

June 26, 1945.

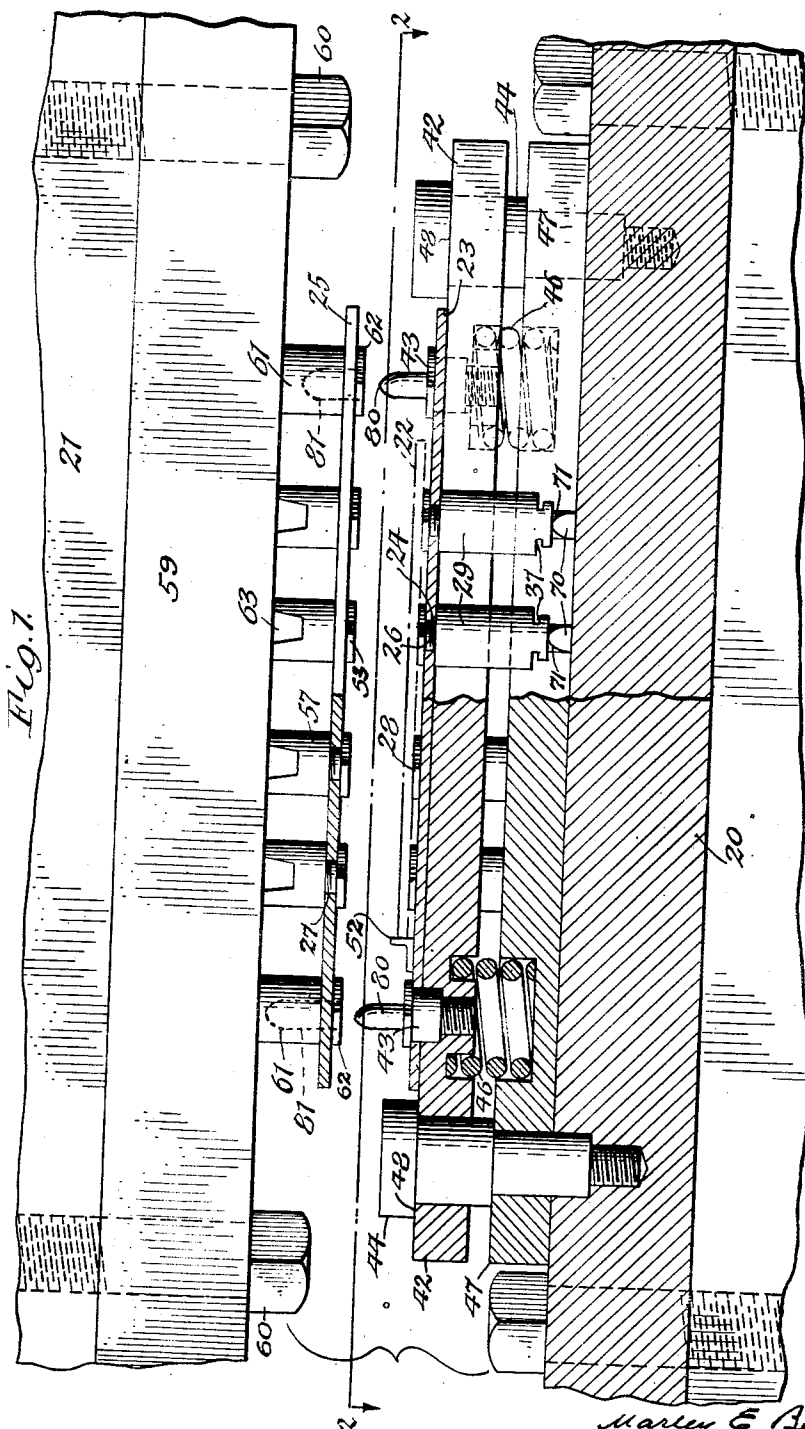
M. E. BECHTEL

2,379,271

PERFORATING UNIT

Filed May 19, 1944

3 Sheets-Sheet 1



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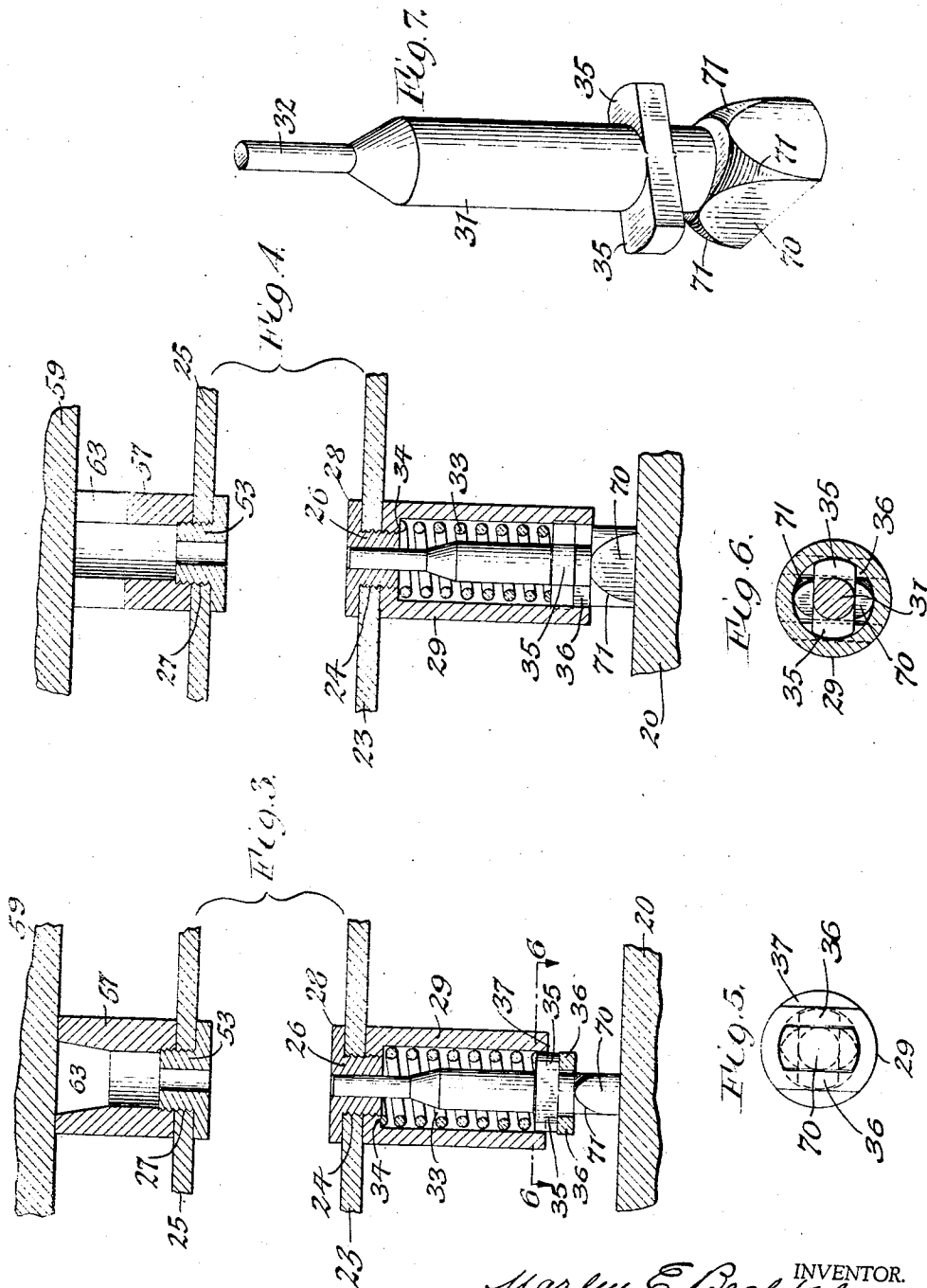
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UNITED STATES PATENT OFFICE

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PERFORATING UNIT

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Application May 19, 1944, Serial No. 536,261

2 Claims. (Cl. 164-124)

This invention relates to a perforating apparatus of the type shown in Letters Patent of the United States No. 2,296,136, granted September 15, 1942, and the present invention is an improvement on the structure disclosed in this patent.

The device shown in this patent consists generally of a supporting table, a guide tube mounted on the table, a punch movable lengthwise in said guide tube, a spring whereby the punch is held in a retracted position within the guide tube, stop means for limiting the retracting movement of said punch, a die cooperating with said punch for perforating sheet material, and a table which is adapted to project said punch into operative relation to said die.

In this prior construction the punch while in use was liable to turn in the guide tube and become displaced relative to said stop means and as a consequence the apparatus was liable to be damaged and rendered inoperative.

It is the object of this invention to provide means which enable the punch and guide tube to be readily assembled and disassembled and to automatically return the punch to its proper working position during its projecting movement for perforating sheet material in case the same has become displaced while retracting after a perforation operation, and to accomplish this purpose by means which are very simple in construction, positive in their action and not liable to get out of order.

In the accompanying drawings:

Fig. 1 is a front elevation, partly in section, of a sheet material perforating apparatus embodying a satisfactory form of this invention, the sectional part being taken on line 1-1, Fig. 2.

Fig. 2 is a horizontal view of the same, taken on line 2-2, Fig. 1 looking downwardly.

Fig. 3 is a fragmentary vertical section, on an enlarged scale, of one of the perforating units of the apparatus viewed in the same direction as Fig. 1.

Fig. 4 is a similar section taken at right angles to Fig. 3.

Fig. 5 is a bottom plan view of the punch element and its mounting of one of the perforating units.

Fig. 6 is a horizontal section, taken on line 6-6, Fig. 3.

Fig. 7 is a perspective view of the punch of one of the punching elements.

In the following description like reference

numerals indicate corresponding parts in the several views of the drawings.

Although the perforating units which embody the present invention may be used in connection with perforating apparatus which differ in details of construction, these units, for example, are shown in connection with an apparatus forming the subject of United States Patent No. 2,296,136 which in its general organization is constructed as follows:

The numeral 20 represents the lower stationary table, bed or platen of a power press and 21 the upper reciprocating ram which moves vertically toward and from the table or bed.

In general this perforating apparatus includes one or more perforating units each of which comprises a punching section and a die section which cooperate for producing a hole in a work sheet 22 and which are mounted on the members of a press, one of which is movable relative to the other, the punching section in the present case being mounted on the stationary bed 20 and the die section on the movable ram 21. In practice a plurality of punching sections are mounted selectively on a horizontal lower supporting plate 23 which is provided over the central part of its area with a plurality of punch section receiving openings 24 and a plurality of die sections are mounted selectively on a horizontal upper supporting plate 25 which is provided over the central part of its area with a plurality of die section receiving openings 27 which are arranged respectively in line with the corresponding punch receiving openings in the lower supporting plate.

Each of the punching sections is constructed as follows:

The numeral 26 represents a punch guide tube which fits in one of the openings 24 of the lower supporting plate 23, while the lower end of this tube projects below the underside of this plate and is provided with an external screw thread and the upper end of this tube is provided with an external flange 28 bearing against the upper side of this plate, as shown in Figs. 1, 3 and 4.

The numeral 29 represents a punch casing provided at its upper end with an internal screw thread which engages with the external thread of the companion guide tube 26 and bears with its upper end against the underside of this supporting plate. Within the casing 29 is arranged the body 31 of a punch, the lower part of which projects downwardly below the lower end of the casing and the bit or cutter 32 at the upper end

of which slides in the bore of the guide tube 26. The punch is retracted by a stripper spring 33 which is arranged within the casing around the punch and bears at its upper end against a downwardly facing upper shoulder 34 at the upper end of the casing, while the lower end of this spring bears against an upwardly facing lower shoulder on the lower part of the punch. This lower shoulder is formed on the punch by making a part of the punch adjacent to its lower or rear end of oblong form in cross section and thus producing two lugs 35 which provide upper and lower shoulders on the opposite sides of the punch. The downward or retracting movement of the punch in the casing 29 under the pressure of the stripper spring 33 is limited by stop means which preferably consist of a shoulder formed by two stops 36 arranged on opposite sides of the casing and adapted to be engaged on their upper sides by the stop lugs 35 of the punch. Each of these stops 36 is preferably formed by cutting a circumferential slit 37 in the lower part of the casing and bending inwardly that part of the casing between the respective slit and the lower end of the casing so that the same projects inwardly from the bore of the casing and into the path of one of the stop lugs 35 on the punch.

Assemblage of the punch with the casing and stripper spring is effected by placing the punch in alignment with the axis of the casing and stripper spring while the oblong part of the punch registers with the oblong form of the opening between the inwardly bent parts 36 of the casing. After the punch is arranged in this position the same is moved into the casing and stripper spring until the stop lugs 35 of the punch are above the stops 36 on the casing after which the punch is turned one-quarter circle about its axis, whereby the stop lugs 35 of the punch are carried over the stops 36 of the casing. Upon now releasing the upward pressure against the punch the stop lugs 35 of the latter will bear against the upper sides of the casing stops 36 and hold the stripper spring in its compressed position, as shown in Figs. 3 and 6.

Whenever it is desired to remove the punch from the casing and stripper spring for the purpose of sharpening its bit or, when broken or replacing the same by a new punch, this can be effected by first turning the punch until its oblong part formed by the stop lugs 35 is in register with the oblong lower part of the bore of the casing between the stops 36 of the latter after which the punch can be freely withdrawn from the casing.

When assembling the elements of a punching section on the lower supporting plate of the perforating mechanism, the guide tube 26 of this section is first placed with its neck in the desired locating opening 24 of the lower supporting plate 23 so that the flange of this tube engages with the top of this plate and then the bit 32 of the punch is introduced into the bore or opening of this tube from the lower end of the latter and then the upper end of the casing is screwed onto the lower end of the guide tube 26 and engaged firmly with the underside of the lower supporting plate.

The punches of the several punch units engage their lower ends with the upper side of the bed or table 20 of the press and the supporting plate 23 is mounted on this bed for the purpose of lowering the casings 29 and guide tubes 26 so as to expose the bits 32 of the punches above

the guide tubes 26 for cooperation with the dies to produce holes in the workpiece 22 and to withdraw the workpiece from said punches after the holes have been formed in the same. The means for thus mounting the lower supporting plate on the press bed are constructed as follows:

The numerals 42, 42 represent supporting bars secured crosswise by screws 43 to the underside of the front and rear edge portions of the lower supporting plate 23 and guided relative to the press bed by means of posts 44 which are connected at their lower ends with the press bed and pass through openings in the ends of the supporting bar 42 for guiding the latter in its vertical movements. The lower supporting plate 23, crossbars 42 and the parts mounted thereon are yieldingly held in an elevated position relative to the press bed by means of lifting springs 46 interposed between the supporting bars 42 and lower bolsters 47 which are secured to the top of the press bed. The upward movement of the supporting bars 42 under the pressure of the lifting springs 46 is limited by stops 48 on the guide posts 44.

On its upper side the lower supporting plate 23 may be provided with suitable gages 52 against which an edge of the workpiece 22 may be placed for properly locating the same relative to the punch and die sections to produce the holes in the workpiece in the desired places.

Each of the die sections which cooperates with one of the punch sections for producing a hole in the workpiece is constructed as follows:

The numeral 53 represents the tubular body of a die, the central part of which fits one of the die openings 27 in the upper supporting plate 25 while the lower end of the same has a cutting edge around its bore and an external flange 55 which bears against the underside of said plate.

Above the upper supporting plate 25 are arranged a plurality of tubular clamping sleeves or nuts 57. Each of these clamping sleeves has its lower end bearing against the top of the upper supporting plate 25 and connected by a screw joint with the upper end of the die body 53, thereby detachably securing the respective die section to the upper supporting plate, as shown in Figs. 1, 3 and 4.

The upper ends of the several die clamping sleeves 57 engage with the underside of an upper pressing plate 59 which is secured to the underside of the ram by screws 60, as shown in Fig. 1.

The upper supporting plate 25 is secured to this pressing plate in a spaced relation thereto by means of spacing sleeves 61 interposed between the upper supporting plate 25 and the pressing plate 59 and fastening screws 62, as shown in Fig. 1.

At its upper end each of the clamping sleeves 57 is provided with a discharge opening 63 which extends from its bore to its periphery and through which escape, to the exterior of the apparatus, the slugs which are formed by the stock which is removed from the workpiece during the formation of the holes therein.

The operation of this apparatus is as follows:

When the ram is raised the lower supporting plate is raised by the stripper springs 33 and the bars 42 are raised by the lifting springs 46 so that the upper ends of the punches are below the top of the guide tubes 26 and a gap is formed between the lower punch sections and the upper die sections of the several perforating units, as

shown in Figs. 1, 3, and 4. While the parts are in this position the work sheet 22 is placed upon guide tubes 26 of the several punch sections, as shown by broken lines in Fig. 1 and then the ram is lowered. During the first part of the downward movement of the ram the lower supporting plate 23 and the parts connected therewith remain at rest until the lower ends of the several die bodies 53 of the die sections bear against the top of the workpiece and clamp the same against the upper ends of the guide tubes 26 of the several punch sections and hold this workpiece securely, against lateral displacement. During the continued downward movement of the ram the workpiece, together with the punch guide tubes, punch casings and lower supporting plate 23, are depressed while the punches are at rest thereby causing the bit at the upper end of each punch to pass through the adjacent part of the workpiece and into the bore of the companion die, thereby punching a slug out of the workpiece and into the die and forming a hole in the workpiece. The slugs which are successively removed from the workpiece are pushed upwardly into the dies and eventually escape to the exterior of the apparatus through the openings 63. During the descent of the punch casings 29 the springs 33 are further compressed and when the ram rises and the grip of the dies on the workpiece is released, the stripper springs 33 hold the punches down in engagement with the press bed 20, whereby the upper or bit ends of the punches are withdrawn from the workpiece and the latter is free to be removed from the punching apparatus and replaced by another unpunched workpiece.

It has been found by actual experience that when the casings 29 of the punching units are depressed relative to the stationary punches during the perforating operation that a punch sometimes is turned about its axis to such an extent that the oblong part which is produced therein by its laterally projecting stop lugs 35 is brought into register with the correspondingly shaped oblong opening or passage between the inwardly deflected parts 36 of the casing. In consequence of this change in position of a punch the same during manipulation of the punching apparatus is liable to drop in the respective casing to such an extent that the stop lugs 35 are below the casing stops 36 and the respective punch may be turned while thus displaced so that these casing stops during a subsequent descent will strike the punch stop lugs 35 and cause breakage or damage.

Means are therefore provided in accordance with this invention whereby the punch of a punching unit which has been accidentally turned from its normal proper position into an abnormal or improper position will be automatically returned to its normal position during the descent of the respective punch casing and thereby avoid the objectionable results above mentioned.

The preferred means for accomplishing this automatic return of a punch from an abnormal to a normal position within the punch casing are constructed as follows:

The numeral 70 represents an alining head arranged on the body 31 of each punch below the stop lugs 35 and spaced from the latter a distance equal to the height of the inwardly bent stops 36 on the punching casing 29.

As a whole this alining head is of oblong form crosswise of the respective punch and of the same general dimensions as the combined form of the stop lugs 35 on the punch body, but the

longitudinal axis of the alining head is arranged at right angles to the longitudinal axis of the stop lugs 35. Each of the corners of this oblong alining head is beveled, rounded or inclined from the outer lower part of this head upwardly and inwardly toward the center of the same, as best shown at 71 in Figs. 1, 3, 4 and 7.

In the properly or normally assembled position of the parts of each punching unit the stop lugs 35 are arranged crosswise of the casing stops 36 and the latter operate to limit the upward movement of the casing on the punch and at this time the alining head 70 of the punch is in a position to permit the casing to slide with its oblong space between its stops 36 downwardly over this alining head and thereby prevent the punch body from turning about its axis and thus maintain the punch in its normal position.

If, however, the punch, during the descent of its companion casing, should be turned more or less about its vertical axis and thus move its lugs somewhat out of full alignment with the casing stops 36, or possibly completely to one side of the casing stops, then the punch during the upward movement of the casing following a perforating operation would leave the punch behind and in a position in which the punch is uncoupled from the casing. If now the punch, due to jarring of the apparatus or other cause, should be turned about its vertical axis the upper side of the alining head would project more or less underneath the casing stops 36, and if no means were provided the subsequent downward movement of the casing would engage its stops 36 with the top of the alining head 70 and not only prevent the perforating apparatus from functioning properly but also injure or damage the same. This objectionable result is, however, prevented by engagement of the overhanging lower stop parts 36 of the punch casing 29 with the inclined faces 71 on the corners of the alining head 70 whereby the punch is turned about its vertical axis until the alining head registers with the oblong space between the stops 36 and permits the casing 29 to slip downwardly over the same and the stop lugs 35 are also turned so that they overhang the stops 36, as shown in Figs. 3 and 6.

It will now be apparent that so long as the punch is in its normal position in which the oblong alining head registers fully with the oblong space between the stops 36 of the punch casing the latter will be free to descend and cause the bit at the upper end of the punch to project above the guide tube 26 and enter the cutting opening of the respective die tube 53, but if the punch has been turned about its vertical axis into an abnormal position in which its stop lugs 35 are out of line with the top of the casing stops 36 and its oblong alining head 70 is underneath said casing stops, then the punch will be automatically restored to its normal operative position by engagement of the stops 36 with the inclines 71 and thus prevent damage to the perforating apparatus and maintain the same in working condition.

Main alining means are provided for alining the punches of the lower supporting plate 23 and the dies 53 of the upper supporting plate 25 before the ram 21 has descended a sufficient distance to engage the dies with the guide tubes 26 preparatory to depressing the latter and causing the dies to slip over the punches and perforating the workpiece. The preferred construction of these main alining means, shown in Figs. 1 and

2, comprise a plurality of upright alining pins 80 connected at their lower ends with the screws 43 which fasten the lower supporting plate 23 to the bars 42 and adapted to cooperate with alining sockets or recesses 81 formed in the fastening screws 62 and spacing sleeves 61. When the ram is raised into its inoperative position, as shown in Fig. 1, the sockets 81 are withdrawn from the alining pins 80, but during the first part of the descent of the ram these sockets 81 slip over the pins 80 and align the punches and dies of the several punching units and during the last part of the downward movement of the ram the dies engage the workpiece and slip over the punches and perforate the workpiece.

I claim as my invention:

1. A unit for perforating sheet material comprising a die and a punch one of which is movable relatively to the other so that the same cooperate to produce a perforating operation, a casing enclosing said punch and movable lengthwise thereof and provided with an internal stop and an oblong space adjacent to said internal stop, an external stop lug projecting laterally from said punch and normally extending over said internal stop, a spring for moving said casing so that said punch is within the casing, means for moving said casing so that the punch extends from said casing, and an oblong alining head arranged on said punch and normally registering with said oblong space and provided with an in-

clined face adapted to be engaged by said casing when the punch is in an abnormal position and turn the same into its normal position.

2. A unit for perforating sheet material comprising a die and a punch which are movable relatively to one another and cooperate to produce a perforating operation, a casing enclosing said punch and movable lengthwise thereof and provided on its diametrically opposite sides with internal stops and an oblong space between said stops, external stop lugs projecting laterally from diametrically opposite sides of said punch and normally extending over said internal stops and adapted to engage their undersides with said internal stops, a spring for shifting said casing so that the punch is within said casing and bearing against the upper sides of said lugs, an oblong alining head arranged at the rear end of said punch and having its longitudinal axis arranged at right angles to the longitudinal axis of said stop lugs and adapted normally to register with the oblong space between said internal stops and provided on its corners with inclined faces which are adapted to be engaged by the lower end of said casing when the punch is in an abnormal position and turn the same into its normal position, and means for shifting said casing so that the punch extends therefrom for cooperation with said die.

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