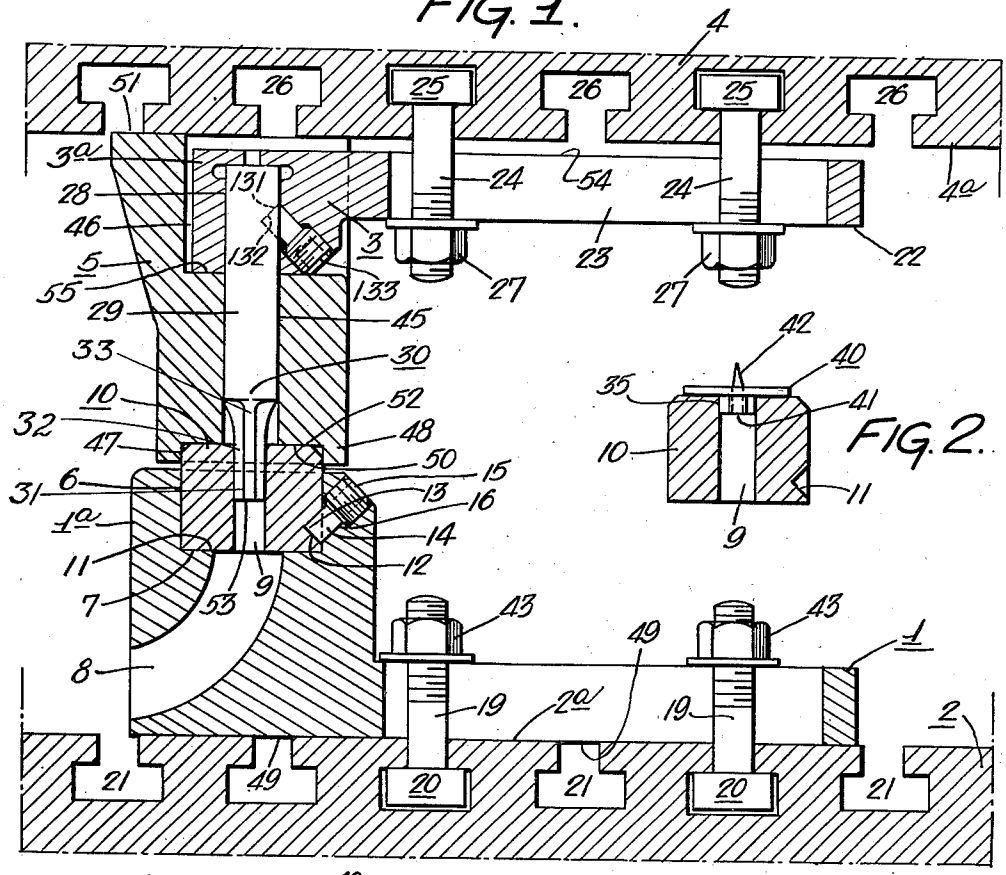


FIG. 2.

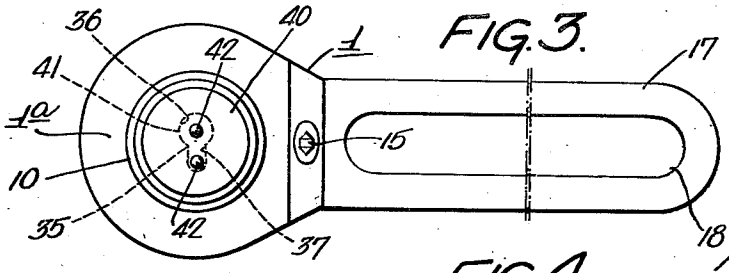


FIG. 3.

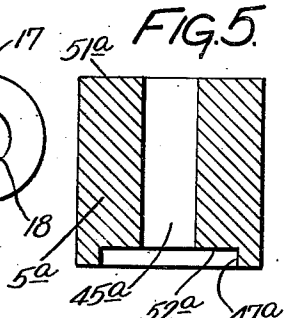


FIG. 5.

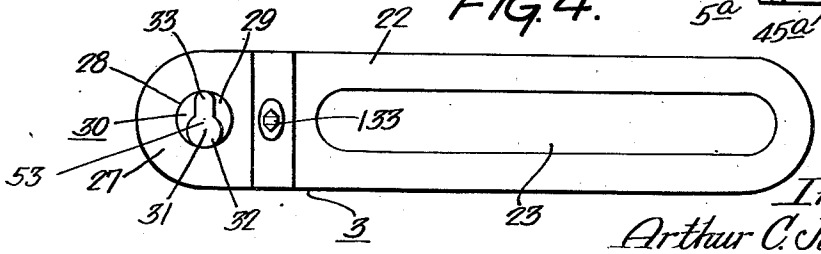


FIG. 4.

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Patented Nov. 6, 1945

2,388,546

UNITED STATES PATENT OFFICE

2,388,546

PUNCH AND DIE SETTING

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Application June 10, 1944, Serial No. 539,732

7 Claims. (Cl. 164—124)

This invention relates to the setting of punches and dies for piercing sheet materials of all kinds, wherein the piercings are arranged in predetermined relation to each other on and with respect to the marginal edges of the sheets.

The present invention is more particularly directed to the setting of dies and punches on the bed and the movable head respectively of a die press or die set when the cross-sectional contour of the punch and its correlated die opening are of irregular shape, or non-circular contour, or circular contour ececntric to the axis of the die block.

One object of the invention is to provide a tool for aligning the punches with their respective die openings, with the tool in each instance being in the form of a sleeve or jig having a guide bore for slidably supporting the punch, and having a pair of true parallel faces at the opposite ends respectively of the tool, in planes disposed in true perpendicular relation to the axis of the guide bore for the punch.

The flat parallel faces of the tool are adapted to bear respectively against the top face of the die, after the die has been secured in position on the press bed with the top face of the die parallel to the top face of the bed, and against the under surface of the movable head of the press, or a flat under surface of the punch retainer disposed parallel to the under surface of the press head, when the press head is lowered with respect to the press bed to an extent wherein the aligning tool will be gripped firmly between the under surface of the press head or punch retainer, and the upper face of the die, whereby the engaging flat surfaces will assume full flat contact and cause the punch to become accurately aligned with the die, prior to the securing of the punch retainer to the under side of the press head.

The present invention is particularly applicable to the setting of dies and punches in instances where a template is employed for locating the dies on the press bed, prior to aligning the punches with the dies with which the punches respectively cooperate to punch holes of various shapes and sizes in sheet material, to a given pattern; and one feature of the invention resides in the provision of a pilot plate having a projection on one of its faces shaped like and adapted to fit accurately, without lateral play, within the punch opening in the die, and two or more relatively spaced pilot pins on the opposite face of the pilot plate for entrance, respectively into correspondingly spaced holes formed in a template according to the pattern to which the piercings are to be made in a sheet of material.

In the accompanying drawing:

Fig. 1 is a vertical sectional view through sufficient of the bed and head of a die press to illustrate the functioning of the aligning tool of the present invention;

Fig. 2 is a vertical section through a die showing the pilot plate in position thereon;

Fig. 3 is a plan view of the die and die-retainer, with the pilot plate in position on the die;

Fig. 4 is an inverted plan view of the punch and punch-retainer; and

Fig. 5 is a longitudinal sectional view of a modified form of the aligning sleeve.

In the accompanying drawing, a die retainer 1 is shown as being secured to the bed 2 of the die press, or to a supplementary plate known as a "die-set" which in turn would be secured to the bed of the press. A punch retainer 3 is shown as being loosely hung in a tentative position to be later drawn into contact with and to be secured to the underside of the movable head 4 of the die press, or to a "die-set" which in turn would be secured to the underside of the press head.

The punch-aligning tool 5 of the present invention is shown as being in its operating position and held firmly between the top surface of the die, which is mounted in the die-retainer 1, and the undersurface 4a of the punch head 4, or a die set secured thereto, as the case may be.

The die-retainer 1 comprises the usual substantially cylindrical boss or head 1a having an axial counter-bore or die cavity 6 terminating in a flat annular base surface 7. A slug channel 8 extends downwardly and curves laterally from the base 7 of the die cavity 6 to the outside of the boss 1a of the die retainer 1 to receive and discharge punchings from a slug channel 9 formed in a die block 10, which block is seated in the cavity 6, with its flat bottom surface 11 in firm contact with the flat base surface 7 of the die cavity 6.

The die block 10 is provided with a transverse angular surface 12, against which a flat end surface 13 formed on a cylindrical neck 14 of a locking screw 15 is adapted to bear, said screw being threaded into an angularly disposed opening 16 formed in one side of the boss 1a of the die-retainer 1.

The die-retainer 1 is provided with an arm 17 which extends laterally from the boss 1a and in which is formed an elongated slot 18 for the reception of securing bolts 19, 19. The secur-

ing bolts 19, 19 are provided with square or T shaped heads 20, 20 adapted to be inserted in undercut T slots 21, 21 formed in the bed 2, or in the die-set adapted to be secured to the bed 2.

The boss or head 3a of the punch-retainer 3 is provided with a similar laterally extending arm 22 having an elongated slot 23 for reception of securing bolts 24, 24 having T or square heads 25, 25, for entrance into T slots 26, 26 formed in the under surface of the press head 4 or the die-set adapted to be secured to the underside of the punch head 4.

The boss 3a of the punch-retainer 3 is bored at 28 for the reception of the shank 29 of the punch 30. The shank 29 is provided with an undercut indentation forming a transverse angular surface 131 inclined with respect to the axis of the punch and adapted to be engaged by a flat end 132 of a locking screw 133 which is threaded into an angularly disposed opening in one side of the boss 27 of the punch retainer 3.

As shown in Fig. 4, the punch 30 has an irregularly shaped end 31 which, for the purpose of illustration, takes the form of a key having a round body portion 32, the axis of which is offset with respect to the axis of the shank 29, and a lateral flat-sided extension 33 on one side of the circular portion 32. However, it will be understood that the piercing end of the punch 30 may have any desired shape or contour falling within the circle described by the outer peripheral surface of the cylindrical shank 29 of the punch 30.

As shown in Fig. 3, the die block 10 is provided with an opening 35 having a key-hole-slot shaped opening corresponding exactly with the shape of the irregular end 31 of the punch 30. The key-hole-slot shaped opening 35 includes a round portion 36, into which the round portion 32 of the punch 30 fits snugly, and a lateral extension 37, into which the lateral extension 33 of the punch 30 fits snugly. The round body portion 32 and the lateral extension 33 of the irregular end 31 of the punch 30 bear exactly the same relation to each other and to the axis of the shank 29 of the punch 30 as the round portion 36 and lateral extension 37 of the key-hole-slot 35 bear to each other and to the axis of the die block 10 which aligns with the axis of the shank 29 of the punch 30. The punch opening 35 communicates with, or has formed as a part thereof, the slug channel 9 of the die block 10.

As shown in Fig. 2, the die block 10 may be temporarily provided with a pilot plate 40, having a projection 41 on one face thereof which is shaped in accordance with the shape of the irregular opening 35 in the die block 10, and which is adapted to fit accurately, without lateral play, within said irregular opening 35.

From the opposite face of the pilot plate 40 projects a pair of pilot pins 42, 42 clearly shown in Fig. 3. The pins 42 are spaced apart and, in the present instance, one of said pins is concentric to the circular portion 36 of the irregular opening 35 while the second of the pins is disposed in the portion of the projection 41 which corresponds to the lateral extension 37 of the irregular opening 35.

As shown in Fig. 1, the setting or aligning tool 5 of the present invention is provided with an axial bore 45 which is adapted to receive and accurately fit, without lateral play, the cylindrical shank 29 of the punch 30, and to afford relative axial movement between the tool 5 and the punch 30.

The upper end of the tool 5 is provided with a cavity 46 of a depth in excess of the depth of the boss or head 3a of the punch retainer 3. The cavity 46 opens outwardly along one side of the tool 5 for accommodating the laterally extending arm 22 of the punch retainer 3.

The opposite end of the tool 5 is counterbored to provide an internal annular wall 47. This annular wall 47 is adapted to extend circumferentially around that portion of the peripheral side wall of the upper part of the cylindrical die block 10 which extends above the top surface of the boss or head 1a of the die retainer 1, and by which the axis of the punch bore 45 in the tool 5 is brought into and maintained in axial alignment with the axis of the die block 10. The annular wall 47, in the present instance, is disposed on the inside of an annular flange 48 formed by said counterboring at the bottom end of the tool 5 and which extends axially thereof.

It will be understood that the axis of the die cavity 6 in the boss 1a of the die retainer 1 is disposed at a true right angle with respect to the base surface 49 of the retainer 1, and that the base surface 7 of the die cavity 6 is disposed in a plane parallel to the plane of the base surface 49 of the retainer 1. The top surface 50 of the die block 10, which in operation supports the sheet to be punched, is disposed in a plane parallel to the plane of the base surface 11 of the die block 10, consequently, with the die block 10 rigidly held in the cavity 6 and seated firmly on the base 7 thereof, and with the base surface 49 of the retainer 1 pulled down tightly against the flat surface 2a of the bed 2, the top surface 50 of the die block 10 will be disposed in a plane parallel to the flat surface 2a of the bed 2.

The flat surface 4a of the press head 4 is at all times parallel to the flat surface 2a of the bed 2. The flat top end surface 51 of the tool 5 and the flat bottom end surface 52 of the tool 5 are disposed in strictly parallel planes at true right angles respectively to the axis of the punch bore 45 in the tool 5, consequently, when the top surface 51 of the tool 5 is firmly pressed into contact with the flat surface 4a of the head 4, the bottom end surface 52 of the tool 5 would be in a plane parallel to the top surface 50 of the die block 10, with the axis of the punch bore 45 in the tool 5 perpendicular thereto and in alignment with the axis of the die block 10.

In use, a die block 10 having an irregular opening 35 therein, is secured in the die-retainer 1, by the set screw 15, against relative axial or circular motion with respect thereto. One or more of the retainers 1, with their die blocks 10 therein, are then placed on the flat surface 2a of the press bed 2 in which the T slots 21 are formed, with the heads 20 of the bolts 19 in the T slots 21, 21, and with the nuts 43, 43 loose on the bolts 19, 19, so that the die retainers 1 may be shifted within a limited compass over the flat surface 2a on which it is positioned.

One of the pilot plates 40 is then placed on the sheet supporting surface 50 of each die block 10, with the irregularly shaped protuberance 41 of the pilot plate 40 fitted into the irregular opening 35 in the die block 10.

A template, not shown, but which is provided

with any desired number of small circular openings arranged in pairs for the reception of pairs of pilot pins 42, 42, is then placed on the upper top surfaces of the pilot plates 40. The template, as is usual in such cases, is held in a fixed position relative to the bed 2, and the die-retainers 1, 1, are maneuvered on the flat surface 2a of the bed 2 until the pilot pins 42, 42 associated with each and all the die blocks 10 which are to be used in the perforating of a sheet to a given pattern represented by the template, are accurately positioned in the pairs of registry holes in the template. The nuts 43, 43 on the bolts 19, 19 are then drawn down tightly to secure all of the die retainers 1, 1 rigidly to the bed 2. The template is then removed from the pilot plates 40, 40, and the pilot plates are then removed from the die blocks 10, leaving the die blocks rigidly secured in their respective die-retainers 1, 1.

The punch retainers 3, 3 with their respective punches 30, 30 rigidly secured therein, are then tentatively positioned over the respective die-retainers 1, 1 and hung loosely from the underside of the press head 4, by the bolts 24, 24.

It will be understood that at such time the head 4 is raised to a sufficient height above the bed 2 to afford ample working clearance for effecting the hanging of the punch retainers 3, 3, as noted above.

One of the setting tools 5, of the present invention, is then placed in position on one of the punches 30, with the boss 3a of the punch retainer 3 located in the cavity 46 of the tool 5. The head 4 is then lowered cautiously until the lower end surface 53 of the punch 30, bears lightly on the top surface 50 of the die block 10, whereupon the assemblage, including the tool 5 and the punch retainer 3 with its punch 30 rigidly secured therein, is maneuvered relative to the head 4 until the irregularly shaped end 31 of the punch drops into the irregularly shaped die opening 35 in the die block 10.

The head 4 is then lowered until the tool 5 is gripped between the top end surface 50 of the die block 10 and the under surface 4a of the head 4, with the top surface 51 of the tool 5 engaging the under surface 4a of the head 4, and with the bottom end surface 52 of the tool 5 engaging the top surface 50 of the die.

Due to the top face 50 of the die 10 and the under face 4a of the head 4 being parallel at all times, and the two end faces 51 and 52 of the tool 5 being parallel to each other, further lowering of the head 4 will cause the surfaces 4a and 51, and the surfaces 50 and 52 to assume flat full contact with each other, whereby the axis of the punch 30 which is perpendicular to the surfaces 51 and 52 will be positioned in exact alignment with the die 10.

Due to the difference in the depths of the cavity 46 in the tool 5 and the boss 3a of the retainer 3, a limited amount of axial relative movement is afforded between the punch 30 and tool 5, and due to the counterbored end of the tool 5 fitting snugly around the outside of the die block 10, relative alignment of the axis of the punch and the axis of the die is effected and no binding of the irregularly shaped end 31 of the punch 30 in the irregularly shaped opening 35 in the die 10 takes place, thus the punch retainer 3 with its punch 30 therein can be readily raised until the top flat surface 54 of the punch retainer 3 bears flatly against the flat under surface 4a of the head 4, with the bore 45 of the tool 5 functioning as an accurate guide for the punch 30, whereupon the nuts 27, 27 on the bolts 24, 24 are drawn down tightly and secure the retainer 3 rigidly to the head 4, with the punch 30 in absolute alignment with the die 10.

The head 4 is then raised sufficiently to permit removal of the tool 5 from the punch 30 whereupon that particular punch and die are ready for operation.

Where a plurality of punches and dies are embodied in the pattern to be punched in a sheet, the foregoing punch setting operations are repeated for each punch-die unit individually.

In the structure shown in Fig. 5, the top end surface 51a of the tool 5a is in parallel relation to the bottom end surface 52a, with the axis of the punch bore 45a perpendicular to the planes of both of these surfaces.

In operation, the flat base surface 54 of the punch retainer 3 is initially drawn into more or less loose contact with the flat surface 4a of the head 4. The flat under surface 55 of the boss 3a is parallel to the base surface 54 of the punch retainer 1. The tool 5a is used between the flat under surface 55 of the punch retainer 1 and the flat top surface 50 of the die 10, so that, when the head 4 is lowered, the end surfaces 52a and 51a of the tool 5a make flat contact respectively with the top surface 50 of the die 10 and the flat under surface 55 of the boss 3a of the punch retainer 1, while the annular wall 47a of the tool 5a engages the peripheral wall of the die block 10 above the die retainer 1, thus the punch and die are brought into true axial alignment preparatory to tightening the nuts 27, 27 by which the punch retainer 3 is rigidly secured to the head 4.

I claim:

1. A punch-setting tool comprising a sleeve having an axial bore for directly slidably supporting a punch for axial movement therein, and a pair of flat parallel relatively spaced surfaces disposed in planes at right angles to the axis of said bore at opposite ends respectively of said tool, said flat surfaces being adapted for simultaneous engagement with a pair of flat parallel surfaces spaced apart and relatively movable perpendicularly to their respective planes in a die press.

2. A punch-setting tool comprising a sleeve having an axial bore for slidably supporting a punch for axial movement therein, a pair of flat parallel relatively spaced surfaces disposed in planes at right angles to the axis of said bore at opposite ends respectively of said tool, one of said flat surfaces being adapted for engagement with a flat sheet-supporting face of a die block fixed in a die press, and the second of said flat surfaces being adapted for simultaneous engagement with a second flat surface spaced from and relatively movable perpendicularly with respect to the plane of said die face in said die press.

3. A punch-setting tool comprising a sleeve having an axial bore for slidably supporting a punch for axial movement therein, a pair of flat parallel relatively spaced surfaces disposed in planes at right angles to the axis of said bore at opposite ends respectively of said tool, one of said flat surfaces being adapted for engagement with a flat sheet-supporting face of a die block fixed in a die press, and an annular wall surrounding said one flat surface for circumferential engagement with the peripheral wall of said die block, the second of said flat surfaces being adapted for engagement with a second flat surface spaced from and relatively movable perpendicularly with

respect to the plane of said die face in said die press.

4. A punch-setting tool comprising a sleeve having an axial bore for slidably supporting a punch for axial movement therein, a pair of flat parallel relatively spaced surfaces disposed in planes at right angles to the axis of said bore at opposite ends respectively of said tool, one of said flat surfaces being adapted for engagement with a flat sheet supporting face of a die block fixed in a die press, and the second of said flat surfaces being adapted for engagement with a second flat surface spaced from and relatively movable perpendicularly with respect to the plane of said die face in said die press, and a flange on one end of said tool providing an annular wall surrounding and projecting axially beyond said one flat surface for circumferential contact with said die block below the plane of said sheet supporting face of said die block.

5. A punch-setting tool comprising a sleeve having an axial bore for slidably supporting a punch for axial movement therein, a pair of flat parallel relatively spaced surfaces disposed in planes at right angles to the axis of said bore at opposite ends respectively of said tool, said flat surfaces being adapted for engagement with a pair of flat parallel surfaces spaced and relatively movable perpendicularly to their respective planes in a die press, said sleeve having a cavity surrounding said bore at one end of said tool for a reception of a retainer for said punch, said cavity being of a depth in excess of the depth of said retainer to afford free axial movement of said retainer with said punch.

6. A punch-setting tool comprising a sleeve having an axial bore for slidably supporting a punch for axial movement therein, a pair of flat parallel surfaces at the opposite ends respectively of said tool in planes perpendicular to the axis of said bore, an annular wall concentric to said bore and projecting axially beyond the flat surface at one end of the tool, said tool having a cavity formed in its opposite end and extending axially into the tool from the second of said flat surfaces.

7. A punch-setting tool comprising a sleeve having an axial bore for slidably supporting a punch for axial movement therein, a pair of flat parallel surfaces at the opposite ends respectively of said tool in planes perpendicular to the axis of said bore, a flange on the opposite end of said bore affording an annular wall concentric to said bore and projecting axially beyond the flat surface at one end of the tool, said tool having a cavity formed in its opposite end and extending axially into the tool from the second of said flat surfaces.

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