July 27, 1943. G. F. WALES 2,325,290

SHEET MATERIAL PUNCHING APPARATUS

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Fig. 1.

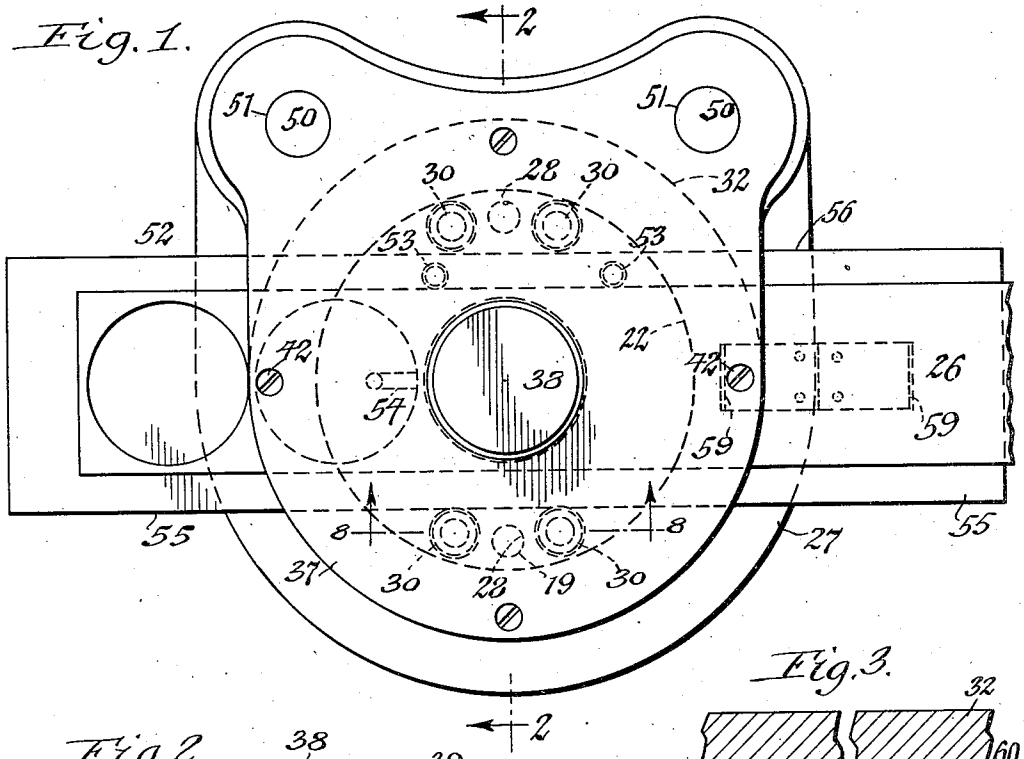


Fig. 2.

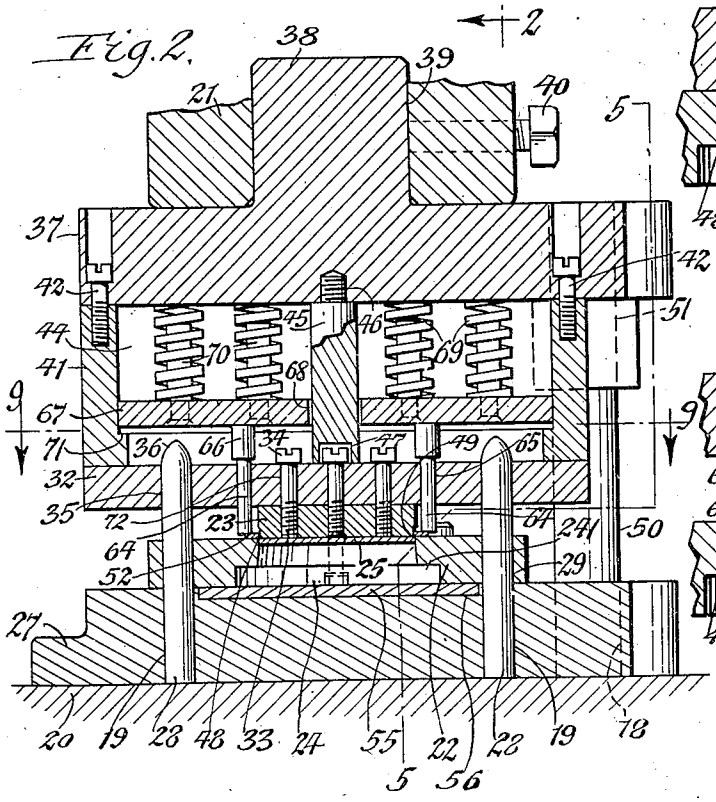


Fig. 3.

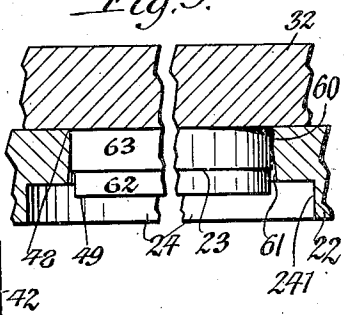
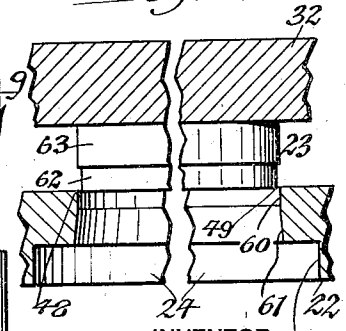


Fig. 4.



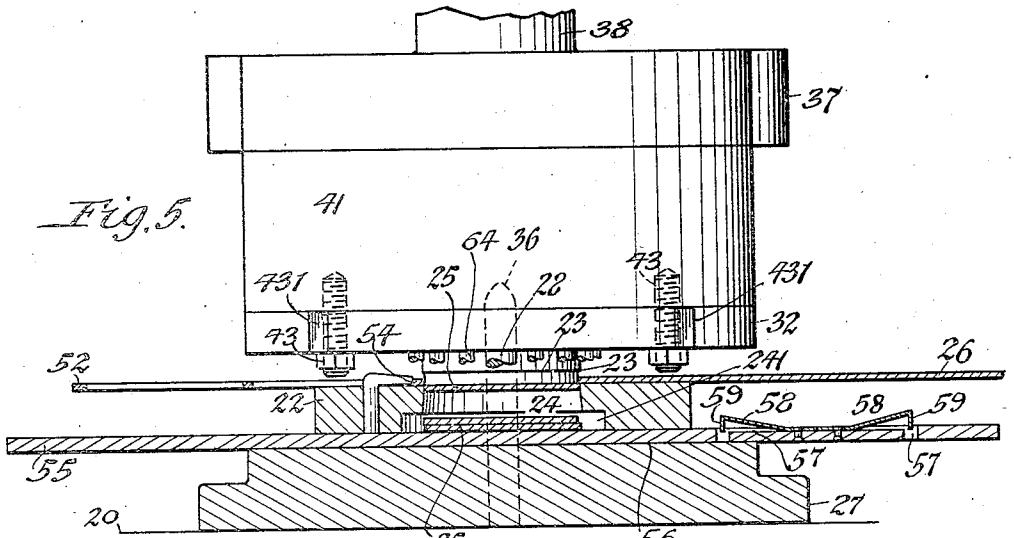
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SHEET MATERIAL PUNCHING APPARATUS

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Fig. 5.



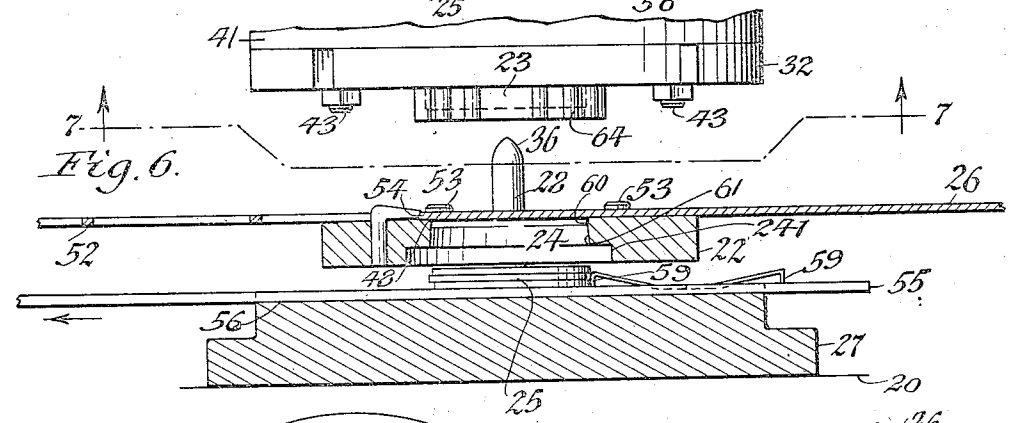


Fig. 6.

Fig. 7.

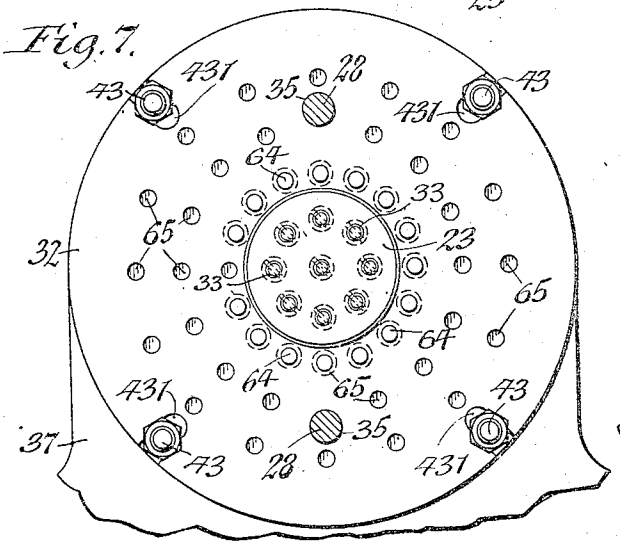
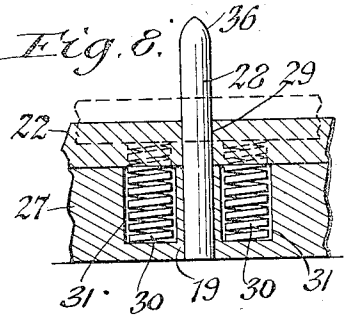


Fig. 8.



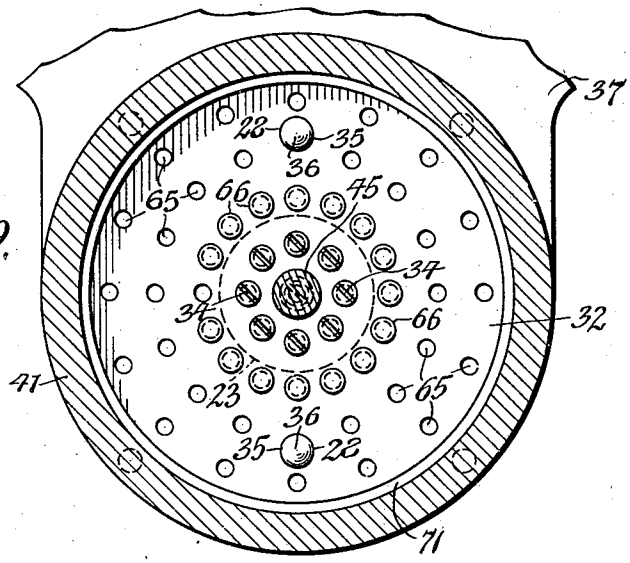
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SHEET MATERIAL PUNCHING APPARATUS

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Fig. 9.



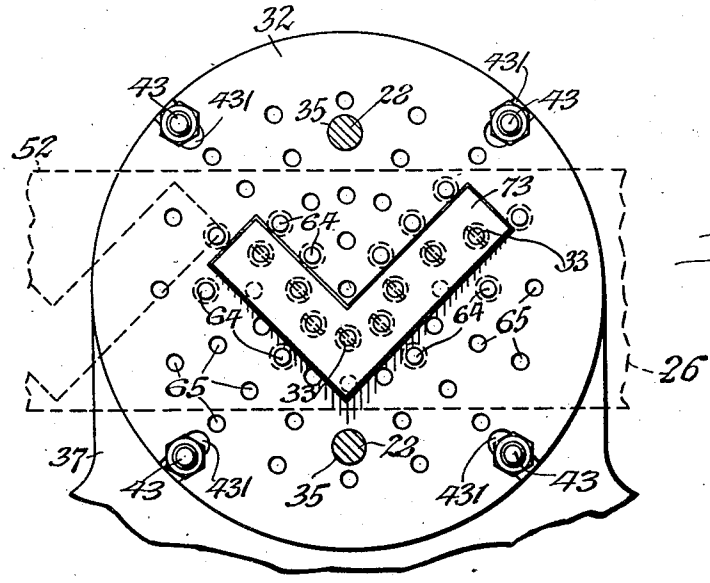


Fig. 10.

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Fig. 11.

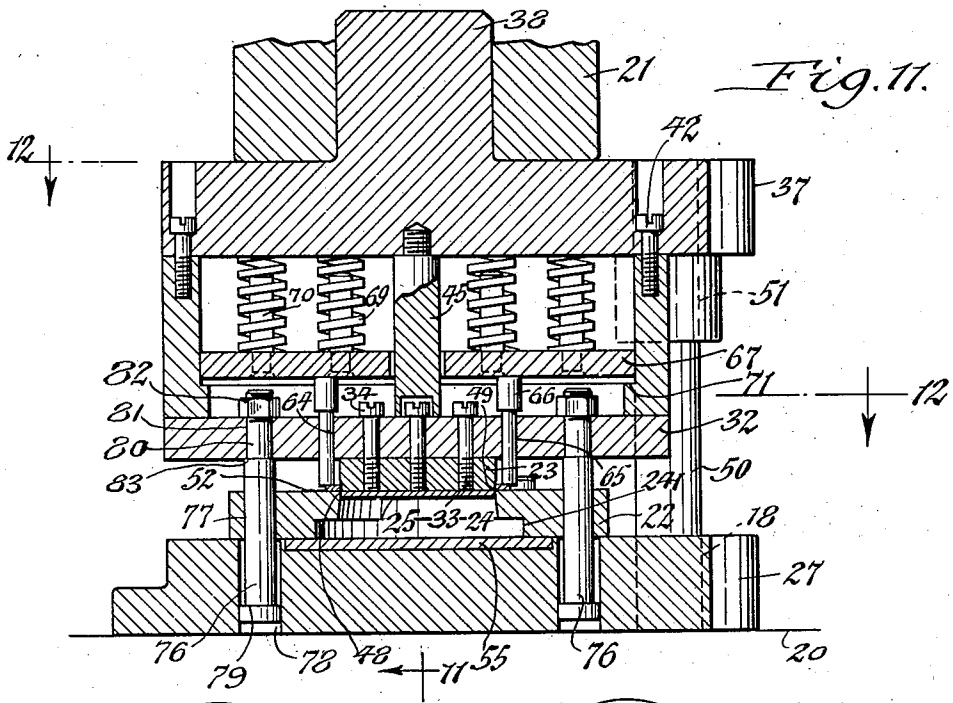
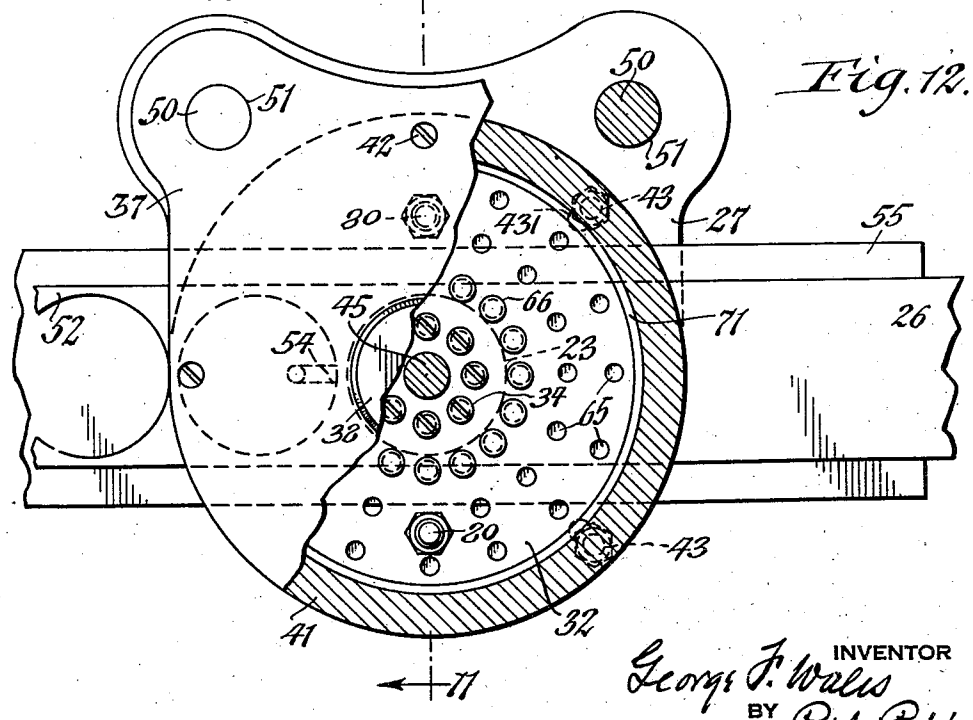


Fig. 12.



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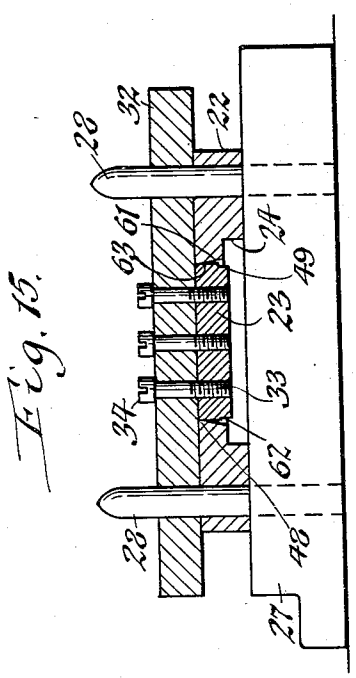


Fig. 15.

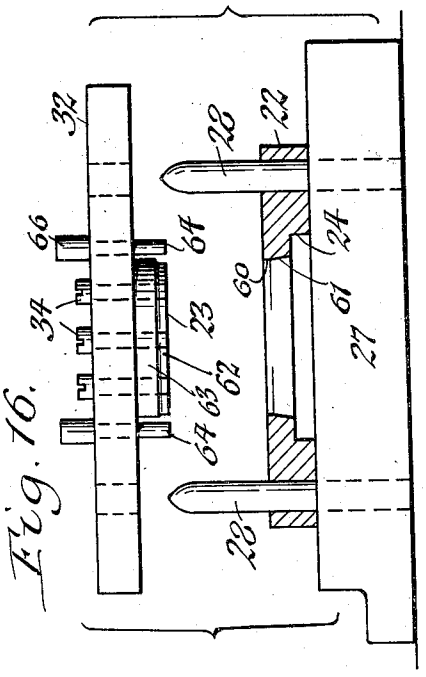


Fig. 16.

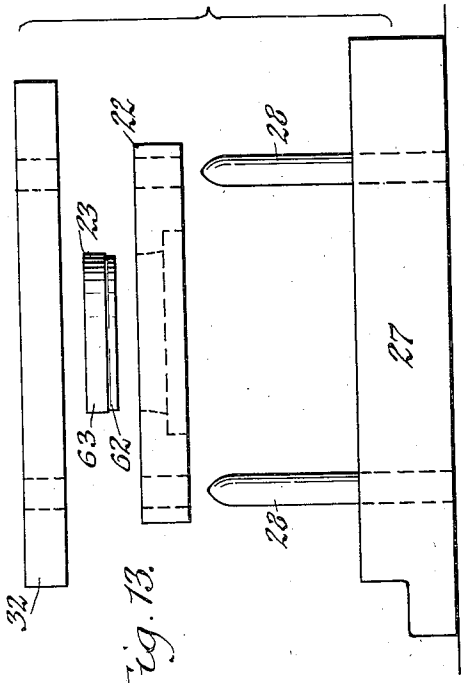


Fig. 13.

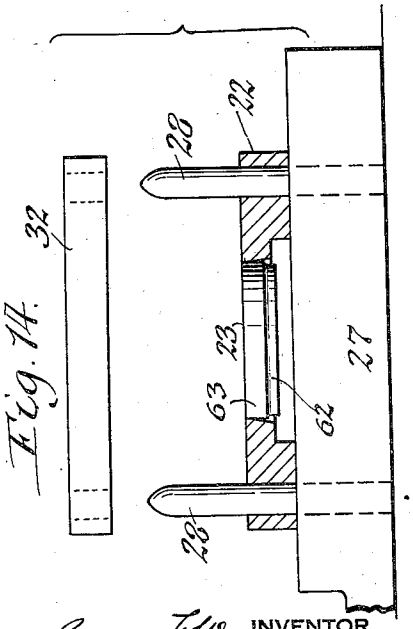


Fig. 14.

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Patented July 27, 1943 2,325,290

UNITED STATES PATENT OFFICE

2,325,290

SHEET MATERIAL PUNCHING APPARATUS

George F. Wales, Kenmore, N. Y.

Application September 27, 1941, Serial No. 412,626

40 Claims. (Cl. 164—110)

This invention relates to a punching apparatus which is more particularly intended for cutting or stamping blanks of various shapes from sheet metal or other sheet material.

Punching apparatus employed heretofore for accomplishing this work has usually been made into complete die assemblages, consisting of a die set comprising a punch holder having a stem for attaching to the ram of a press and a die shoe for mounting to the bolster of a press, the die shoe having guide posts firmly attached to it and the punch holder, which moves toward and from the die shoe with the reciprocating movement of the ram, having openings for receiving the guide posts for the purpose of insuring the respective parts operating in perfect alignment. On the die shoe have been permanently mounted the die member and accessory parts while on the punch holder have been permanently mounted the punch member and accessory parts.

The present invention has to do with the cutting of blanks from strips or sheets of metal or other material. When these blanks have been cut with a conventional punching apparatus as described above, the die shoe has been usually provided with an opening through which the cut blanks may drop into a container. Otherwise, if provision is not made for the blanks to drop through the die shoe it has been necessary to provide an ejecting means for emitting the blanks back to the face of the die.

It has been the practice, up to now, to mount the punch and die members with their strippers, guides, lift-out devices, and stops permanently into individual die sets so that when blanks for which the tool was built were to be produced it has been necessary merely to fasten the complete assemblage into a suitable press and proceed with the work.

This is the best possible way to make punching apparatus but it is also the most expensive for if blanks of, say, fifty different shapes are to be made, it is necessary to make fifty different complete blanking devices. There has up to now been no satisfactory way to dismantle the die members from the die shoes or the punch members from the punch holders so that the shoes and punch holders could be used in a practical manner by mounting other punch and die implements for blanking with them.

As a matter of fact, the die sets consisting of the punch holder, die shoe and guide posts are by far the cheap parts of the entire assemblage while the remaining parts of these sets are more expensive.

It is the object of this invention to provide a blank punching apparatus which is so constructed that the die set comprising a punch holder, die shoe, and guide posts may have permanently added to them parts which make it possible to use the one die set for any size blank within its scope without taking the die set out of its press; it being necessary only to change the punch which is mounted on an auxiliary plate on the punch holder and to change the die which is loosely assembled on the die shoe.

It is the object further to provide a punching apparatus in which it is only necessary to make a punch steel of simple construction and prepare its companion die steel to punch out blanks of the desired contour.

A further object is to provide a punching apparatus which is novel in construction, efficient in its operation and economical in its manufacture and use.

A further object is to provide a punching apparatus in which the die member is caused to rise above the shoe to provide a space through which the blanks may be removed.

These, and other objects, will be apparent from the following description.

In the accompanying drawings:

Fig. 1 is a top plan view of one form of sheet metal punching apparatus embodying this invention.

Fig. 2 is a vertical cross section of the same taken on line 2—2, Fig. 1 and showing the die and punch closed.

Fig. 3 is a fragmentary sectional elevation of the die and punch in a fully closed position.

Fig. 4 is a similar view showing the die and punch in an open or separated position.

Fig. 5 is a fragmentary longitudinal sectional elevation of the punching apparatus, showing the same closed and the upper part thereof in elevation and the lower section being taken generally on line 5—5, Fig. 2.

Fig. 6 is a similar view showing the punching apparatus open.

Fig. 7 is a horizontal section taken on line 7—7, Fig. 6, looking upwardly.

Fig. 8 is a fragmentary vertical section taken on line 8—8, Fig. 1.

Fig. 9 is a horizontal section taken on line 9—9, Fig. 2.

Fig. 10 is a view similar to Fig. 7, but showing the apparatus organized for making an L-shaped

blank instead of a round or circular shape, as shown in Figs. 1–7.

Fig. 11 is a vertical section similar to Fig. 2, and taken on line 11—11, Fig. 12 and showing a slightly modified form of this invention in which the die is raised positively instead of resiliently, as in the construction shown in Figs. 1–8.

Fig. 12 is a horizontal section taken on line 12—12, Fig. 11.

Fig. 13 is a diagrammatic view showing in a separated position the die shoe having the guide pins, the die, the punch and the punch plate preparatory to assembling the same with other parts for use as a complete operating unit.

Fig. 14 is a similar view showing the die assembled with the die shoe and its guide pins, the die inserted in the opening of the die and the punch plate ready to be assembled with the punch.

Fig. 15 is a similar view showing the punch plate lowered over the guide pins and resting on the die plate and the punch connected with the punch plate.

Fig. 16 is a similar view showing the punch plate, together with the punch attached thereto, lifted from the die plate and guide pins and stripping pins inserted in the punch plate at the side of the punch.

In the following description similar reference characters indicate like parts in the several figures of the drawings:

Referring to Figs. 1–10, the numeral 20 represents a lower stationary support of the punching or stamping press such as a base, table, bolster or bed and 21 the ram thereof which is arranged above the base as in the usual and well known construction of presses of this type now in common use. The numeral 22 represents the die or die steel and 23 the punch arranged above the die adapted to enter an opening 24 in the die for cutting blanks 25 from a sheet metal workpiece 26 which latter in the present case has the form of a strip. The cutting edges of the die and punch are of circular form so that the blank which is produced between the die and punch is of corresponding shape. As will later appear this blank may be of any desired contour to suit the purpose for which the same is intended. The die preferably has the form of a horizontal plate which is arranged above a shoe 27 mounted on the upper side of the support or base, the latter being normally stationary and the die being movable vertically relative to the shoe. The die is guided in its vertical motion toward and from the shoe by means which preferably consist of two vertical guide pins 28 arranged on opposite sides of the path of the workpiece and the opening in the die and secured at their lower ends in the openings 19 in the shoe and sliding with their upper parts through guide openings 29 in the marginal parts of the die. The die is yieldingly held in its elevated position by spring means consisting preferably of two upright helical springs 30 arranged on opposite sides of each of the guide pins 28 and each seated at its lower end in a pocket 31 in the upper side of the shoe 27 and bearing with its upper end against the underside of the die, as best shown in Fig. 8.

The punch is secured to the underside of a vertically movable punch plate 32 by means consisting preferably of a plurality of screws 33 the bodies of which are arranged in openings 72 in the punch plate and engage the threads on their lower parts with threaded openings in the punch and bear with the heads 34 at their upper ends against the upper side of the punch plate, as shown in Fig. 2. While the punch is in the lower part of its vertical movement the same is guided so that it is alined accurately with the die and cooperates properly therewith by engagement of guide openings 35 formed in the punch plate on opposite sides of the punch and slipping over the upper parts of the guide pins 28, as shown in Fig. 2. When the punching mechanism is open the punch and punch plate are elevated so that the punch plate is disengaged from the guide pins 28, as shown in Fig. 6, but during the descent of the punch and associated parts into an operative position the guide openings 35 receive the guide pins 28, entrance of the latter into these openings being facilitated by tapering these pins upwardly at their upper ends, as shown at 36 in Figs. 2, 5, 6 and 8.

The preferred form of the means for mounting the punch and its punch plate on the ram 21 are constructed as follows:

The numeral 37 represents a punch holder which preferably has the shape of a plate which moves vertically with the ram.

This punch holder engages with the underside of the ram and is detachably connected therewith by a stem 38 projecting upwardly from the holder into an opening 39 in the ram and held therein by a clamping screw 40 on the ram engaging with said stem, as shown in Fig. 2.

This punch holder is guided so that in its vertical movement it will always be in correct alinement with the die shoe and the parts associated therewith, the means for this purpose preferably consisting of two upright guide posts 50 arranged in rear of the path of the workpiece 26 so as to leave the space in front of the die and punch unobstructed and each of these posts being secured at its lower end in an opening 18 in the die shoe 27 and sliding at its upper part in a guide opening 51 in the adjacent marginal part of the punch holder, as shown in Figs. 1 and 2.

Between the marginal parts of the punch plate and the punch holder is arranged a bracket or spacer 41 which is detachably connected at its upper edge with the punch holder by screws 42 and detachably connected at its lower edge with the punch plate by screws 43 thereby forming a chamber 44 between the punch plate and holder, as shown in Figs. 1, 2, 5, 6 and 7. By these means the punch is raised and lowered relative to the die and pressure is transmitted from the ram to the punch for cutting the workpiece. When the punch and punch plate are comparatively small the bracket 41 is sufficient to hold the punch plate in place while the punch is producing a cutting effect in cooperation with the die but if the punch and punch plate are comparatively large a brace or reenforcing member 45 is interposed between the central parts of the punch and the punch holder so as to prevent upward deflection of the central part of the punch plate and the punch mounted on the underside thereof. In its preferred form this brace has the shape of an upright thrust rod, pin or bar which is secured at its upper end by a screw joint 46 with the punch holder and provided at its lower end with a recess 47 which receives the head 34 of the fastening screw 33 which connects the central parts of the punch and punch plate, as shown in Fig. 2.

When the press is opened upon raising the ram the die is raised by the springs 30 and forms a gap between the die and the shoe 27 and the punch is raised and forms a gap between the

same and the die, as shown in Fig. 6. While the parts are in this position the operator places the sheet metal workpiece 26 upon the die over the opening 24 therein after which the punch descends. During the first part of this descent the workpiece is clamped between the punch and die and then the die, punch and workpiece descend in unison and the springs 30 are compressed until the die engages with the shoe after which the downward movement of the die is arrested but the punch continues to descend and completes its downward stroke independently of the die, thereby causing a blank 25 to be cut from the workpiece between the respective cooperating cutting edges 48, 49 of the die and punch. The blank 25 thus produced passes downwardly into the opening 24 of the die and the scrap 52 left over from the workpiece lies on the die around the punch, as shown in Figs. 2 and 5.

During the upward movement of the punch the die moves therewith together with the scrap resting on the die until the lifting springs 30 have expanded to their fullest extent after which the punch completes its upward movement independently, thereby forming a lower gap between the die and shoe and an upper gap between the die and punch.

The workpiece 26 from which the blanks are cut may be fed to and discharged from the punching apparatus either manually or by automatic mechanism. For the purpose of readily centering the workpiece crosswise of the die and punch two side gages or guides 53 having preferably the form of pins are mounted on the upper side of the die in front and in rear of the die opening 24 therein and adapted to be engaged by one of the longitudinal edges of the workpiece when the latter is in the desired position for punching a blank therefrom, as shown in Figs. 1 and 6.

Positioning of the workpiece lengthwise relative to the die and punch is facilitated by a front stop or gage 54 which is mounted on the die in front of its opening 24 and adapted to be engaged by a forwardly facing edge of the workpiece, as shown in Figs. 5 and 6, for arresting the forward movement of the workpiece when the same is in the proper position relative to the punch and die to cut or stamp a blank therefrom. After each punching operation the workpiece is lifted to disengage the respective edge from the front stop or gage 54 and then advanced a step and dropped so as to engage a succeeding edge of the workpiece with this stop preparatory to effecting the next following punching operation on the workpiece.

As the blanks 25 descend in the opening 24 of the die they may be removed either individually after each punching operation or in groups by hand or mechanical means. The means for discharging the blanks from the punching apparatus, shown in Figs. 1, 2, 5 and 6, are constructed as follows:

The numeral 55 represents an ejector having preferably the form of a bar or slide which is adapted to reciprocate horizontally between the die shoe and the die and slide in a groove 56 formed in the upper side of the die shoe. This ejector bar is provided with two ejector fingers which are adapted to engage alternately with opposite edges of one or more blanks which drop on this bar as the same descend in the die opening 24 after the punching operations. Each of these ejector fingers is arranged in a recess 57 in the ejector bar and comprises a longitudinal arm 58 of spring metal arranged in the respective recess and secured at its rear end thereto and provided at its front end with an upright shoulder 59. The two ejector fingers are preferably close together with their shoulders 59 facing outwardly in opposite directions away from each other. While the punch and die are in a depressed position the ejector bar has been shifted to locate its spring ejector fingers on one side of the die and punch, as shown at the right in Fig. 5, and when the die and punch are elevated, the ejector bar is moved lengthwise toward the left for engaging the shoulder of the active or foremost ejector finger with the adjacent edge of the blank or blanks which have dropped onto the ejector bar from the die opening and then discharging the same from underneath the die and on the left side of the die and punch by the continued longitudinal movement of the ejector bar the requisite distance in this direction. After the blanks have been thus discharged on the left hand side of the die and punch the ejector mechanism remains at rest while the die and punch perform one or more punching operations after which the ejector bar, while the die and punch are separated, is moved in the opposite direction and causes the shoulder 59 of the other ejector finger to engage the opposite edge of one or more blanks which have dropped on the ejector bar and discharge the same from the right side of the die and punch.

If the die should descend while one or the other of the ejector fingers is underneath the same this finger will be merely deflected downwardly into the respective recess 57 in the bar without doing any harm.

As best shown in Figs. 3 and 4, the upper part 60 of the bore of the die opening 24 is of cylindrical form and of the same diameter as the cutting edge 48 of the die so as to provide a substantial support for this edge and maintain its wearing capacity, but the lower part 61 of the bore of this opening flares or enlarges downwardly in the form of a cone whereby each blank after being severed between the cutting edges of the die and punch and passing downwardly below the small upper part 60 of the die bore will be spaced at its edge from the larger lower part 61 of this bore and drop freely downward through the die opening 24 upon the ejector bar 55 or other part adapted to receive the same, thereby avoiding undue wear on the die and also permitting the press to be operated by less power.

In order to prevent the blanks deposited on the bar 55 of the ejecting mechanism from being engaged on the edge by the die and tilted or cocked in case the blanks are shifted laterally during the operation of the apparatus, the lowermost part of the die opening is enlarged, as shown at 24' in Figs. 2, 5 and 6, whereby possibility of the die engaging with the blanks is avoided.

In constructing the die and punch it is necessary to provide a slight clearance between the cooperating cutting edges 48, 49 of the die and punch in order to permit the workpiece to be severed between the opposing cutting edges of the die and punch. For the purpose, however, of assembling the die and punch in a position in which the same are accurately centered relative to each other and guided while moving toward and from each other the lower part 62 of the periphery of the punch immediately above its cutting edge 49 is made cylindrically of smaller diameter than the die cutting edge 48 while the

upper part 63 of this periphery is cylindrically of the same diameter as the diameter of the cutting edge 48 of the die opening 24. In preparation for making the guiding means for maintaining the die and punch always in a centered position relative to each other when the press is open and closed, the punch while attached to its punch plate is inserted into the opening 24 of the die so that the large upper peripheral part 63 fits snugly into the small upper part 60 of the die opening and the punch plate 32 rests on the die at which time the small lower part 62 of the periphery of the punch is spaced from the large lower flaring part 61 of the bore of the die opening, as shown in Fig. 3.

Although the procedure for centering the punch and die relative to each other and also maintaining clearance between the cutting edges of the same may be accomplished in various ways, the following method has been found satisfactory:

Assuming that the die shoe, punch holder and the posts or pillars 50 for guiding this shoe and holder have been previously prepared, a bracket or frame having preferably the form of a hollow cylinder 41 is secured at its upper end to the underside of the punch holder. The punch plate having the holes 35 therein is placed on top of the die and used as means for locating the holes 19 which are drilled to receive the guide pins 28 which pass through the holes 29 in the die and the holes 35 in the punch plate 32 and permit the latter to ride up and down accurately on the pins 28.

Individual jigs are employed, each of which has holes which are in exactly the same location as the holes 35 in the punch plate and with the aid of this jig the holes 29 are drilled in the die 22. The punch 23 is now attached to the punch plate by means of screws 33 which are passed through the most convenient holes 72 and 65 but these screws at this time should not be too tight. The punch plate with the punch attached thereto is now assembled with the die, as shown in Fig. 3. After the punch plate 32 is slid down on the guide pins 28 and the punch is properly centered in the die opening, as shown in Fig. 3, the screws 33 are tightened for firmly securing the punch on the punch plate and maintaining these parts in the required position relative to the die. This assemblage of the punch and punch plate with the die and die shoe may be made in the press while the ram is raised sufficiently to provide the necessary working space or this assemblage may be effected by the use of another fixture having pins which are spaced exactly the same as the pins 28 on the die set which is to be used.

Obviously the punch 23 can be mounted on the punch plate 32 and placed in the proper position relative to the die 22 in a fixture having liner pins outside of the die and punch assemblage, so that these parts could be put into the press in an assembled condition after which the ram could be lowered and the lower end of the hollow bracket 41 secured to the punch plate by means of the bolts 43 so that during each downward stroke of the ram the punch plate holes 35 would properly engage with the die set guide pins 28. The openings 431 in the punch plate 32 which receive the body of the bolts 43 are preferably in the form of radial slots which are open at the periphery of this bracket, as shown in Figs. 5, 7 and 10, thereby permitting of easily adapting the punch plate to the bracket 41 and connecting the same thereto. Upon thereafter assembling the die, die shoe and punch plate with the guide pins 28 and also assembling the die shoe and punch holder with the guide posts 50 the punch and die will be centered perfectly relative to each other and insure proper spacing or clearance between the periphery of the punch and the bore of the die opening to produce accurate cooperation between the cutting edges of the die and punch while severing a blank from the workpiece.

Stripping means are provided for removing from the outer side of the punch the scrap 52 which adheres thereto after severing a blank from the workpiece which stripping means may be variously organized but as shown in Figs. 2, 5, 6, 7 and 9, are constructed as follows:

The numeral 64 represents the vertical bodies, shanks or stems of a plurality of stripping pins which are adapted to slide vertically in guide openings 65 in the punch plate 32 and adapted to bear at their lower ends against the upper side of the scrap 52 from the workpiece and provided at their upper ends with enlarged heads 66 forming stop shoulders which are adapted to engage with the upper side of the punch plate for arresting the downward movement of the stripping pins when the lower ends of the same are flush with the underside or face of the punch, as shown in Fig. 6. Within the chamber 44 and between the punch plate 32 and punch holder 37 is arranged a vertically movable horizontal stripping plate 67 which bears against the heads 66 at the upper ends of the stripping pins. This stripping plate is provided centrally with a clearance opening 68 which receives the central reenforcing post or rod 45. Spring means are provided which tend constantly to move the stripping plate and the stripping pins downwardly which means preferably comprise a plurality of helical springs 69 which are placed under an initial compression and engaged at their lower and upper ends, respectively, with the top of the stripping plate 67 and the underside of the punch holder 37, and upright retaining pins 70 secured at their lower ends to the stripping plate and projecting upwardly therefrom into said helical springs. Downward movement of the stripping plate is arrested by stop means consisting preferably of an upwardly facing stop shoulder 71 formed on the inner side of the bracket 41 and adapted to be engaged by the edge of the stripping plate for arresting the downward movement of the latter when the lower ends of the stripping pins 64 are flush with the underside of the punch. During the initial part of the upward movement of the punch holder and the parts associated therewith, the die is also raised by the lifting springs 30 until the compression of the latter has been exhausted, thereby forming a gap between the shoe and the die, after which the punch continues its upward movement independently of the die, whereby a gap is formed between the punch and the die and the punch is disengaged from the guide pins 28, as shown in Fig. 6.

While the punch is thus elevated, the workpiece 26 is placed between the cooperating faces of the die and punch and then the punch holder and parts carried thereby are moved downwardly with a working stroke. During the first part of this downward stroke the punch plate is engaged with the upper ends of the guide pins 28 so as to exactly center or align the punch with the die. During the latter part of the descent of the

punch holder and associated parts, the lower ends of the stripping pins 64 first engage with the upper side of the workpiece immediately around the periphery of the punch and clamp the same against the top of the die, depresses the die 22 to bottom on the shoe 27 and thereafter the punch engages the top of the workpiece and causes a blank 25 to be cut out of the workpiece by cooperation of its cutting edge 49 with that of the die, as shown in Fig. 2. The severed blank, as previously described, drops through the die opening 24 and is carried therefrom by the discharge bar 55. During the last part of the descent of the punch the stripping pins and stripping plate are at rest, whereby the shoulder 71 of the bracket 41 is carried downwardly away from the underside of the stripping plate 67 and the stripping springs 69 are further compressed between the stripping plate and the punch holder 37.

During the first part of the subsequent upward movement of the punch holder and associated parts the stripping pins are at rest and pressed by the springs 69 against the scrap 52 of the workpiece until the heads 66 of these pins are engaged by the punch plate 32 after which the punch, stripping pins and parts carried by the punch holder move upwardly in unison to the end of the upward stroke of the same. It follows from this that the punch is first withdrawn from the die and the scrap 52 is held down on the die until the punch has effected the first part of its upward movement, whereby the scrap is stripped from the punch and remains on the die preparatory to presenting another part of the workpiece to the working position. It is preferable to have the heads of the stripping pins 64 engage the punch plate 32 at the same time that the stripping plate under the expansion of the stripping springs 69 is engaged with the shoulder 71 of the bracket 41 and thus equalize the stopping action of the several stripping pins.

The openings 65 and 72 in the punch plate 32 which receive the bodies of the punch fastening screws 33 and the stripping pins 64 are preferably of the same size, or substantially so, and thus permit any one of these openings to receive either the body of a punch fastening screw 33 or the body of a stripping pin. Openings of this character are distributed in closely spaced relation over the entire area of the punch plate and thus enable certain of these openings to be used for fastening the punch to the punch plate and others to be used to guide stripping pins in accordance with the shape of the particular punch and die which are employed for cutting blanks from a workpiece.

For example, when using a cylindrical punch of comparatively small diameter, as shown in Figs. 1, 2, 5, 7 and 9, only the central fastening screw 33 and a plurality of such screws are arranged in an annular row immediately around this central screw and engaged with the corresponding openings in the punch for securing the punch to the punch plate, and a plurality of stripping pins 64 are arranged in an annular row around the periphery of the punch and engaged with the corresponding openings in the punch plate for engaging the scrap of the workpiece adjacent to the outer side of the line on which the blank is cut from the workpiece, while the remainder of the selective openings in the punch plate are left vacant, as shown in Figs. 7 and 9.

When using a punch which is non-circular such, for example, as the L-shaped punch 73 shown in Fig. 10, this punch is fastened to the punch plate by a plurality of fastening screws 33 which are arranged generally in the form of the letter L and placed in the selected corresponding openings in the punch plate which most closely approximate the contour of the L-shaped punch, and stripping pins 64 are placed around the outline of the L-shaped punch and engage with the most suitable guide openings in the punch plate so as to enable the lower ends of the stripping pins to engage the scrap of the workpiece immediately around the punch and strip the scrap therefrom upon moving the punch away from the correspondingly shaped die.

It will thus be apparent that by selecting the appropriate openings in the punch plate to receive screws for fastening a punch of a particular shape thereto and also selecting appropriate openings in the punch plate to receive stripping pins and arrange them to fit the contour of the respective punch, that this invention enables all parts of the die and punch mounting to be used in connection with various shapes of dies and punches, and that it is only necessary to rearrange the punch fastening screws and the stripping pins when changing from one shape of punch and die to another shape of punch and die. The cost of doing work of this character particularly when running a small order of any particularly form of blank is therefore materially reduced due to the rapidity with which the dies and punches may be set up and no new parts are required for mounting dies and punches.

In the operation of mounting the companion die plate and punch for producing blanks of a particular shape the procedure is preferably as follows:

It will be assumed that the die shoe having the guide pins, the die plate, the punch and the punch plate are separate and arranged successively one above the other in the order mentioned preparatory to being assembled, as shown diagrammatically in Fig. 13.

The first step in this assemblage is to place the die plate over the guide pins of the die shoe and rest the same on the die plate, and also place the punch within the opening of the die plate and over the top of the die shoe, as shown in Fig. 14.

Thereafter the punch plate is placed over the guide pins and engaged with the die plate and the punch is connected with the punch plate by the fastening screws, as shown in Fig. 15.

The punch plate is now lifted from the guide pins and die shoe and the punch is removed from the opening of the die plate and stripper pins are inserted in the appropriate openings in the punch plate around the punch.

The parts are now ready to be assembled with the other non-changeable members of the operating unit ready for producing blanks corresponding in shape to the cutting edges of the respective die opening and punch.

While one of said operating units is in use in a press, any number of similar assemblages may be prepared awaiting to be run in the press for producing blanks of different contour.

Instead of using resilient means for raising the die or die steel when the press opens, as shown in Figs. 1 to 10, the lifting of the die or die steel may be effected positively by means which are constructed as follows, and shown in Figs. 11 and 12:

The numeral 76 represents upright lifting rods arranged on opposite sides of the path of the workpiece and each passing with its central part

through a guide opening 77 in the die or die steel on one side of its die opening 24 and slidable at its lower end in a guide opening 78 in the shoe 27 while its upper end is rigidly connected with the punch plate 32. Adjacent to its lower end the lifting rod is provided with an upwardly facing shoulder 79 which is adapted to engage with the underside of the adjacent edge portion of the die. The means for connecting the lifting rod to the punch plate preferably consist of a reduced neck 80 formed on the upper end of the lifting rod and arranged in an opening 81 in the punch plate and forming an upwardly facing shoulder 83 which engages with the underside of the punch plate, and a screw nut 82 applied to the upper end of the neck 80 and bearing against the top of the punch plate.

In the elevated position of the punch, punch holder and associated parts the shoulders 79 of the lifting rods engage with the underside of the die and raise the same from the shoe 27 so as to permit cut blanks to be removed from the gap between the shoe and the die. During the subsequent descent of the punch holder the die is first deposited on the shoe 27, then the stripping pins press the marginal part of the workpiece against the die and then the punch cuts the blank out of the workpiece while the lifting rods move idly downwardly through the die and the shoe. Thereafter the punch holder rises and first lifts the punch from the workpiece and die, then the stripping pins remove the scrap from the die and then the lifting rods raise the die from the shoe preparatory to effecting the next operation of the punching mechanism.

In the construction shown in Figs. 11 and 12 the lifting rods 76 also perform the function of guiding the punch and associated parts relative to the die and shoe for the purpose described with reference to the guide post 28 in Figs. 1–10. In other respects the apparatus shown in Figs. 11 and 12 operates exactly like that shown in Figs. 1–10.

It will be apparent from the foregoing that by means of this invention the stripper pins can be placed at different intervals in various arrangements on the punch plate around punches of varying sizes and contours and thus enable the location of the pins to be changed to suit different requirements.

It will be noted from Figs. 13–16 and the description relating thereto that the preassembling of the die 22, punch 23 and punch plate 32 may be effected before installing these members in the basic operating unit by employing for such assemblage a separate jig or assembling fixture having parts which correspond to those in the basic operating unit in which the punch and die are to be used.

By means of these improvements, a sheet material punching apparatus is provided in which the same stripping mechanism can be used with varying forms of dies and punches, thereby rendering the same particularly useful for punching sheet material blanks of which only small lots are required at any one time.

Obviously fastening means may be provided for firmly securing the die plate 22 to the die shoe 27, such as screws or clamps of any suitable character, and that the structure may be otherwise modified within the scope of the appended claims.

If desired this apparatus may be inverted and the blanks removed from above the die or knocked out by a conventional knock-out bar in the ram of the press or by spring stripping means.

Instead of pushing the blanks laterally from underneath the die element after the same have been cut from the workpiece, the bed of the press may be provided with openings through which said blanks may drop.

It will be noted that this invention includes a method of cutting blanks from sheet or strip material whereby a die member having guide accommodation means and a punch mounting plate, universal in its purpose, and having like guide accommodation means, are placed in an alining fixture having guide means simulating that of the apparatus in which they are to operate and then, while said die member and plate are in said position, inserting the cooperating punch member into the aperture of said die member, said punch member being so constructed that, when inserted into said die member aperture, it seeks its own concentric position relative to the cutting contours of said punch member and said die member before being attached to said punch plate and then, after firmly fastening and dowelling same, removing said assemblage from said alining fixture and placing stripper pins selectively around said punch through some of the many openings with which the plate is provided, the attachment of said punch to said plate being by fastening means inserted through other of said openings, then mounting the above described parts in an operating unit in a stamping press in such manner that the reciprocal action of the press ram carries said punch assemblage, consisting of said plate, punch member and stripping pins, toward and away from said die member to cut blanks from said material when inserted between said die and punch members, said operating unit being provided with means for disposing of the cut out blanks, comprising yielding support means which elevate said die member above its base to provide space through which said blanks may be removed, and also means for applying pressure on said stripping pins to strip the residual material from around said punch, including a yielding pressure plate and pressure means built into said apparatus in such manner as to engage said stripping pins in non-pressure contact when said punch plate and pins are in non-operative position, but to deliver pressure on and through said pins when the action of blanking causes them to bear against said material and, therefore, dwell while said punch members continues through said material.

Moreover, this invention contemplates an apparatus for attachment to a stamping press to serve as a basic operating unit to which various punch and die element pairs for cutting blanks from sheet or strip material may be interchangeably mounted while said apparatus is in said press, said apparatus having means for accommodating said punch and die elements and retaining them in the same relative proper operating register gained in an assembly fixture prior to said accommodation, said fixture being independent of said apparatus, said register retaining means in said apparatus comprising guide means which engage successively each of said die elements and a universal plate on which each of said punch elements is mounted, each said die element and universal punch plate being held in proper relation in said fixture so that the fastening of said punch element to said plate results in proper register of the cutting edge of said die element and the cooperating cutting edge of said punch element.

The preferred construction of this blanking and punching apparatus employs means for locating the punch and die cutting edges in proper register including punch and die members having a clearance, or space, existing between the contour of the cutting edge of the punch member and the companion contour of the cutting edge of the opening in the die member, said space being equal to from one percent to twenty-five percent of the thickness of the material to be cut when said cutting edges are in operative position, said punch contour or portions thereof, increasing in size starting at a distance greater than the thickness of the material to be cut until it becomes of a size which locates itself within said die opening so that, when withdrawn, the clearance between the cutting edges is the same amount all around, and means for mounting said punch to a mounting member while said enlarged contour is in engagement with said die contour, said mounting member and die member being guided by means which assures proper register when placed in operation.

Furthermore, in the operation of this apparatus in accordance with this invention for cutting blanks from sheet or strip material a method is practiced in which a die member having guide post accommodation openings, has guide posts inserted in said openings from the underside of said member, said guide posts projecting through said die and engaging attachably with openings in a mounting plate, then placing the upper or cutting face of said die member in contact with the adjacent face of said mounting plate and inserting a punch member into said die member opening with the cutting face away from said mounting plate, said punch member being of enlarged form at its plate contacting contour to fit into the contour of said die member opening contour and said punch cutting edge contour being of an amount sufficiently smaller to provide proper clearance between said punch cutting edge contour and said die cutting edge contour and then fastening said punch to said punch plate and, after inserting stripping pins around said punch in some of the many holes provided for this purpose, placing the assemblage into a general purpose operating unit mounted in a stamping press having a reciprocating member and attaching the punch mounting plate to that part of the unit attached to said reciprocating member, said part being provided with pressure means for actuating said stripping pins to remove the residual material from around said punch member, and said guide posts being of a length to lift said die member above its base to provide a space for the removal of said blanks when lifting means are provided.

I claim as my invention:

1. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage the scrap of the workpiece, and means for selectively mounting said pins in different positions relative to said punch.

2. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage the scrap of the workpiece, and a punch plate supporting said punch and provided with a plurality of guide openings around said punch which are adapted to selectively receive said pins.

3. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage the scrap of the workpiece, a punch plate supporting said punch and provided with a plurality of guide openings around said punch which are adapted to selectively receive said pins and means for yieldingly projecting said pins downwardly relative to the face of said punch.

4. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage the scrap of the workpiece, a punch plate supporting said punch and provided with a plurality of guide openings around said punch which are adapted to selectively receive said pins, means for yieldingly projecting said pins downwardly relative to the face of said punch, and means for limiting the extent of projection of said pins.

5. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage the scrap of the workpiece from which the blank is cut, a punch plate arranged above said punch, and fastening means connecting said punch and plate, said plate being provided with a plurality of openings some of which receive said stripping pins and others receive said fastening means.

6. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage the scrap of the workpiece from which the blank is cut, a punch plate carrying said punch and provided with a plurality of guide openings which receive said pins, and means for projecting said pins to bring their lower ends in line with or below the face of the punch including a stripping plate engaging with the upper ends of said pins, and resilient means which urge said stripping plate downwardly.

7. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage the scrap of the workpiece from which the blank is cut, a punch plate carrying said punch and provided with a plurality of guide openings which receive said pins, and means for projecting said pins to bring their lower ends in line with or below the face of the punch including a stripping plate engaging with the upper ends of said pins, a punch holder arranged above said stripping plate and connected

with said punch plate and springs interposed between said stripping plate and punch holder.

8. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage the scrap of the workpiece from which the blank is cut, a punch plate carrying said punch and provided with a plurality of guide openings which receive said pins, and means for projecting said pins to bring their lower ends in line with or below the face of the punch including a stripping plate engaging with the upper ends of said pins, a punch holder arranged above said stripping plate and connected with said punch plate, springs interposed between said stripping plate and punch holder, and retaining pins arranged on said stripping plate and projecting upwardly into said springs.

9. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage the scrap of the workpiece from which the blank is cut, a punch plate carrying said punch and provided with a plurality of guide openings which receive said pins, each of said pins being provided with a stop shoulder adapted to engage said punch plate to limit the downward movement of the pin, and spring means which urge said stripping pins downwardly.

10. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage the scrap of the workpiece from which the blank is cut, a punch plate carrying said punch and provided with a plurality of guide openings which receive said pins, a stripping plate engaging with the upper ends of said stripping pins, a punch holder arranged above the stripping plate, a bracket connecting said punch plate and punch holder, and provided with a shoulder adapted to be engaged by said stripping plate for limiting the downward movement of the same, and springs interposed between said stripping plate and punch holder.

11. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage the scrap of the workpiece from which the blank is cut, a punch plate carrying said punch and provided with a plurality of guide openings which receive said pins, a stripping plate engaging with the upper ends of said stripping pins, a punch holder arranged above the stripping plate, a bracket connecting said punch plate and punch holder, a brace interposed between the central parts of said punch plate and punch holder and extending through said stripping plate, and springs interposed between said stripping plate and punch holder.

12. A die set for a punching apparatus including a shoe, a die element mounted on the shoe, a holder movable relative to said shoe, a punch element mounted on the holder, stripping means mounted on the holder, and guide means for guiding said holder, punch element, die element, shoe and stripping means in proper alinement with one another, said guiding means serving as a means for maintaining said punch element in proper register with said die element.

13. In a die set having a punch holder, a punch element mounted on the punch holder, a die element, a yielding stripping device built into the punch holder, a die element guide built into the punch holder and means for attaching said punch element and stripping device as an assemblage to said punch holder and using said die element guide to aline said punch element in proper register with said die.

14. In a stamping press having a stationary bed and a reciprocating ram, a die set comprising a die shoe mounted on said bed and having a die element, a punch holding means mounted to said ram, means for causing the shoe and holder to operate in alinement, a yielding pressure means built into said punch holding means, a die element guide built into said die shoe and means for attaching an assemblage comprising a punch element and stripping means to said punch holding means and yielding pressure means, and using said die element guide to aline said punch element in proper register with said die element.

15. A stamping apparatus for cutting sheet material blanks comprising a stationary bed and a reciprocating ram, a die shoe on said bed, a punch holding means on said ram, means for causing said shoe and holding means to operate in alinement, a yielding stripping means mounted within said punch holding means, a die element guide means in said die shoe, and a die element lifter in said die shoe to all of which may be added successively, selective assemblages, each comprising a punch and its stripping means mounted on a plate together with its companion die element, said plate and die element using said die element guide to aline said punch element in proper register with said die element.

16. A stamping apparatus for cutting sheet material blanks, comprising a stationary bed, a reciprocating ram, a die shoe on said bed, a punch holding means on said ram, means for causing said shoe and holding means to operate in alinement, a resilient stripping device arranged within said punch holding means, a die element guide means in said die shoe, a die element lifter means in said die shoe, and means for adding successively and selectively die elements cooperating with said die element guide means and selective companion assemblages, each comprising a punch element rigidly mounted to a plate, selective stripper means surrounding said punch element and mounted on said plate, said plate cooperating with said die element guide means to aline said punch element in proper register with said die element.

17. A stamping apparatus for cutting sheet material blanks, comprising a stationary bed, a reciprocating ram, a die shoe on said bed, a punch holding means on said ram, means for causing said shoe and holding means to operate in alinement, a resilient stripping means mounted in said punch holding means, a die element guide means in said die shoe, a die element lifter means in said die shoe, and means for adding a die element to said die element guide means, and a companion assemblage, compris-

ing a punch element rigidly mounted to a punch plate, selective stripper means surrounding said punch element and mounted on said punch plate, said punch plate cooperating with said die element guide means to aline said punch element in proper register with said die element, said selective stripper means engaging said resilient stripping means upon attachment of said plate to said punch holding means.

18. A stamping apparatus for cutting sheet material blanks comprising a stationary bed, a reciprocating ram, a die shoe on said bed, a punch holder on said ram, means for causing said shoe and holder to operate in alinement, a resilient stripping element in said punch holder, a die element guide means in said die shoe, a die element lifter means in said die shoe, a blank ejector means in said die shoe, a die element engagng said die element guide means, lifter means and blank ejector means, a companion assemblage comprising a punch plate, a punch element rigidly mounted on the punch plate, and stripper means mounted on the punch plate, said punch plate engaging said die element guide means to aline said punch element in proper register with said die element, said stripper means engaging said resilient stripping element upon attachment of said punch plate to said punch holder, to strip the material from the punch and said die element lifting means elevating said die element above said die shoe to provide a space through which the blanks may be removed from under the die element by means of said blank ejector means.

19. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, a shoe upon which said die is adapted to rest and from which the die is adapted to rise, a punch plate movable toward and from the die and carrying said punch, and means for guiding said die and punch plate relative to each other and the shoe consisting of guide pins each of which projects upwardly from said shoe through openings in said die and punch plate.

20. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, a shoe upon which said die is adapted to rest and from which the die is adapted to rise, a punch plate movable toward and from the die and carrying said punch, and means for raising the die during part of the upward movement of said punch plate including lifting rods passing through said die and connected at their upper ends with said punch plate and having their lower ends guided on said shoe and provided with shoulders adapted to engage with said die.

21. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, a shoe upon which said die is adapted to rest and from which the die is adapted to rise, a punch plate movable toward and from the die and carrying said punch, and a blank discharging device movable horizontally between said shoe and die and adapted to engage the blanks passing through the die and discharging the blanks on one side thereof, including a reciprocating bar, and spring fingers mounted on said bar and provided, respectively, at their front ends with shoulders which face outwardly away from each other and are adapted to engage alternately with opposite sides of the edges of the blanks to be discharged.

22. An apparatus for punching sheet material comprising a die having a die opening, and a punch movable toward and from said die, said die having a cutting edge at the upper end of its opening and said punch having a cutting edge at its lower end for cooperation with the cutting edge of the die and the lower part of the periphery of said punch being smaller than the periphery of the cutting edge of the die and the upper part of the periphery of the punch being of the same size as the cutting edge of said die periphery and adapted to fit into the same.

23. An apparatus for punching sheet material comprising a die having a die opening, and a punch movable toward and from said die, said die having a cutting edge at the upper end of its opening and said punch having a cutting edge at its lower end for cooperation with the cutting edge of the die and the lower part of the periphery of said punch being smaller than the periphery of the cutting edge of the die and the upper part of the periphery of the punch being of the same size as the cutting edge of said die periphery and adapted to fit into the same, and the upper part of said die opening being of any desired shape and the lower part of said opening being of downwardly enlarging form.

24. A punching apparatus for perforating sheet material comprising a punch holder adapted to be attached to the reciprocable ram of a press and provided with guide openings, a die shoe adapted to be attached to the bolster of the press, guide posts mounted on the die shoe and adapted to enter said openings of the punch holder for maintaining the punch holder and die shoe in alignment, a hollow bracket secured at its upper end to said punch holder, a punch plate secured to the lower end of the bracket and provided with a plurality of openings, a punch engaging with the underside of said punch plate, screws arranged in some of the openings in said punch plate and fastening said punch thereto, stripping pins slidable in other of said openings of the punch plate and adapted to engage their lower ends with the scrap of the workpiece immediately around the punch, a stripping plate arranged in the space between the punch holder, bracket and punch plate and engaging with the upper ends of said stripping pins, spring means interposed between said stripping plate and punch holder and exerting a constant downward pressure against said stripping plate and pins, stop means for limiting the downward movement of said stripping pins; stop means for limiting the downward movement of said stripping plate, and a die cooperating with said punch and mounted on said die shoe so that the die will be pressed downwardly upon the die shoe during the downward working stroke of the punch and elevated from said die shoe during the upward idle stroke of the punch to form a clearance space between the die holder and die through which the blanks cut from the workpiece may be removed.

25. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage said scrap adjacent to said punch, and means for mounting said pins in

different positions which vary in distance from the axis of said punch.

26. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage said scrap adjacent to said punch, and means for mounting said pins in different positions which vary in distance from the axis of said punch including a punch plate supporting said punch and provided with a plurality of guide openings which are adapted to selectively receive said pins.

27. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage said scrap adjacent to said punch, and means for mounting said pins in different positions which vary in distance from the axis of said punch including a punch plate supporting said punch and provided with a plurality of guide openings which are adapted to selectively receive said pins, and means for yieldingly projecting said pin downwardly relative to the face of said punch.

28. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage said scrap adjacent to said punch, and means for mounting said pins in different positions which vary in distance from the axis of said punch including a punch plate supporting said punch and provided with a plurality of guide openings which are adapted to selectively receive said pins, means for yieldingly projecting said pins downwardly relative to the face of said punch, and means for limiting the downward movement of said pins.

29. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a plurality of stripping pins adapted to engage said scrap adjacent to said punch, and at variable distances from the axis thereof, a punch plate arranged above the punch, and fastening means for connecting said punch and plate, said plate being provided with a plurality of openings spaced different distances from the axis of the punch and adapted to selectively receive said stripping pins and said fastening means.

30. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a stripping pin adapted to engage said scrap adjacent to said punch, a punch plate arranged above said punch, fastening means for connecting said punch plate and punch, said punch plate being provided with openings which selectively receive said stripping pin and said fastening means, and means for projecting said pin relative to the face of said punch including a stripping plate engaging with the upper end of said pin, and resilient means for urging said stripping plate downwardly.

31. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a stripping pin adapted to engage said scrap adjacent to said punch, a punch plate arranged above said punch, fastening means for connecting said punch plate and punch, said punch plate being provided with openings which selectively receive said stripping pin and said fastening means, a holder connected with said punch plate, and means for projecting said pin relative to said punch including a stripping plate engaging the upper end of said pin, and spring means interposed between said stripping plate and holder.

32. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a stripping pin adapted to engage said scrap adjacent to said punch, a punch plate arranged above said punch, fastening means for connecting said punch plate and punch, said punch plate being provided with openings which selectively receive said stripping pin and said fastening means, a holder connected with said punch plate, and means for projecting said pin relative to said punch including a stripping plate engaging the upper end of said pin, helical springs interposed between said stripping plate and holder, and retaining means mounted on said stripping plate and projecting into said helical springs.

33. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, and means for removing the scrap of the workpiece from said punch including a stripping pin adapted to engage said scrap adjacent to said punch, a punch plate arranged above said punch, fastening means for connecting said punch plate and punch, said punch plate being provided with openings which selectively receive said stripping pin and said fastening means, a holder connected with said punch plate, and means for projecting said pin relative to said punch including a stripping plate engaging the upper end of said pin, spring means for moving said pin downwardly, and stop means for limiting the downward movement of said pin.

34. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, a punch plate secured to said punch and provided with a plurality of guide openings, a support connected with said punch plate and provided with a stop shoulder, a stripping pin selectively guided in one or another of said guide openings, a stripping plate engaging with said pin and adapted to engage with said stop shoulder, and spring means for urging said stripping plate and pin downwardly.

35. An apparatus for punching sheet material comprising a die and a punch which cooperate and are relatively movable for cutting a blank from a workpiece of such material, a punch plate secured to said punch and provided with a plurality of guide openings, a support connected with said punch plate and provided with a stop shoulder, a stripping pin selectively guided in one or

another of said guide openings, a stripping plate engaging with said pin and adapted to engage with said stop shoulder, spring means for urging said stripping plate and pin downwardly, a holder connected with said support, and a brace interposed between the central parts of said holder and said stripping plate.

36. An apparatus for attachment to a stamping press, to serve as a basic operating unit, to which various punch and die elements pairs for cutting blanks from sheet or strip material may be interchangeably mounted while said apparatus is in said press, said apparatus having means for accommodating said punch and die element pairs and retaining them in the same proper operating register gained in an assembly fixture prior to said accommodation, said register retaining means in said apparatus comprising guide posts over which said die element is placed and which, when the press stroke advances, carrying said punch element, also engage openings in a detachable plate which carries said punch element and thus assures the clearance between the cutting contour of the punch element and the cooperating cutting contour of the die element being the same amount all around.

37. The herein described method of cutting blanks from sheet or strip material whereby a die member having guide accommodation means and a punch mounting plate, universal in its purpose, and having like guide accommodation means and also having many holes located different distances from the axes of the punch and die, are placed in an alining fixture having a separate jig with guide means simulating that of the apparatus in which they are to operate and then while said die member and plate are in said position, inserting the cooperating punch member into the aperture of said die member and attaching it tightly to said plate, then removing said assemblage from said alining fixture and placing unitary stripping pins contourly around said punch through at least a plurality of the many openings with which the plate is provided, the attachment of said punch to said plate being by fastening means inserted through other of said openings, then mounting the above described parts in an operating unit in a stamping press in such manner that the reciprocal action of the press ram carries said punch plate assemblage, consisting of said plate, punch member and stripping pins, toward and away from said die member to cut blanks from said material when inserted between said die and punch members, and said punch plate and die member being guided relative to each other during this operation by their respective guide accommodation means.

38. The herein described method of cutting blanks from sheet or strip material whereby a die member having guide accommodation means and a punch mounting plate, universal in its purpost, and having like guide accommodation means and also having many holes located different distances from the axes of the punch and die, are placed in an alining fixture having a separate jig with guide means simulating that of the apparatus in which they are to operate and then, while said die member and plate are in said position, inserting the cooperating punch member into the aperture of said die member and attaching it tightly to said plate, then removing said assemblage from said alining fixture and placing unitary stripping pins contourly around said punch through at least a plurality of the many openings with which the plate is provided, the attachment of said punch to said plate being by fastening means inserted through other of said openings, then mounting the above described parts in an operating unit in a stamping press in such manner that the reciprocal action of the press ram carries said punch plate assemblage, consisting of said plate, punch member and stripping pins, toward and away from said die member to cut blanks from said material when inserted between said die and punch members, said operating unit being provided with means for disposing of the cut out blanks, comprising yielding support means which elevate said die member above its base to provide a space through which said blanks may be removed, and also means for applying pressure on said stripping pins to strip the residual material from around said punch including a yielding pressure plate and pressure means built into said apparatus in such manner as to engage said stripping pins in non pressure contact when said punch plate and pins are in non operative position but to deliver pressure force on and through said pins when the action of blanking causes them to bear against said material and, therefore, dwell while said punch member continues through said material.

39. The herein described method of cutting blanks from sheet or strip material whereby a die member having guide accommodation means and a punch mounting plate, universal in its purpose, and having like guide accommodation means, are placed in an alining fixture having guide means simulating that of the apparatus in which they are to operate and then, while said die member and plate are in said position, inserting the cooperating punch member into the aperture of said die member, said punch member being so constructed that, when inserted into said die member aperture, it seeks its own concentric position relative to the cutting contours of said punch member and said die member before being attached to said punch plate and then, after firmly fastening and dowelling same, removing said assemblage from said alining fixture and placing stripper pins selectively around said punch through some of the many openings with which the plate is provided, the attachment of said punch to said plate being by fastening means inserted through other of said openings, then mounting the above described parts in an operating unit in a stamping press in such manner that the reciprocal action of the press ram carries said punch assemblage, consisting of said plate, punch member and stripping pins, toward and away from said die member to cut blanks from said material when inserted between said die and punch members.

40. The herein described method of cutting blanks from sheet or strip material whereby a die member having guide post accommodation openings, has guide posts inserted in said openings from the underside of said member, said guids posts projecting through said die and engaging attachably with openings in a mounting plate, then placing the upper or cutting face of said die member in contact with the adjacent face of said mounting plate and inserting a punch member into said die member opening with the cutting face away from said mounting plate, said punch member being of enlarged form at its plate contacting contour to fit into the contour of said die member opening contour and said punch cutting edge contour being of an amount sufficiently smaller to provide proper clearance between said

punch cutting edge contour and said die cutting edge contour and then fastening said punch to said punch plate and, after inserting stripping pins around said punch in some of the many holes provided for this purpose, placing the assemblage into a general purpose operating unit mounted in a stamping press having a reciprocating member and attaching the punch mounting plate to that part of the unit attached to said reciprocating member, said part being provided with pressure means for actuating said stripping pins to remove the residual material from around said punch member, and said guide posts being of a length to lift said die member above its base to provide a space for the removal of said blanks when lifting means are provided.

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