

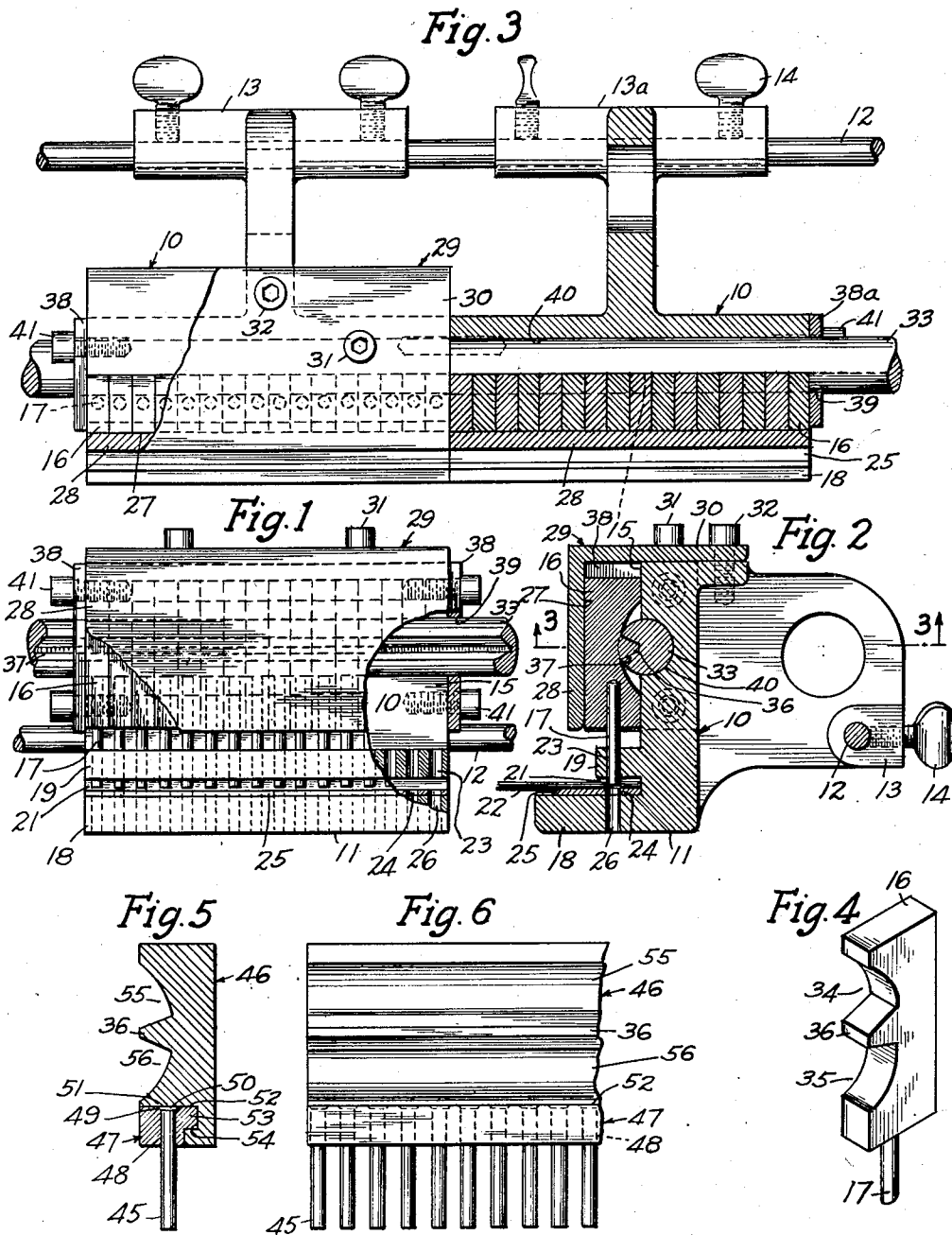
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SECTIONAL PERFORATING DIE

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SECTIONAL PERFORATING DIE

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11 Claims. (Cl. 164—90)

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This invention relates to perforating dies for sheet material and particularly to those employing a gang of individual punches.

The invention contemplates the provision of a multiple perforating die made of sections having separate individual punches or perforators which are adapted to be arranged in substantial alignment and at any selected uniform or variable spaced intervals, each of the punches being easily removable and replaceable independently of the remaining punches and each being also adapted to be omitted entirely.

The invention further contemplates the provision of a reciprocating multiple perforating die which may conveniently be combined with additional similar dies to punch a row of any number of holes and of any desired length on each stroke of the die.

The invention further contemplates the provision of a simple and relatively inexpensive but efficient perforating die designed for quick and easy attachment to a suitable reciprocating press to be automatically and continuously or intermittently operated thereby as desired, and wherein the perforators or punches are so supported, operated and guided that accurate operation is assured at all times, wear is reduced to a minimum and long life and quick and easy replacement of the parts when necessary is attained, the individual punches being replaceable without the necessity for removing the die from the press.

The various objects of the invention will be clear from the description which follows and from the drawings, in which

Fig. 1 is a front elevational view of one form of the multiple or sectional perforating die, certain of the parts being partly broken away to show the interior structure.

Fig. 2 is a vertical sectional view of the die taken through one of the punches and showing the punches about to complete the perforating operation.

Fig. 3 is a top plan view of two longitudinally aligned identical dies of the kind shown in Figs. 1 and 2, said view showing certain parts of the left hand die broken away, the right hand part of the view being a horizontal sectional view taken on the line 3—3 of Fig. 2.

Fig. 4 is a perspective view of one of the sectional punch holders as it appears assembled with its punch.

Fig. 5 is a vertical sectional view of a modified form of the punch holder.

Fig. 6 is a front elevational view of the holder of Fig. 5.

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In the practical embodiment of the invention shown by way of example in Figs. 1 to 4, the main body or frame 10 of the die is designed to be secured directly or indirectly to the bed of a suitable press, as for example, by resting its lowermost surface 11 on the bed or on a plate which in turn is secured to the bed, or by keying the frame to the bed or to a fixture secured to the bed in a manner which is so well understood that no further description nor illustration thereof is deemed necessary. The rod 12 passing through and adjustably held to the bearing 13, which forms the rear part of the body 10, serves to fix the body in adjusted position relatively to the bed of the press when the set screws 14 are tightened. Said rod may be supported by suitable brackets or bearings, (not shown) secured to and upstanding from any convenient fixed part in an obvious manner. As best seen in Fig. 2, there is arranged on the front face 15 of the body, a punch holder comprising a number of individual separate sections 16, each fixedly carrying a punch or perforator as 17 which projects downwardly therefrom. The rear edges of the respective sections slide on the face 15 toward and from the base 18 of the body. A stripper 19 of considerable height relatively to the diameter of the punch, is formed integrally with the body 10 and projects forwardly of the face 15 a lesser distance than the base 18, the stripper being separated from the base by the space 21 therebetween, and the sheet or sheets 22 to be perforated, being inserted into said space. The stripper is perforated as at 23 with a row of equally spaced apart holes each adapted to receive and support a punch 17 and serving as a bearing for that purpose, a substantial part of the length of the punch remaining in its hole at all times and being adequately guided thereby during its reciprocatory movement in the hole.

The cutting edge at the lower end of each of the punches is designed to cooperate with the edge of the corresponding hole as 24 in the plate or anvil 25, thereby to shear off an area of the sheet or stack of sheets 22 corresponding to the shapes of the punch and of the hole 24 as the punch holder descends. The waste material is deposited in the hole 26 in the forwardly projecting base 18 of the body and ultimately falls out of the base.

All of the holder sections 16 are shown as of the same size and as equally spaced apart longitudinally and as aligned longitudinally of the die. The corresponding holes 26 in the base or the anvil holes 24 hence are also shown as equally

spaced apart. It will be understood, however, that the die is not limited to sections of the same width or to holes spaced equally apart provided that the anvil holes and base holes are spaced apart to correspond to the spacing of the punches 17 and to the thicknesses of the respective sections. Nor need any of the holes and corresponding punches be of any particular shape nor the same shape as the others as will be readily understood from the use of separate punches independent of each other. If the punches are to be interchangeable, it is obvious that the spacing therebetween should be uniform and that the sections should be of the same size and shape.

To avoid the exertion of any undue stress on the punches such as might cause them to break or to wear out prematurely, each section 16 is guided in its vertical reciprocating motion by the rear surface 27 of the upright flange 28 of the angle member 29, the horizontal flange 30 of which is removably secured to the upper face of the body 10 as by means of the screws 31, 32. Excessive twisting of the holder or of the sections thereof in the spaces between the surfaces 27 and 15 and bending and consequent overloading of the punch is thereby prevented, the punch being additionally braced and supported by the stripper 19 in which a substantial part of the punch remains at all times.

The means for reciprocating the holder and the punches carried thereby includes the operating shaft 33 which is oscillated or rocked by suitable connections to a moving part of the press in a manner which is well understood. In a continuously operated press, the shaft 33 is automatically rocked continuously. In a one-revolution press controlled for example by a foot lever, the shaft comes to rest after each actuation of the lever and each consequent complete oscillation of the shaft. In any case, the oscillation of the shaft is transferred to the punch holder sections to reciprocate them and the punches secured thereto. For this purpose, a pair of spaced, generally triangular, slots as 34, 35 are made in the rear edge of each section, to leave the tapered member 36 separating the slots. Said member enters loosely into the somewhat larger longitudinal slot 37 in the shaft 33 and is retained in said slot. The entire set of sections constituting the holder is thereby positively reciprocated as a unit on the oscillation of the shaft, first to drive the punches through the sheets 22 and into the holes 26 of the base and then to withdraw the punches upwardly past the space 21, without the necessity for springs. Accurate alignment of the punch with the anvil hole 23 and the consequent clean perforating operation is assured by reason of the relatively high stripper 19 which prevents shifting of the punch out of alignment with its anvil hole.

Displacement of the sections and punches longitudinally of the shaft 33 is also prevented by means of the end bearing plates 38, 38a each provided with a circular hole as 39 for the reception and support of the shaft and each secured to the body 10 by screws as 41. Since the width of the body 10 is equal to the overall width of the holder, those parts of the plate which forwardly overhang the body serve to hold the holder sections properly between them and against longitudinal displacement. The walls of the openings 39 also serve as bearings for the shaft 33, which is also partly supported in the longitudinal hole 40 through the body 10 and extending to the front surface 15 of said body. Since the wall surround-

ing the hole 40 cooperates with the members 36 to hold the shaft 33 against transverse and lateral movement, the shaft is inserted into and withdrawn from the die by a longitudinal movement. When a holder section and its punch are to be replaced, the angle member 30 is first removed to expose the sections, whereafter the shaft 33 is withdrawn longitudinally as above explained. Any damaged section may then be lifted out from between its adjacent sections and an identical but undamaged section substituted. In the case where a hole ordinarily made by any particular section is to be omitted, that section is replaced by an otherwise identical section without a punch.

The end plates 38, 38a also serve to hold together any number of dies similar to each other, so that a row of holes of any desired length may be made at one time. As best seen in Fig. 3, to assemble two of such dies, the non-corresponding adjacent end plates are removed, and the body of the second die mounted on the shaft 33, with the tapered members 36 entering the slot 37, the bearing 13a being at the same time mounted on the rod 12 and the adjacent terminal holder sections of the respective dies being then pressed together. The end plate 38a at the right hand end of the right hand die as viewed in Fig. 3, remains secured by the screws 41 to its die body thereby to prevent longitudinal displacement of the sections 16 when relative movement of the dies is prevented. Finally, the set screws 14 are tightened to prevent displacing movement of the second die. When one or more dies are so assembled, oscillation of the shaft 33 reciprocates all of the sections in both dies simultaneously.

In the modified form of the invention shown in Figs. 5 and 6, the punches 45 are each separately and independently removable from the holder which comprises two sections 46 and 47, each of which extends the entire length of the frame. Instead of fixing each punch to a section having a width about equal to the distance between punches as in Fig. 1, the lower section 47 of the holder is provided with a hole 48 for each punch 45. The uppermost part 49 of the hole is preferably countersunk to receive the conical head 50 of the punch, the upper face 51 of the head being preferably flush with the upper surface 52 of the holder section 47, which carries all of the punches. The transversely projecting tongue 53 of the holder section 47 is fitted into the groove 54 of the section 46, the parts being readily separable by removing the tongue from its groove, thereby providing access to the individual punches. The section 46 is provided with the slots 55, 56 similar to the slots 34, 35 of the section 16. Between the slots is the tapered member 36 as in the section 16. The holder 46, 47 is therefore similar to the sectional holder of Figs. 1-4 insofar as its operating mechanism and insertion into and support in the die are concerned.

When a punch is to be replaced or omitted, access thereto is quickly had without removing the shaft 33. The end plates 38 and preferably the angle member 30 need merely be removed, whereupon the upper holder section 46 may be removed by a longitudinal movement which slides the member 36 thereof out of the slot in the shaft 33 and exposes the lower holder section 47. Said section 47 may then be raised to remove all of the punches from their holes in the stripper 19, whereafter the selected punch is merely pushed out of its hole in said section 47 in which it rests loosely by gravity, and a new punch substituted

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If desired. If the punch is omitted, no perforation is made in the sheet and there is no necessity for adding any section to attain such result as is necessary with the holder sections 16. When the sections 46 and 47 are assembled, the heads of the punches are held down by the upper wall of the grove 54 so that the sections 46, 47 and the punch 45 all move as in a unit in operation.

It will be seen that I have provided a simple but efficient multiple perforating die in which the perforators or punches are adequately guided and supported against danger of breakage, that the individual punches may be quickly and easily replaced when and if necessary, that a number of similar dies may be readily assembled to punch a row of holes of any desired length, and that I have provided a structure well designed to meet severe commercial requirements.

While I have shown and described certain specific forms of the invention, it will be obvious that various changes may be made therein without departing from the spirit of the invention defined by the appended claims.

I claim:

1. In a perforating die of the character described, a frame provided with a forwardly projecting base, a punch holder comprising separable holder sections reciprocating as a unit in the frame, a stripper projecting forwardly of the frame and in upward spaced relation to the base, said base and stripper having longitudinally aligned and spaced perforations therein, a series of punches individually and separately removable from the holder, a member fixed to and overhanging the frame and the holder and having a guiding face thereon engaging the front face of the holder to guide the holder, end plates, each removably secured to and extending past an end of the frame and having a circular bearing hole therein, said plates guiding and confining between them the ends of the holder, an oscillatory shaft mounted in the frame and passing through said hole in the end plate, and interengaging means on the shaft and the holder for positively reciprocating the holder.

2. The perforating die of claim 1, the holder sections being of the same size and shape and each carrying one of the punches.

3. The perforating die of claim 1, the holder comprising two holder sections connected by a tongue and groove joint, one of the sections loosely carrying the punches and the other engaging the ends of and removably maintaining the punches in said one section.

4. In a perforating die of the character described, a punch holder comprising separable holder sections, punches individually supported in said holder and individually removable therefrom, means for reciprocating the punches as a unit, means engaging the front and rear faces of the holder for guiding and supporting the holder in the reciprocating movement thereof and removable means slidably engaging the ends of the holder and preventing relative longitudinal movement of the sections.

5. The perforating die of claim 4, the means for preventing relative movement of the sections comprising a pair of relatively fixed end plates between which the holder is arranged.

6. The perforating die of claim 5, each of the end plates having a circular bearing hole therein, the means for reciprocating the punches including an oscillatory shaft passing through and supported by the plates and having an operative connection to the holder to reciprocate the holder.

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7. The perforating die of claim 4, the means for guiding and supporting the holder comprising a frame having a front surface engaging the rear surface of the holder, and an angle member removably secured to the frame and having a flange in forward spaced relation to the front surface and engaging the front face of the holder.

8. In a perforating die of the character described, a frame having a front face provided with a longitudinal recess, a shaft having a longitudinal slot therein oscillating in said recess and projecting beyond both ends of the frame, a punch holder comprising a series of substantially identical sections arranged in side by side relation and each carrying a punch, each of the sections having a slot in the rear edge thereof and having a tapered projection extending rearwardly at the mid-portion of the slot and entering the slot of the shaft, an angle member having one flange thereof slidably engaging the front edges of all of the sections and having the other flange thereof removably secured to the top of the frame, and a pair of plates each removably secured to an end of the frame and having a hole therein for the passage of the shaft, and means for adjustably securing the frame in an operative position.

9. In a perforating die of the character described, a frame having a front face provided with a longitudinal recess, a slotted shaft oscillating in the recess and projecting forwardly out of the recess, a punch holder comprising an upper section and a lower section, the upper section having a slot in the rear face thereof receiving the projecting part of the shaft, a projecting member on the rear face of the upper section entering the slot of the shaft, the lower section having a series of spaced perforations therein countersunk at the upper ends thereof, a headed punch loosely fitted into each one of the perforations and held therein by the under face of the upper section and a tongue and groove connection slidably securing the sections together.

10. In a perforating die of the character described, a punch holder having sections arranged to form a front face and a rear face on the holder, relatively fixed and laterally spaced apart members slidably guiding the front and rear faces of the holder respectively for reciprocation therebetween, and preventing lateral displacement of the sections, and longitudinally spaced members engaging the respective ends of the holder and preventing relative longitudinal displacement of the sections, said sections being of the same length and being slidably connected by means of a tongue and groove joint, one of the sections loosely carrying a series of spaced punches, and the other section engaging corresponding ends of the punches and preventing displacement thereof.

11. In a perforating die of the character described, a frame, a punch holder comprising separable holder sections arranged in face to face contact and reciprocating as a unit in the frame, a series of punches individually supported in said holder and individually removable therefrom, a member removably secured to the frame and having a guiding face thereon engaging the front face of the holder to guide the holder during the reciprocation thereof, end plates removably secured to the frame and guiding and confining between them the ends of the holder, and means supported by the frame and engaging the holder for reciprocating the holder, the holder sections being two in number and being slidably connected, one of the sections loosely carrying the

punches and the other engaging the ends of and removably maintaining the punches in said one section.

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