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APPARATUS FOR PUNCHING CORRUGATED METAL PLATES

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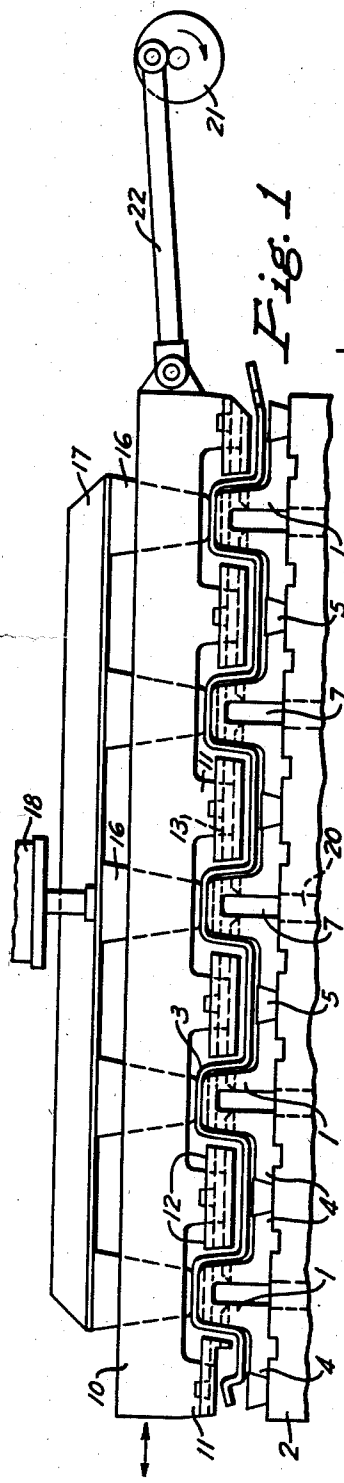


Fig. 1

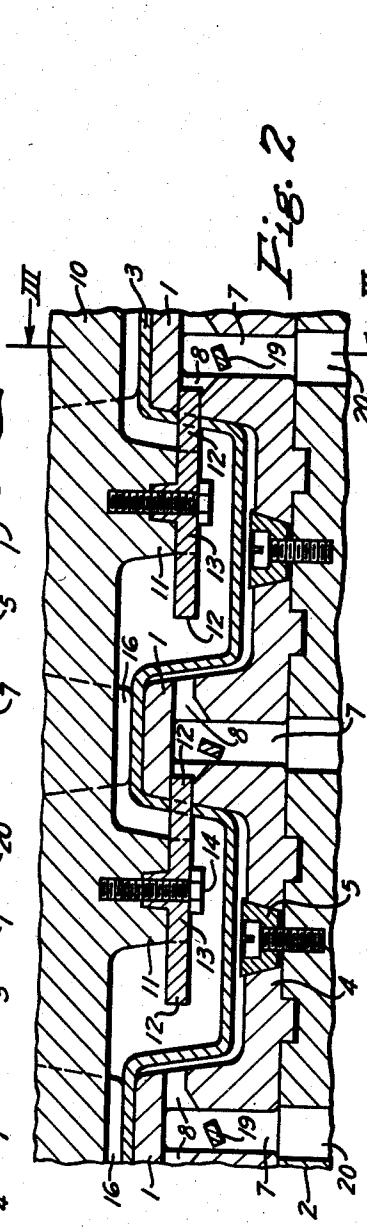


Fig. 2

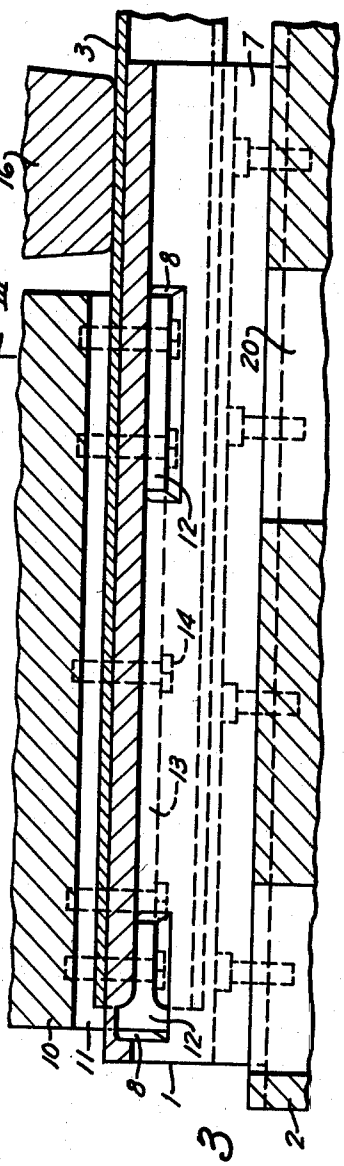


Fig. 3

INVENTOR.
GERALD G. GREULICH
BY
Brown, Critchlow, Flick & Peckham
HIS ATTORNEYS

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APPARATUS FOR PUNCHING CORRUGATED METAL PLATES

Gerald G. Greulich, Pittsburgh, Pa.

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3 Claims. (Cl. 164—90)

This invention relates to punching apparatus for forming holes or notches in the opposite sides of the corrugations of corrugated metal plates.

As an example of the need for such apparatus, the metal mats that often cover military airfields are generally formed from corrugated metal plates. In some cases the side walls of the corrugations of these plates are provided with openings to receive fastening members, by which the plates are connected together. In the past it has been the practice to punch such openings through the plates before they are corrugated. As it is very difficult to control the size and positions of the corrugations exactly when the punched flat plate is then corrugated, the openings have had to be made oversize to allow for variations in their positions. Oversize openings often result in loosely connected plates, which are highly undesirable.

It is among the objects of this invention to provide apparatus which will punch openings in the opposite sides of the corrugations of a corrugated plate, which will punch the openings exactly where needed and in correct size, and which will punch all of the openings in one back and forth movement of the punches.

In accordance with this invention, a number of laterally spaced parallel dies, which are adapted to fit into the corrugations of a corrugated plate, are mounted in fixed position for receiving such a plate. One or both sides of each die are provided with punch-receiving openings. Means are provided for pressing the corrugated plate against the dies between their sides. Located in the spaces between dies are punches that project laterally toward adjacent dies. These punches are carried by a support which extends across the dies. The support is reciprocated transversely of the dies in order to cause the punches to punch the sides of the plate corrugations. When some of the punches project in one direction and others in the opposite direction, punching will occur when the punch support is moved backward as well as when it is moved forward. The punches then are centered between the dies, and the punched plate is pulled lengthwise away from the dies. All of the punched openings will be the same distance from the plate surfaces that were pressed against the dies during the punching operation.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which

Fig. 1 is an end view of my apparatus with the punches in neutral position, ready to punch a corrugated plate that is in position;

Fig. 2 is an enlarged fragmentary transverse section through the apparatus, showing the punches just as they have punched one side of each plate corrugation; and

Fig. 3 is a longitudinal section taken on the line III—III of Fig. 2.

Referring to the drawings, a number of parallel dies 1, which are disposed in laterally spaced relation, are secured to the bed 2 of a machine. Each die has a top which is slightly narrower than the space between the opposite sides of the plate corrugation that is to fit over the die. The opposite sides of the die are long enough to extend down below the corrugated plate 3 and may be provided with outwardly directed feet 4 having inclined outer ends so that adjacent dies can be held on the bed by downwardly tapered bars 5 screwed to the bed between adjacent dies. The dies are spaced far enough apart to accommodate the horizontal portions of the plate between its corrugations. The bottom surfaces of those portions are not supported by any part of the machine.

Extending lengthwise of each die, midway between its opposite sides, is a downwardly extending recess 7. As shown in Figs. 2 and 3, opening into the upper part of this recess are the inner ends of horizontal punch-receiving openings 8, with which the dies are provided. In one example, where an airfield deck plate like that shown in my corresponding patent application Ser. No. 566,265, filed February 17, 1956, now Patent No. 2,824,501, is to be formed, each end of the plate is to be provided in the opposite sides of its corrugations with inwardly extending notches and with horizontal slots spaced inwardly from the notches. Accordingly, in such a case, both sides of the dies are provided with punch-receiving openings of corresponding shape.

Extending across the top of the dies and spaced a short distance above them is a movable support member or punch holder 10 which is supported in any suitable manner. Preferably, this member has, along its bottom, parallel ribs 11 that extend down into the spaces between some or all of the dies. The punches are fastened to the bottoms of these ribs. Most suitably, each group of punches 12 projects at longitudinally spaced intervals from the opposite sides of a flat bar 13, with which they are integral. Each bar is fastened to the bottom of one of the ribs by set screws 14. Although the punches project from the oppoite sides of the ribs, when the ribs are centered between the dies the punches are spaced from the adjacent dies a distance greater than the thickness of the stock from which the corrugated plate is formed. This permits one end of a corrugated plate to be slid lengthwise over the dies and beneath the punches to insert or remove the plate.

After the end portion of a corrugated plate has been moved into place in this manner, the tops of its corrugations are pressed down tightly on the tops of the dies by hold-down members 16 which may be rubber or smooth metal blocks or pads. These are attached to the bottom of a bar 17 that can be lowered and raised in any suitabe manner, such as by a fluid pressure cylinder 18. The punch holder 10 then is reciprocated from its neutral position, shown in Fig. 1, to cause it to move first toward one side of the machine and then back toward the other side and then to return to neutral position and stop. When this occurs, the punches along one side of each rib strike the adjacent side of a corrugation and punch openings through it as shown in Fig. 2. On the return stroke, the punches on the opposite sides of the rib punch openings through the side of the corrugation adjacent those punches. The punchings 19 fall into the central recesses 7 through the dies and drop through wide slots 20 in the bed of the machine. The punch holder can be reciprocated by any suitable mechanism. For the purpose of illustration only, a crank 21 and pivoted link 22 are shown in Fig. 1.

When a corrugated plate is placed in the machine in such a way that both sides of each die are spaced from the plate, as shown in Fig. 1, engagement of the punches with the sides of the corrugations will move the entire plate sideways until the corrugation sides strike the adjoining sides of the dies as shown in Fig. 2. The punches then will penetrate the plate. This lateral movement of the plate is allowed by the hold-down members 16, because the plate can slip beneath them or, in the case of

rubber pads, can flex the pads sufficiently for this purpose. As the punches are pulled out of the plate, the opposite unpunched sides of the corrugations may be pulled against the dies adjoining them before the punches leave the holes they have formed. Thus, the dies can serve as strippers for holding the plate while the punches are retracted. The same thing happens after the second set of punches has punched the plate.

As soon as both sides of the corrugation have been punched, the punches are returned to neutral position and the hold-down members are raised so that the punched plate can be pulled lengthwise out of the machine. Due to the fact that the tops of the corrugations were held down on the dies during the punching operation, all of the punched openings will be the same distance from the top of the corrugations and therefore will not have to be oversize to allow for being out of position. After one end of the corrugated plate has been punched in this manner, the opposite end can be inserted into a similar punching machine and punched in the same way.

Although this apparatus has been described as if the dies project upwardly from a machine bed, it will be evident that the position of the dies is unimportant and that they could project horizontally or at some other angle just as well. It also will be evident that there does not have to be the same number of punches on both sides of each bar **13** and they do not have to be opposite one another. They even can be omitted entirely from one side of the bar if desired, or they can be located on one side of one bar and on the opposite side of another bar. In that event, only the lefthand side of one corrugation and the righthand side of another corrugation will be punched, but it will be done during only one complete stroke of the punch holder.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. Apparatus for punching openings through the sides of corrugations of a corrugated plate, comprising laterally spaced parallel dies adapted to fit into those corrugations and having punch-receiving openings in their sides, means adapted to press the plate against the dies between their sides, punches in the spaces between the dies and projecting laterally toward adjacent dies, some of said punches projecting in one direction and the others projecting in the opposite direction, and means for reciprocating all of the punches in unison transversely of the dies to enable some of the punches to punch plate corrugations when the punches move in one direction and to enable the rest of the punches to punch plate corrugations when the punches move in the opposite direction.

2. Apparatus for punching openings through the opposite sides of the corrugations of a corrugated plate, comprising laterally spaced parallel dies adapted to fit into the corrugations of such a plate and having punch-receiving openings in their sides, means adapted to press the plate against the dies between their sides, punches in the space between each adjacent pair of dies and projecting in opposite directions toward both of them, a support extending across the dies and rigidly secured to the punches, and means for reciprocating said support transversely of the dies to enable the punches to punch both sides of each plate corrugation.

3. Apparatus for punching openings through the opposite sides of the corrugations of a corrugated plate, comprising laterally spaced parallel dies adapted to fit into the corrugations of such a plate and having punch-receiving openings in their sides, means adapted to press the plate against the dies between their sides, a support member extending across the dies and having portions projecting into the spaces between the dies, bars secured to the inner faces of said projecting portions and projecting from opposite sides thereof to form punches normally spaced from the adjacent sides of the dies, and means for reciprocating said support member transversely of the dies to cause the punches to punch both sides of each plate corrugation.

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