Dec. 28, 1926. 1,612,156

A. E. SMALL

MULTIPLE PUNCH

Filed May 10, 1922 5 Sheets-Sheet 1

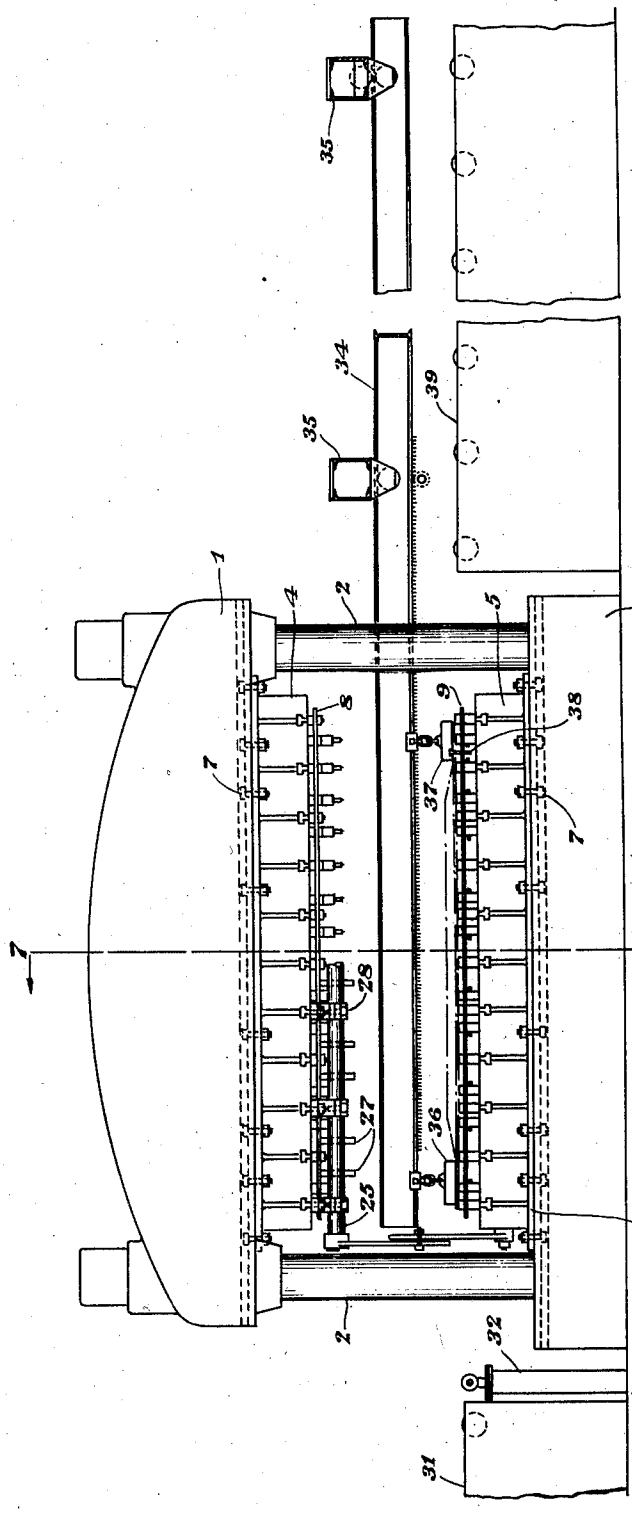


Fig. 1

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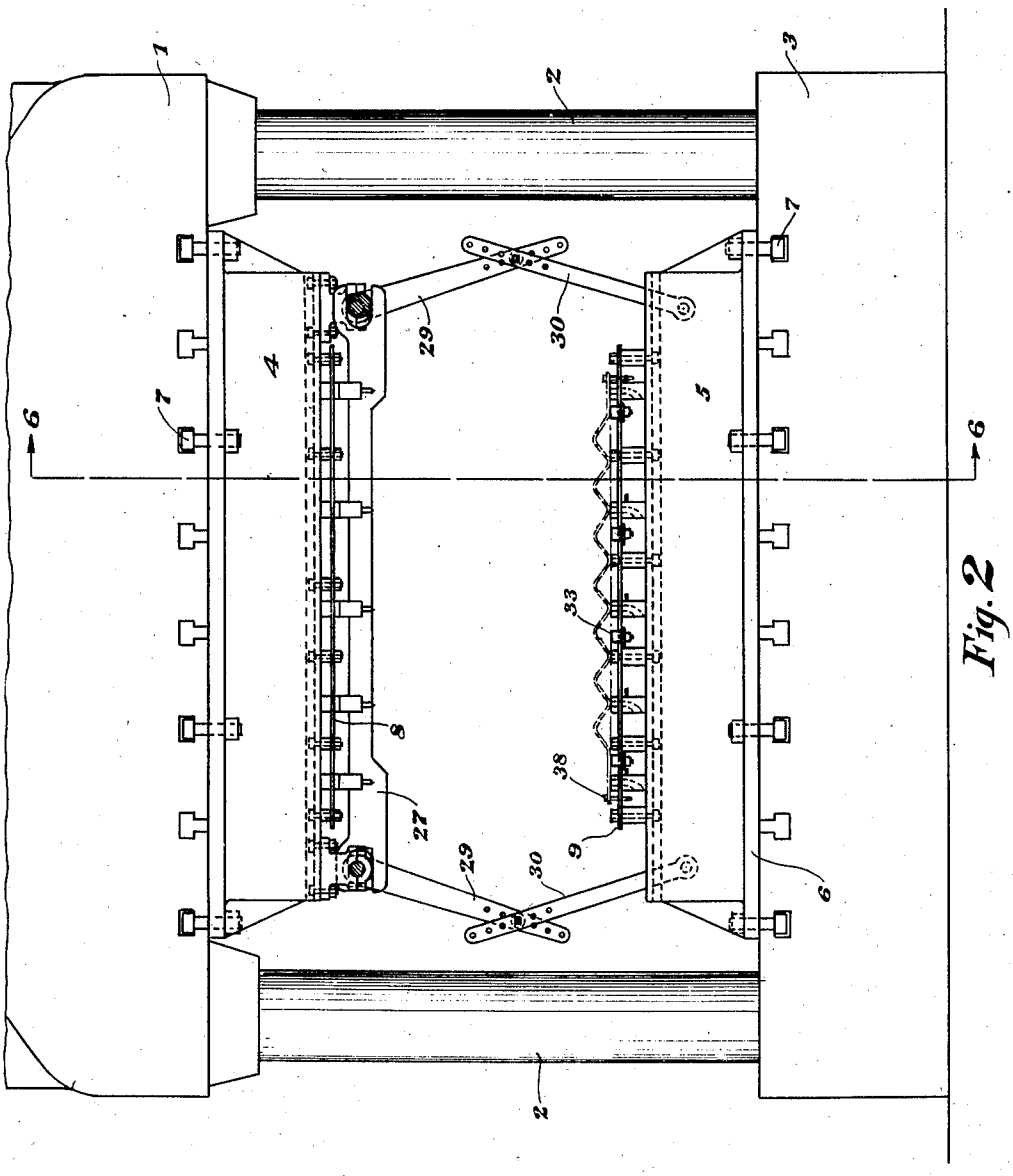


Fig. 2

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MULTIPLE PUNCH

Filed May 10, 1922 5 Sheets-Sheet 3

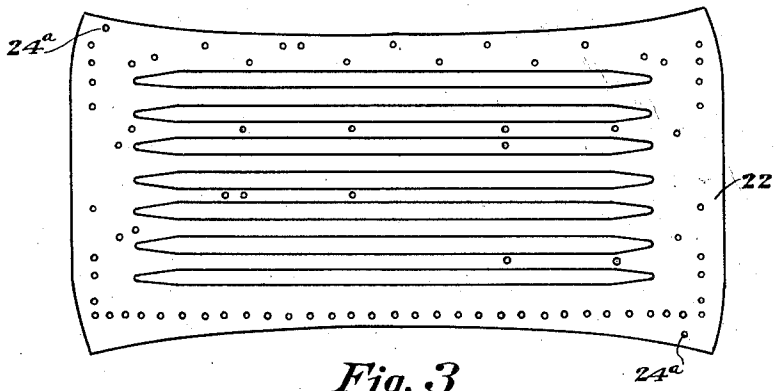


Fig. 3

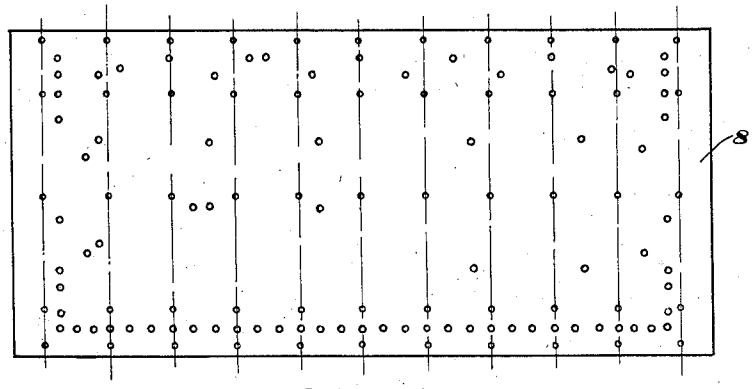


Fig. 4

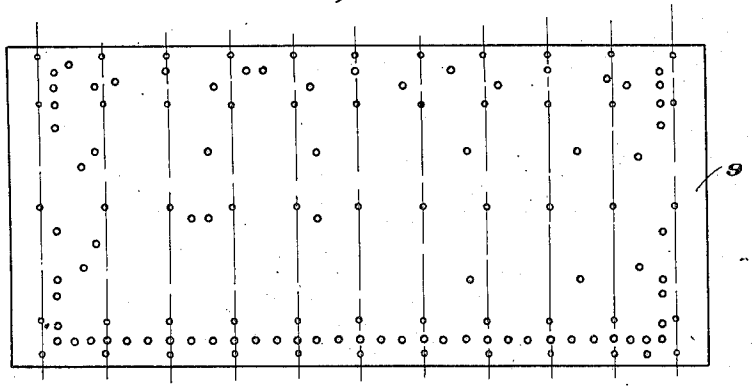


Fig. 5

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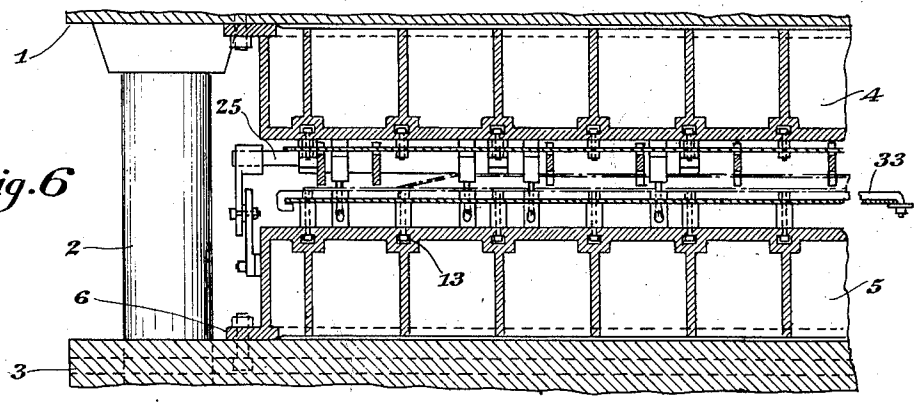
Dec. 28, 1926. 1,612,156

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MULTIPLE PUNCH

Filed May 10, 1922 5 Sheets-Sheet 4

Fig. 6



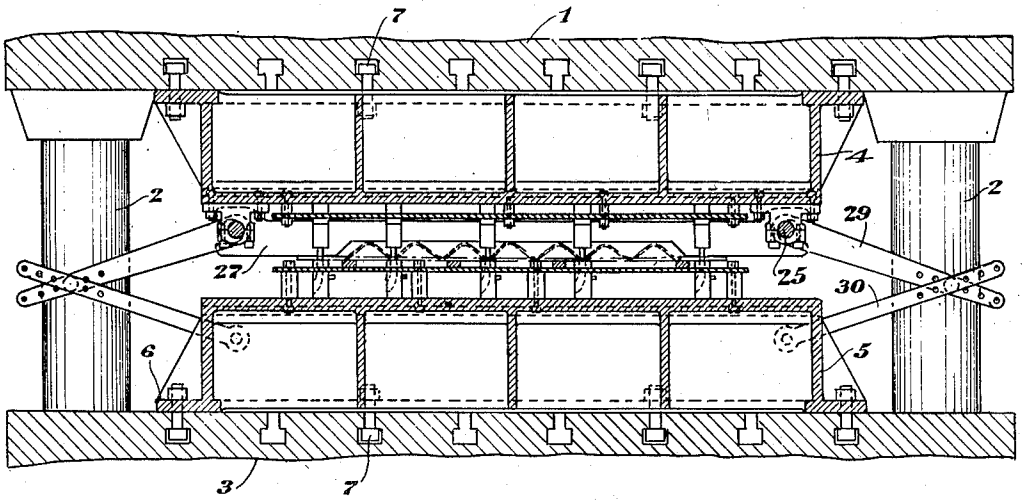


Fig. 7

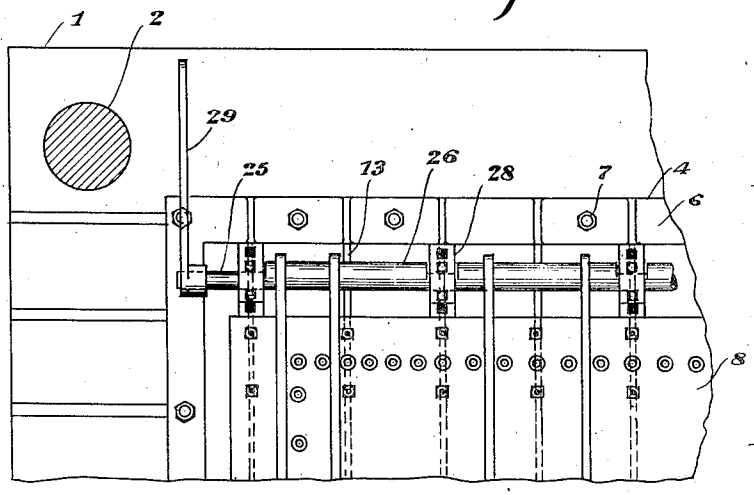


Fig. 8

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MULTIPLE PUNCH

Filed May 10, 1922 5 Sheets-Sheet 5

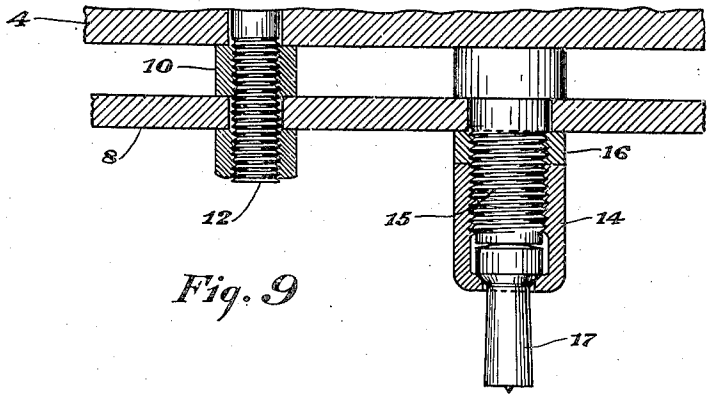


Fig. 9

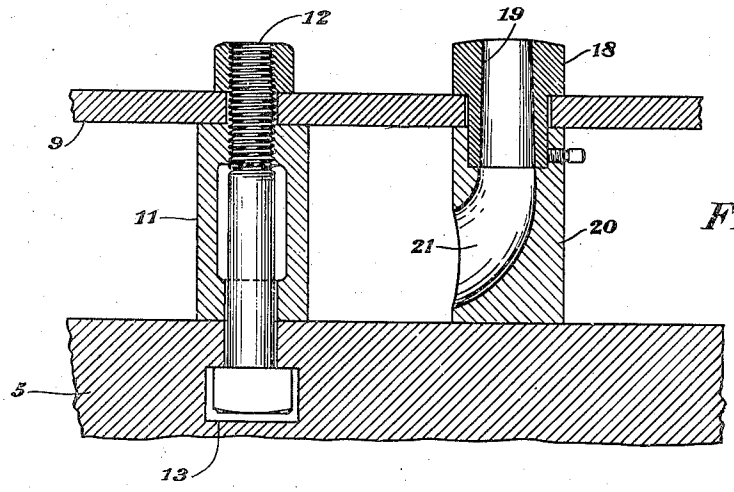


Fig. 10

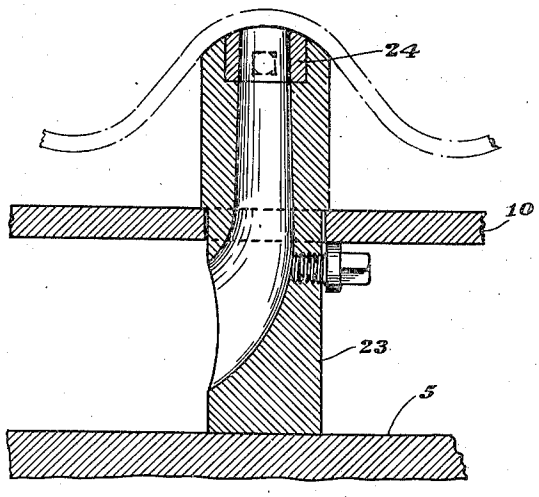


Fig. 11

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UNITED STATES PATENT OFFICE.

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MULTIPLE PUNCH.

Application filed May 10, 1922. Serial No. 559,835.

This invention relates to improvements in multiple punching machines and more particularly to a multiple punch by which a plurality of holes in any desired relation to each other may be punched in metal sheets of different thicknesses at the same time.

It is an object of this invention to provide a machine whereby metal plates of different thicknesses may be punched with a plurality of holes at one operation. It is another object of this invention to so construct this machine that any number of holes in any predetermined location upon the sheet may be punched in one operation, and it is a further object to provide a means for stripping the punched plates from the punches to prevent the tearing or deforming of the sheet after the holes have been punched.

While the preferred form of this invention is illustrated upon the accompanying sheets of drawings, yet it is to be understood that minor detail changes may be made without departing from the scope thereof.

In the drawings:

Fig. 1 is a view in side elevation of a punching machine constructed in accordance with this invention.

Fig. 2 is a view in end elevation of Fig. 1.

Fig. 3 is a top plan view of a sheet of metal to be punched.

Fig. 4 is a plan view of the punch template.

Fig. 5 is a plan view of the die template.

Fig. 6 is an enlarged detail view in longitudinal section taken on the line 6—6 of Fig. 2, with parts broken away.

Fig. 7 is an enlarged detail view in transverse section taken on the line 7—7 of Fig. 1.

Fig. 8 is an enlarged detail view in plan of the eccentric stripping shaft.

Fig. 9 is an enlarged detail view in elevation and partly in section of a punch illustrating its means of attachment.

Fig. 10 is a similar view of the die.

Fig. 11 is a similar view of a modified form of die.

While the machine constructed in accordance with this invention may be used for punching large sheets of metal of various types, it is particularly adapted for punching corrugated sheets as will hereinafter be described.

Figs. 1 and 2 illustrate a usual type of hydraulic punching machine in which the upper platen is stationary and the lower platen reciprocated to and from the stationary platen to perform the punching operation and needs no particular description as this invention relates to the formation of the templates, the arrangement of the punches and dies and means for stripping the punched plate from the punches.

Fig. 3 illustrates a corrugated plate for which this machine is particularly adapted and the only requirement is that the body of the machine be of sufficient size to receive the plate. The corrugated plate illustrated is one described in other patents for forming an end or portion of an end of a freight car, and is illustrated in the form in which it comes from the corrugating press before shearing. Plates of this kind are pressed from rectangular blanks of steel generally of $\frac{3}{16}$ to $\frac{3}{8}''$ in thickness with corrugations usually of $2''$ in depth which merge into the plane of the sheet at their ends so that there is a margin of metal on all four sides in the original plane of the sheet and as the corrugations are usually pressed from one side of the apices of the corrugations on one side will also lay in the plane of the plate. The pressing up of the corrugations within the body of the plate contracts the sides of the plate, as shown, and the plate is sheared to rectangular form before being applied to the car and it is also necessary to punch a large number of rivet holes for securing the top and bottom of the plate to other plates or the car frame and as the ends of the plate are bent at right angles to form flanges which together with the adjacent body are riveted to the end posts of the car it requires a line of rivet holes along each end. Numerous other holes are required in the body of the plate for securing the lining or nailing strips, grab irons, ladders, etc. These latter rivet holes are usually in the apices of the corrugations that lie in the plane of the plate. However, at times rivet holes in the apices of the corrugations at a distance from the plate are required.

The object of this invention is to punch all of the required holes in the plate at one operation, preferably after the plate has left the corrugating press and before its edges are sheared so that after the shearing the plate needs no further handling or operating upon except where the ends are flanged

before shipment. However, it may be desired to shear the plates before punching the holes and use gauge strips to center and hold the plate in position.

As shown in Figs. 1 and 2 the punching machine comprises an ordinary form of hydraulic press in which the upper platen 1 is held stationary above the base by columns 2 which are spaced apart a sufficient distance to allow the entrance of the plate to be punched and be placed beneath the upper platen. The lower platen 3 is reciprocated to and from the upper platen by a hydraulic ram and is guided by the columns during its movement.

Similarly formed punch and die blocks 4 and 5 are secured in line with each other upon the platens and may be of solid metal or may be hollowed out on the platen side if desired, said blocks having a continuous flange 6 about the face contacting with the platen which flange is provided with bolt holes so that the blocks may be secured to the platen by a series of bolts 7. To the faces of the punch or die blocks which are adjacent each other are secured punch and die templates 8 and 9 for positioning the punches and dies in line with each other and in accordance with the holes required to be punched in the plate. By the use of these templates any desired arrangement of rivet holes may be punched. In order that the dies and punches may be both secured to the templates and rest upon the punch and die blocks the templates are spaced apart from the faces of the blocks by threaded spacing blocks 10 and 11 and are secured to the punch and die blocks by bolts 12 threaded through the spacing blocks and passing through templates and secured thereto by nuts on the exterior of the templates. To receive and hold the heads of the bolts the adjacent faces of each punch and die block are provided with a plurality of corresponding transverse grooves 13 through which the shank of the bolt may be passed with the bottom of the grooves gained out or increased in width to receive the bolt heads, so that while the bolts may be moved transversely of the blocks they will be held securely in position when the nuts are taken up.

After the location of the desired rivet holes has been determined and one template so marked it is preferable, while not necessary, to place the two templates together and drill or punch the punch and die positioning apertures in both at the same time thereby insuring an accurate disposition of both apertures in line with each other.

It is preferable to carry the punches upon the upper and stationary platen with the dies upon the lower and movable platen, although the relations may be reversed if desired. The punches are carried in holders 14 upon the upper template and secured thereto by a threaded bolt 15 passing through the template apertures with the head resting against the punch block, the bolt secured by a lock nut 16 on the opposite side in contact with the outer surface of the template. The punch proper 17 is secured to the bolt by means of a coupling nut 14 provided with threads adapted to engage the threads of the bolt and at the other end with a circular aperture through which the shank of the punch is passed.

The inner end of the punch is provided with an enlarged head so that the coupling nut will secure the punch to the bolt. This end is slightly convex and is held in engagement with the end of the bolt by means of the coupling nut. Threaded spacing blocks 10 equal in thickness to the positioning bolt heads are disposed about the template positioning bolts so that the template is secured rigidly to the punch block holding the punch carriers against the blocks and since the punch carrier bolts are all of the same dimension and the punches of the same length the operative ends of the punches are positioned in the same horizontal plane.

The dies 18 are preferably in the form of shouldered cylinders having a central passage 19 through which the punch and slug punched from the plate may pass with the distance from the upper or operating surface and the shoulder equal in all instances and the restricted portion is passed through the template positioning aperture with the shoulder in contact with the outer surface of the template and with a portion of the die extending beyond the inner surface thereof. A cylindrical die holder 20 is interposed between the bottom of the die and die block having a circular recess at the top to receive the portion of the die projecting beyond the inner surface of the template and which may be secured thereto by a set screw. A passage 21 is provided in the die holder leading from the passage in the die and opening on the side of the holder for the discharge of the slug punched from the plate. The threaded spacing blocks 11 about the template securing bolts are of equal height to the die holders so that the template will be held rigidly in place with the dies positioned thereon and through the die holder in contact with the die block.

The apertures in the templates for positioning the punch holders and dies may be of the same size and both may be drilled at the same time by placing the templates together and this is preferable as then exact registry of punches and dies is thereby assured. The apertures in the templates for the bolts securing them to their respective blocks are preferably drilled or punched at the same time, while the templates are face to face. These apertures may be arranged in any de-

sired location to avoid being too near the punch or die apertures as long as they are in line with the bolt receiving grooves in the respective die blocks.

The templates are then secured to their respective punch and die blocks with the punches and dies in line and which will be by their holders held resting upon the punch or die blocks so that when the plate is placed between them the pressure of the press will be communicated from the blocks through the holders to the punches and dies uniformly at the same time and as the dies are on the under or lower platen the metal slugs punched from the metal plates will fall through the passage in the die holders to the upper surface of the die block.

Since it is necessary that the holes in all the plates be punched uniformly care must be taken that each plate 22 is placed upon the press in exactly the same position. The majority of the plate holes are punched from the metal plate which lies in the normal plane of the plate so that the plate may be rested upon the dies of the punch and when it is desirous to punch holes in the crowns of the corrugations which lie above such plane a special die holder 23 and die 24 is provided for punching such holes in which the holder is of greater height, as shown in Fig. 11, and the corresponding punch likewise shortened. To secure the same relation between the plates and punch it is preferable to punch or drill pilot holes 24ª in the excess metal of the plate and the part that will later be sheared and provide corresponding pilot holes in the die or lower template and its respective die block, if necessary, so that as the plate is suspended above the dies before being laid thereon the bolts may be inserted through the pilot holes in the plate with the bolt head upon the upper surface and the lower free ends depending below the plate inserted in the template or die block holes so that as the plate is lowered the bolts in both sets of pilot holes will guide the plate to the same location upon each operation, or should the plate be sheared before punching gauge strips may be provided secured to the templates so as to register with the sheared edge of plate.

The metal plates for which this multiple punch is especially designed ranges from $\frac{3}{16}$ to $\frac{3}{8}$" in thickness and it takes a large, powerful press to punch all the necessary holes at one time. To strip the punched plate requires a considerable pressure and therefore mechanical means must be provided that will exert the stripping pressure evenly on the upper side of the plate at the same time to remove or strip it from the shanks of the punches without tearing or mutilating the body of the plate about the punch holes. The mechanical means provided for this purpose comprises an eccentric shaft 25 mounted longitudinally on each side of the press having corresponding cams 26 on opposite sides which co-operate with stripper bars 27 arranged transversely of the press, the ends of which engage the cams, the reciprocation of the platen of the press being transmitted to the shafts to strip the punched plates from the punches. As illustrated, the eccentric shafts are mounted in bearings 28 on each side of the press outside of the templates which bearings are adapted to be secured to the punch block in the same manner as the template by bolts having their heads positioned in the transverse grooves in the blocks and with the base of the bearing resting against the surface of the block and therefore may, if desired, be arranged with a bearing adjacent each groove with cams upon the shafts between each bearing or may be mounted on the sides of punch or die blocks. As many stripper bars as desired may be arranged transversely of the press, each of which is provided with a continuous straight upper surface adapted to clear the template and having the lower side recessed intermediate its ends so that the end portions are adapted to engage the margins of the plate that lie in the normal plane of the plate and the body of the recessed portion engage the apices of the corrugations of the plate and some strippers at edge of the corrugated plate are not recessed so that when pressure is applied in a downward direction the stripper bars will transmit such pressure to the entire surface of the plate it contacts with. Each end of each stripper bar is bifurcated having sides parallel to the surface of the template adapted to receive between them the cams of the eccentric shaft by which means the stripper bars are held and reciprocated. The reciprocating movement of the die platen of the press is preferably transmitted to the shaft by providing at each end of the shaft, or at as many intermediate points as desired, an outwardly extending crank arm 29 fixedly secured to the shaft which in turn is connected by a link 30 pivoted at one end to the end of the crank arm and at the other to the platen or block so that the up and down movement of the movable platen will impart a rotary movement to the eccentric shaft. The adjacent ends of the crank arm and link are each provided with a plurality of pivot bearings by which the pivot point may be adjusted to regulate the operation of the cam shaft.

There being a plurality of stripper bars provided across the punch plate which may be arranged between the punches and adjacent the punched holes which engage the upper surface of the plate after the punching operation is completed and the die plate begins to descend and impart a downward

pressure upon the upper surface of the punched plate which pressure continues as the die plate descends the punched plate will be uniformly and continuously forced downward by pressure applied throughout the surface of the punched plate adjacent the punches that will strip the plate from the punches without tearing, buckling or otherwise deforming the plate.

The corrugated plates 22 to be punched are of considerable weight and are cumbersome to handle by hand in position upon the press so that it is desirable to make the operation on the plates as nearly continuous as possible from the flat plate to the completed corrugated punched and sheared plate, that is, ready for application to the car. To this end, an electromagnetic hoist or crane is provided at either or both ends for positioning and removing the corrugated plates over the dies and also a conveyor from the corrugating press to the punch and another from the punch to the distribution point.

As shown in Fig. 1 a roller conveyor 31 is preferably provided from the corrugating press comprising a plurality of transverse rollers preferably operated in unison by a chain or other mechanical means which is adapted to receive the plate as it leaves the press and deliver it to the punch. At the punch end the conveyor is of a height corresponding to the height of the operating surface of the dies of the lower platen when at the end of the downward movement and it is preferable to provide a pneumatic lift or hydraulic ram 32 comprising a vertical cylinder having a vertical lifting arm terminating in a roller bearing so that should from any cause the end of the delivered plate be below the dies of the punch, such as occasioned by an incompleted opening of the punch platens, the plates may be lifted to the proper height.

To protect the operating surface of the dies it is preferable to provide a plurality of longitudinal skids 33 upon the upper surface of the die templates over which the plate to be punched may slide without damaging the dies which are preferably formed of metal bars having bent back ends adapted to be engaged with the under side of the template and as these skids are removable they may be placed as desired between the dies.

To complete the positioning of the plate after it has been presented to the punch an electromagnetic crane is provided which preferably comprises a reciprocating arm or arms arranged to travel longitudinally over the center of the punch between the punches and dies. This arm is preferably in the form of an I beam 34 mounted in bearings 35 on the side opposite the press conveyor and having rollers adapted to engage the upper and lower sides of the top flange and a rack on the under side of the lower flange adapted to engage a power driven pinion by which the arm may be reciprocated. The reciprocating arm is provided with two electromagnets 36 and 37 on its under side spaced apart so that they will be adapted to engage the marginal flat surfaces of the ends of the plate and are provided with adjustable clamps to provide proper spacing and also limit connection. One end of the arm is adapted to travel through the punch and therebeyond a sufficient distance to be over the adjacent end of the plate presented by the press conveyor with the magnet adjacent this end positioned over the adjacent flat marginal portion of the plate. The end magnet is then energized to attach the plate to the arm and the arm is retracted, carrying the plate over the template until in proper position to be punched and deposited. The pilot bolts 38 having been inserted will engage the pilot holes in the template and upon the release of the magnet will guide the plate to the proper position to be punched. The retraction of the arm is continued until it is free from the punch. After the punching operation is completed and the plate stripped and the die platens depressed the crane arm is again moved over the punched plate until its magnets lie over the plate, the magnets energized which will hold the plate while the plate is slightly lowered and the arm retracted carrying with it the plate from between the platens of the punch. A transfer table or conveyor 39 similar to the press conveyor is provided at this end of the punch over which the punch plate is moved by the crane and upon de-energizing the magneto the punched plate is rested upon this conveyor or transfer table for such disposition as is desired and the arm is ready for another travel through the punch to reach the end plate.

It is, therefore, seen that any number of similar plates can be punched one after the other and in each the holes punched will be in the same relation to each other on the margins of the plate. It is also readily seen that the dies and punches being positioned to register by the templates with the pressure exerted directly upon the punches and dies independently of the positioning means will positively cause the dies and punches to register at each operation of the punch. A reciprocation of the press having die and punch blocks of the character described can be readily adapted to punch any arrangement of holes by having the templates. The means for securing the templates to the punch and die blocks is such that the securing means never interfere with any arrangement of the punches and die holders and the template not only positions the punches and dies but also insures that the punch and

die holders engage the punch and die blocks.

What I claim is:

1. In a reciprocating punch, punch and die blocks, punches and dies secured in alignment to each other upon the respective blocks, a stripper operating shaft mounted on one of the blocks, a plurality of stripper bars arranged adjacent the punches in engagement with the shaft adapted to strip the punched plate from the punches, and means operated by the reciprocation of the punch to actuate the shaft.

2. In a reciprocating punch, punch and die blocks, punches and dies secured in alignment thereon, stripper shafts on opposite sides of the punch mounted on the punch block, a plurality of stripper bars arranged adjacent the punches adapted to strip the punched plate from the punches in engagement with the shafts, and means operated by the reciprocation of the punch to actuate the shafts.

3. In a reciprocating punch, punch and die blocks, punches and dies secured in alignment thereon, stripper shafts on opposite sides of the punch mounted on the punch block, a plurality of stripper bars arranged adjacent the punches adapted to strip the punched plate from the punches in engagement with the shafts, and adjustable means operated by the reciprocation of the punch to actuate the shafts.

4. In a reciprocating punch, punch and die blocks, punches and dies secured in alignment thereon, stripper shafts on opposite sides of the punch mounted on the punch block, a plurality of stripper bars arranged adjacent the punches adapted to strip the punched plate from the punches in engagement with the shafts, and means operated by the reciprocation of the punch to actuate the shafts, said means including bar engaging cams upon said shafts.

5. In a reciprocating punch, punch and die blocks, punches and dies secured in alignment thereon, stripper shafts on opposite sides of the punch mounted on the punch block, a plurality of stripper bars arranged adjacent the punches adapted to strip the punched plate from the punches having bifurcated ends embracing the shafts, cams of the shafts adapted to actuate the bars, and means operated by the reciprocation of the punch to rotate the shafts.

6. A reciprocating punch, a reciprocating electromagnetic crane adapted to move through the parts of the punch when open, a conveyor adapted to present a plate to the punch having a lift at the punch end adapted to carry the plate to engage the crane, said crane adapted to engage the plate, position it on the press and remove the punched plate.

7. In a machine; the combination of reciprocating elements, punches and dies secured in alignment thereon, stripper shafts positioned on the opposite sides of the machine mounted on one of the reciprocating elements, a plurality of stripper bars in engagement with said shafts adapted to strip a punched plate from the punches upon rotation of the shafts, and means operated by the reciprocation of the machine to rotate the shafts.

8. In a machine; the combination of reciprocating elements, punches and dies secured in alignment thereon, stripper shafts positioned on the opposite sides of the machine mounted on one of the reciprocating elements, a plurality of stripper bars in engagement with said shafts adapted to strip a punched plate from the punches upon rotation of the shafts, and means operated by the reciprocation of the machine to rotate the shafts, said means including bar engaging cams upon said shaft.

9. In a machine; the combination of reciprocating elements, punches and dies secured in alignment thereon, stripper shafts positioned on the opposite sides of the machine mounted on one of the reciprocating elements and having cams rigidly secured thereto, a plurality of stripper bars having bifurcated ends engaging said cams, adapted to strip a punched plate from the punches upon rotation of the shafts, and means operated by the reciprocation of the machine to rotate the shafts.

10. In a reciprocating punch, punch and die blocks, punch and die holders, removable templates for positioning and holding the punch and die holders against their respective blocks, means to maintain the templates in rigid spaced relation to their respective blocks, said means having a passage leading from the die to the space between said template and said die block for the discharge of slugs, and additional means to secure the template to the respective blocks.

11. In a punching machine, a die holder, a die block, a removable template, and means to hold said block and template in rigid relation, said means also maintaining said holder against said block, said holder provided with a passage opening on the side thereof for the discharge of slugs.

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