Feb. 14, 1939. G. F. WALES 2,146,780

APPARATUS FOR NOTCHING SHEET MATERIAL

Filed March 17, 1936 3 Sheets-Sheet 1

Fig. 1.

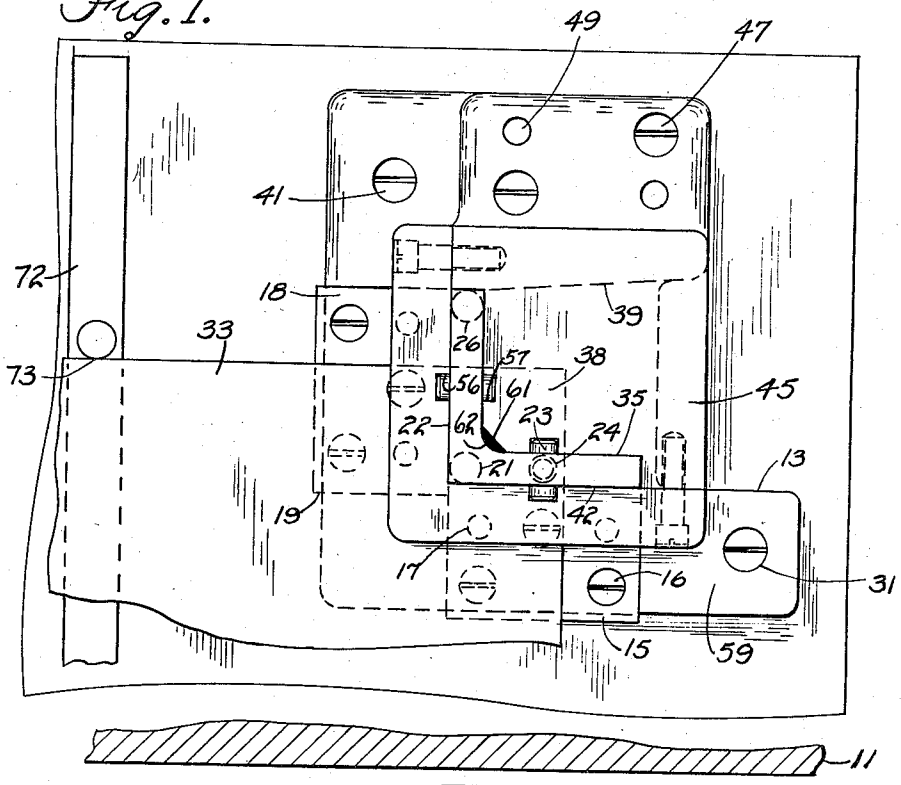
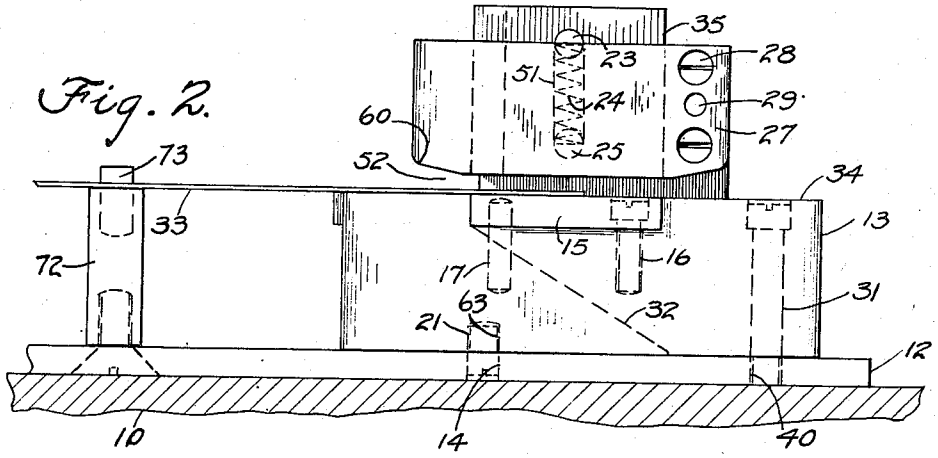


Fig. 2.



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APPARATUS FOR NOTCHING SHEET MATERIAL

Filed March 17, 1936 3 Sheets-Sheet 2

Fig. 3.

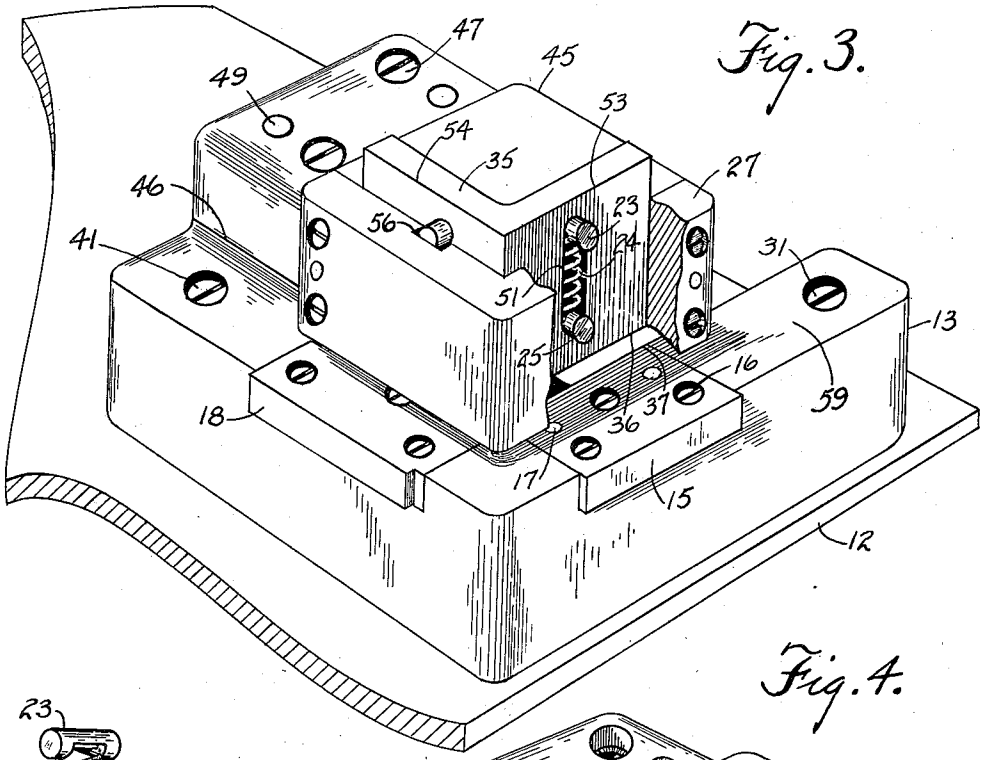


Fig. 4.

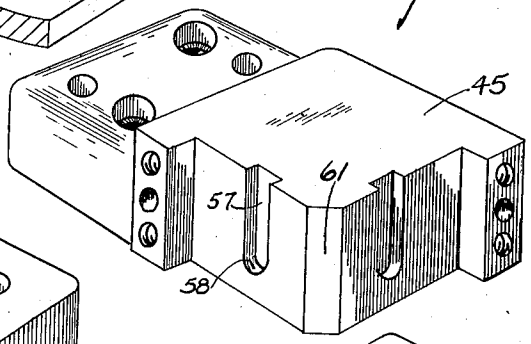
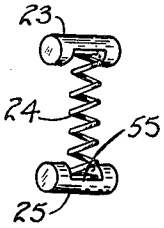


Fig. 6.



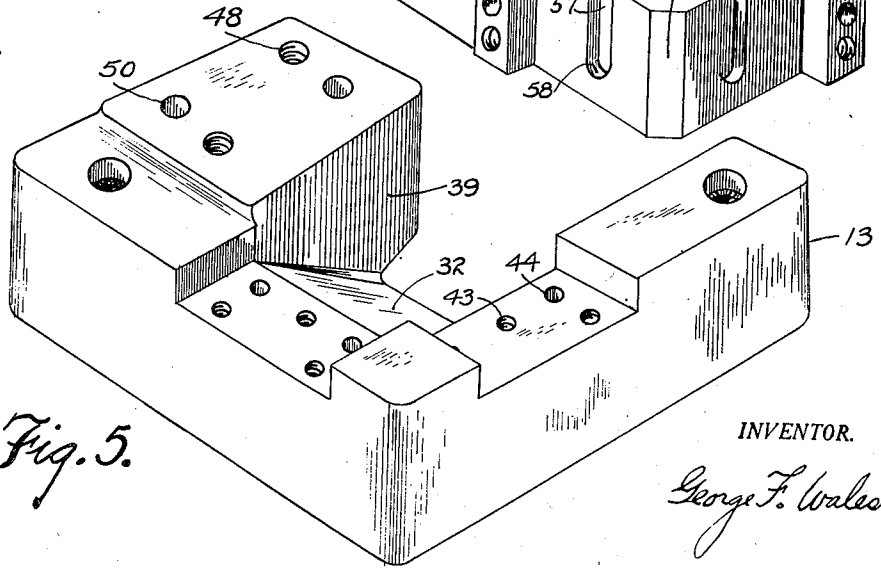


Fig. 5.

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Feb. 14, 1939. G. F. WALES 2,146,780

APPARATUS FOR NOTCHING SHEET MATERIAL

Filed March 17, 1936 3 Sheets-Sheet 3

Fig. 7.

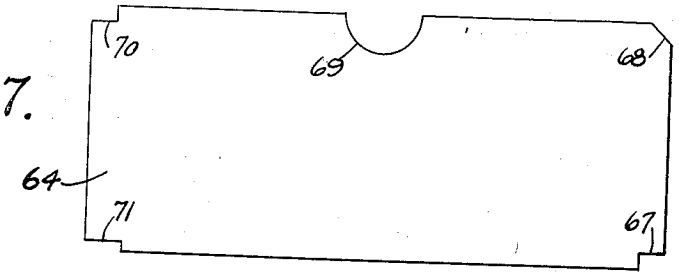


Fig. 8.

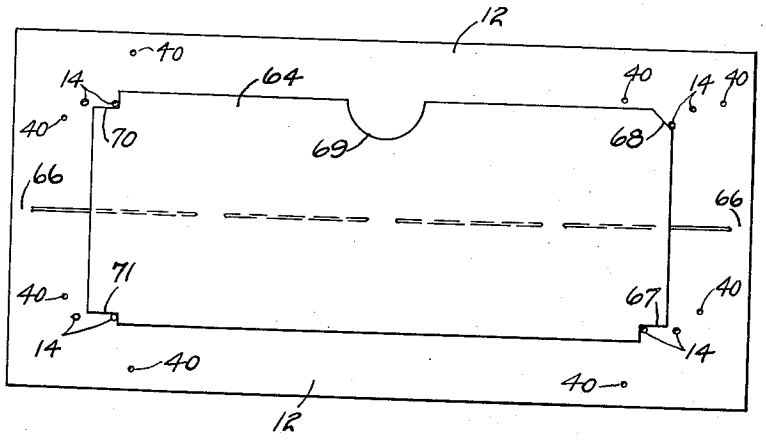
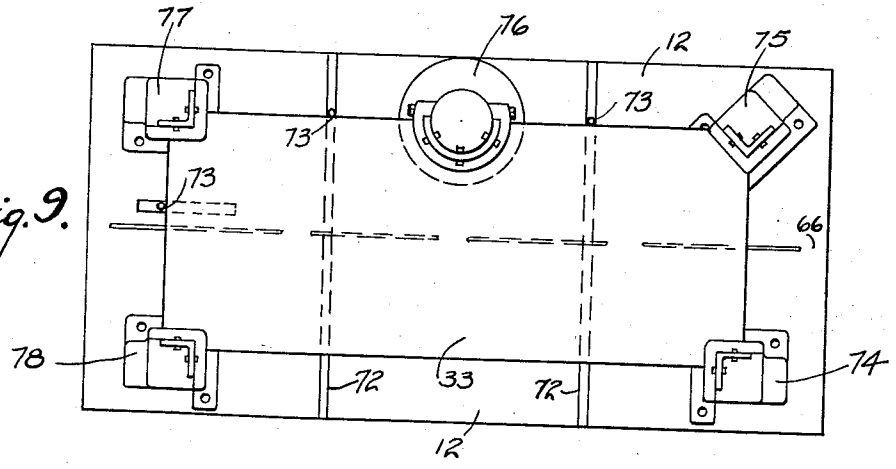


Fig. 9.



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UNITED STATES PATENT OFFICE

2,146,780

APPARATUS FOR NOTCHING SHEET MATERIAL

George F. Wales, Buffalo, N. Y.

Application March 17, 1936, Serial No. 69,301

8 Claims. (Cl. 164—110)

Although a large quantity of sheet metal is constantly being notched for use in fabricating various commodities in different industries it is well known that few, if any, sheets which have been notched to suit one commodity will have the notches properly located so that the same may be used for making another article.

Heretofore various means have been employed for punching notches in the required places in sheets of metal or the like but all of them comprise dies rigidly mounted on the stationary bed of the press and a punch cooperating with the die and rigidly mounted on the ram which moves vertically toward and from the bed.

Heretofore when it has been required to notch a small quantity of sheets of the same size it has been necessary to place the individual sheets on the die and against suitable gauging stops so that when the ram descended it forced the punch through the metal and into the die and thus caused a notch to be formed in the edge of the sheet. The shape of the notch depended upon the shape of the cooperating punch and die while the depth of the notch and its position on the sheet depended upon the setting of the gauging stops in relation to the cutting edges of the die.

If more than one notch of the same size and shape was to be punched in the sheet, these notches could only be punched in successive strokes of the press when they were located from the edges of the sheet in exactly the same relation as the gauging stops were to the cutting edges of the die. For example, if a quantity of rectangular sheets were required with each of the four corners punched so that notches of equal size and shape were to be cut, the gauging stops on the die were set for that particular notch and then by placing each corner of the sheet on the die and against the gauging stops successively, the press would make one stroke for each corner, or four strokes to punch the four notches in the sheet.

If, on the other hand, all of the four notches in the above example were of the same shape but of four different sizes, the operation of punching the notches became more difficult and more expensive, for with the gauging stops set for one size of notch, that size only was punched in the first sheet, then in another, and another until the entire lot had been run. The gauging stops were then adjusted for the second size of notch and each of the sheets had to be lifted and entered into the die again. This process was repeated until the four corners of each sheet had been notched.

If all of the notches in the above example were different in shape from each other, it became still more difficult and expensive, for four different dies had to be made and after the first corner had been notched on all of the sheets on the first die, the second die would be set into the press and the second notch punched on all of the sheets, and so on. Thus four dies were required, four strokes of the press used, and four handlings of the sheet necessary.

The foregoing is a description of the methods employed at present for punching single notches in vast quantities of sheet metal parts in the industries. These methods are both slow and expensive.

However, if the quantity of sheets to be notched was large enough to warrant the expenditure, a multiple punch and die was made for this particular job, the die shoe carrying all the dies in their proper relative position and the punch holder carrying the corresponding punches in the required relative position. Each sheet of the large quantity to be notched was placed over the several dies and during the descent of the punches, all of the notches were punched simultaneously in the sheet. Notching sheets by this method involves a tremendous expenditure for dies, as each individual part requires its own particular die which can be used for nothing else.

It is the purpose of this invention to provide an economical and inexpensive sheet material notching apparatus which is so organized that the same can be adjusted to punch all the notches of the same or different sizes in the sheets, regardless of whether the quantity is large or small, and thus effect a substantial saving over the method in which the notches were punched one at a time in the sheets, as well as the method of making multiple punches and dies for use in notching large quantities of sheets.

Another object is to provide a plurality of punch and die assemblages which can be readily and easily shifted and interchanged for punching notches of the same or different sizes in various locations on the same or different sheets.

Another object is to provide means for locating the punch and die assemblages by means of templates so that the assemblages can be set in the various positions required to punch notches accurately in the parts.

Another object is to provide improved gauging means whereby the sheets may be properly and quickly located relative to the several dies to insure punching of notches therein in their proper

relative positions to the edges of the sheets and to other notches or holes which may already be present in the sheet.

Another object is to provide a notching assemblage which is so organized that the members of the holder carrying the die and punch are rigidly connected and the punching and stripping device is independent of said holder and capable of being readily guided thereon and easily removed therefrom and the punching element may be driven through the work piece and stripped therefrom without liability of distorting that part of the holder on which the punch is guided.

Another object is to provide an adjustable punch and die means for notching sheet metals and the like which can be used in the standard punch presses and machines now in general use.

Another object is to so construct the punching and stripping mechanism that the same will always remain in a raised position in relation to the die so that the work may be fed underneath same preparatory to performing the notching operation.

Another object is to provide a construction of the punching and stripping mechanism in which the punch proper may be quickly and conveniently changed without disturbing any other parts of the die assemblage or of the machine in which it is operating.

Another object is to provide a punch and die for cutting notches in sheet material, in which the punch assemblage is symmetrical about both vertical and horizontal centerlines, and can therefore be inverted to present a new cutting edge to the work whenever the other cutting edge becomes dull or worn.

Another object is to so organize the punch and die assemblages that various methods of making measurements in setting them may be made.

Another object is to provide a mounting for the punch and die assemblages which consists of a combined lower base plate and templet equipped with rails for supporting the work piece and guiding same into the gap between the punch holder arm and the die shoe together with work piece gauging stops for locating same in proper relation to the cutting elements of the punch and die assemblage.

These objects and the several novel features of the invention are hereinafter more fully described and claimed and the preferred form of construction by which these objects are attained is shown in the accompanying drawings, in which:

Figure 1 is a fragmentary plan view of one corner of a template on which is mounted a notching punch and die assemblage, showing a work piece inserted in same and supported on a guide rail equipped with a stop gauge.

Figure 2 is a fragmentary side elevation of the same showing a notching punch and die assemblage in position between the bed and ram of a stamping press preparatory to notching a sheet of material interposed between the punch and die, together with a guide rail for supporting said sheet and with both guide rail and punch and die assemblage mounted on a template.

Figure 3 is a fragmentary perspective view of a notching punch and die assemblage mounted on a template and showing details of construction of a preferred form of my invention.

Figure 4 is a perspective view of the upper portion of the body of the punch and die assemblage, showing details of construction for guiding the punch as well as the guideway and seat for the punch lifting device.

Figure 5 is a perspective view of the lower portion of the body of the punch and die assemblage showing details of construction and particularly the inclined surface for providing ejecting means for the cut out slugs.

Figure 6 is a perspective view of one form of punch lifting device.

Figure 7 is a plan view of a sample sheet to be used as a guide for making a template on which notching punch and die assemblages may be mounted in such relation to each other that when operated they will produce duplicates of said sample sheet.

Figure 8 is a plan view of the sample sheet placed upon the template and showing one method of locating pilot holes in said template.

Figure 9 is a plan view of a complete assemblage of a multiple notching device comprising punch and die assemblages, rails, and template and showing a work piece in position against the gauging stops ready to be notched.

Although this invention is capable of use in various installations, the same is shown in the present case in the drawings as used in connection with stamping presses of the kind commonly used for blanking, piercing, trimming, punching, and notching sheet metal.

It is obvious that the type of notching unit described in the drawings may be used to cut all shapes of notches, being varied in detail to suit conditions and also that the punch lifting detail may be varied to accomplish the purpose without limiting the scope of the present invention.

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

In Figure 2 numeral **10** represents the bed of a press or machine in which my invention is operated and **11** represents the vertically movable ram which contacts the punch **35** to depress it sufficiently to cause the lower cutting edges **36**, Figure 3, of the latter, to cooperate with the cutting edges **37** of the die members **15** and **18**, in order to cut the slug **38** from work piece **33**, said slug **38** dropping onto the downwardly inclined surface **32** in the die shoe **13** which conveys it to the bottom of said incline, whence it may be readily removed. In order to assist the slug and prevent it from becoming obstructed in its descent, the surface **39** of shoe **13** is relieved or made wider at the bottom, than the size of the maximum slug which may be cut.

Die members **15** and **18** are mounted on shoe **13** so their cutting edges are directly under the cutting faces **42** and **22** of the punch, except that proper clearance is allowed between the cooperating cutting edges. Die members **15** and **18** are rigidly mounted on shoe **13** by means of bolts **16** and dowels **17** which extend through them and into their cooperating holes **43** and **44**.

Although it is possible to construct the punch holder **45** as an integral part of the die shoe **13** I prefer as shown in the drawings these elements separated as at **46** and the punch holder **45** attached to the shoe by means of bolts **47** extending through said punch holder and into threaded holes **48** in shoe **13** and dowels **49** extending into holes **50**.

As punch **35** is in no way attached to ram **11** of the press it would stay in a lowered position after being depressed to cut the material unless some means were provided to raise it, which is

necessary so that subsequent work pieces may be inserted into gap 52 and under said punch. Although many ways of lifting the punch may be devised, I prefer to employ the one shown in the drawings, it being understood that any other means for accomplishing the same result in no way confines the scope of the present device.

Numeral 51 represents an elongated opening extending through punch 35 in such manner that the distance between the ends of the opening 51 and the top and bottom edges of the punch are equidistant, thus permitting said punch to be operated with either end down to engage the die members and thus giving the punch the double cutting edges 36 and 53. This only applies when the horizontal cross section of the punch is symmetrical. Otherwise the distance between the ends of the opening and the top and bottom edges of the punch may vary to suit conditions. In the drawings punch cutting edge 36, as shown in Figure 3, engages die cutting edge 37, but with the punch inverted, punch cutting edge 54 engages die cutting edge 37, this being a punch which is symmetrical about its center. Into said elongated openings 51 in the punch are inserted two pins 23 and 25 with a spring 24 assembled under compression between them, the spring acting to force the pins apart with a strong initial load and against the ends of the elongated opening. The load of the spring is strong enough to lift the punch to its idle position away from the die members and also to strip the punch from the work piece, although in notching operations of this character comparatively little stripping force is required, as in most cases the slug merely falls away from the work piece and the punch does not adhere to the work as in hole punching operations. Pins 23 and 25 are provided with flat surfaces 55, for the ends of the spring to seat on, as shown in Figure 6. Upon assembly into the holder these pins are guided in slots 57 in the punch holder and 56 in the cap 27 which retains the punch in its proper position on the punch holder. Both punch holder and punch cap slots are provided with seats 58 against which the lower pin rests, thus retaining punch 35 in an elevated position until sufficient pressure is applied on the top face of the punch to overcome the load being exerted by springs 24.

Shoe 13 has an extension 59 which projects beyond the punch holder on the side from which the materials are being fed into the gap 52, which extension acts as a ledge on which to first place the work piece to be notched. Cap 27 is provided with a mouth or outwardly increasing taper 60, to facilitate the feeding of materials under same. Punch holder 45 is provided with an angular clearance 61 obviating the necessity for finishing the radius 62 of punch 35.

In assembling this device the die members 15 and 18 are attached to shoe 13 in their proper position. Punch holder cap 27 is then attached to punch holder 45 with punch 35 in position, but with pins 23 and 25 omitted. This punch holder assemblage is then arranged in position on die shoe 13 so that punch 35 contacts die elements 15 and 18 in proper relation for cutting material and is then attached rigidly to said shoe. The punch is then withdrawn from the assemblage and pins 23 and 25 used to compress spring 24 sufficiently for them to be assembled into slots 51 of the punch. This punch, spring and pins assemblage is then a free and sepaarte part of the complete assemblage and may be inserted into or withdrawn from its guideway between cap 27 and punch holder 45 without disturbing any other part of said assemblage.

Now if the edge 36 which has first been used for cutting material becomes worn or dull it is only necessary to lift the punch, spring and pin assemblage out of its guideway and invert it, when the new cutting edge 54 will be in position to continue the operation.

During the operation the ram 10 of the press descends and presses against the upper face of the punch 35 depressing same until lower edges 36 press the work piece 33 against die cutting edges 37 and causes slug 38 to drop onto chute 32. As soon as the ram starts to depress the punch, upper pin 23 is carried downward with it, thus increasing the compression of spring 24 which cannot descend because lower pin 25 remains stationary and pressing against seats 58 in the punch holder 45 and cap 27. The lower end of slot 51 in the punch is thereby forced away from its contact with the lower side of pin 25 a distance equal to the distance the ram depresses the punch. As the ram ascends after completing the operation the punch is forced upward with it until the lower end of slot 51 again contacts the lower side of pin 25 when the upward movement of the punch will cease and it will rest with only the weight of the punch assemblage being carried on pins 25 bearing on seats 58 of punch holder 45 the cap 27. Spring 24 thus returns to its original compression value.

The foregoing is a description of the details of a single assemblage of simple construction. It is understood however that this construction may be adapted to cut notches of various shapes and sizes and that details of construction may be altered to suit conditions.

A plurality of such notching devices are employed advantageously in producing a plurality of notches simultaneously in sheets of metal or other material without the necessity of making multiple punches and dies for this purpose. In order to enable a plurality of such notching devices to be used in this manner a templet 12 having preferably the form of a sheet metal plate is supported on the bed 10 of the press and provided with locating or pilot openings 14 with which pilot pins 21 and 26 engage. The pilot pins preferably have the form of screws secured to the under side of shoe 13 and corresponding in location to the position of the notches 38 which are to be cut in the work piece 33. Each of the pilot pins is fastened into a recess 63 formed into the under side of the shoe in vertical alignment with the die and punch of the respective notching device and can be screwed into said shoe so that it does not project below the under side if the assemblage is to be used at times without the pilot.

Each of the assemblages is secured to this templet and prevented from becoming displaced thereon, either vertically or horizontally by fastening means consisting preferably of bolts 31 passing downwardly through said shoe and into companion threaded holes 40 in templet 12.

Owing to width limitations in the fabricating of flat steel plates having the necessary characteristics for base plate use it is often necessary to use two or more plates rigidly attached, edge to edge, in order to obtain a base plate large enough for certain conditions. In Figures 8 and 9 a base plate of this nature is shown and the plates are attached together by conventional means. In the drawings the plates are shown welded together as indicated by numerals 66.

When it is desired to utilize this notching apparatus for producing a plurality of notches in a sheet of metal or the like, an accurate sample sheet 64 is made under conventional methods representing the finished product. Such a sheet is shown in Figure 7. This sample sheet 64 is placed on the base plate 12 as shown in Figure 8 and pilot holes 14 bored in proper relation to the notches so that the dies will punch sheets which are duplicates of the sample.

The first of any pair of pilot holes 14 may be bored in the corner of the notch in the sample as shown in Figure 8 with the edges of the notch tangent to the diameter of the bored hole, or the hole may be bored with its center at the intersection of the angular edges, or at any other location relative to said notch, it being understood that the pilot pins in the die shoe are in the same relation to the cutting edges of the die. The second pilot hole is then bored in the templet in proper relation to the first pilot hole so that when the assemblage is placed with the two pilot pins engaging same the cutting edges will be in their proper place for notching the work pieces. The fastening bolt holes 40 are then located through the holes in the shoe, and the templet then drilled and tapped to accommodate screws 31 which attach the assemblage firmly to the templet.

A plurality of notching devices are now attached to the base plate 12 in proper position for enabling each notching device to punch one of the notches 67, 68, 69, 70, or 71 in the work piece. This is accomplished by placing the punch and die assemblage on the templet and engaging pilot pins 21 and 26 of the shoe with pilot holes 14 of the templet and base plate 12. When several notching devices are thus secured in their proper positions to the upper side of the base plate they are rigidly connected and form practically a unitary structure which can be slid as a whole over the bed of the press and permit of notching a sheet by lowering the ram of the press so that same engages simultaneously with the anvils or uppermost faces of the several notching devices and depresses the several punches so that in cooperation with the several die members, a plurality of notches will be formed in the work piece. In order to insure that the work pieces will be fed into the gaps 52 of the punch and die assemblages, guiding rails 72 are attached to the upper face of the base plate or templet 12 in such manner that they are the same height above the upper face of the base plate as the die member upper faces.

These rails are spaced between the die assemblages so that they not only support the work piece to prevent sagging but also provide the means to which three work piece gauging stops 73 are attached in order that when work pieces 33 of the same size are slid into the gaps 52 of the punch and die assemblages and against said gauging stops the notches 67, 68, 69, 70, and 71 will be formed exactly as required in said work pieces, upon the ram of the press descending once for each piece. In order that the rails may serve as ledges on which the work pieces may be placed before they are slid or fed into the gaps 52 of the punch and die assemblage, the rails project a suitable distance toward the feeding side of the die as shown in Figure 9.

The location of the notching devices is determined by each particular piece of work and the distribution of the notches which are to be formed therein and also to permit the operator to readily feed the work pieces to the apparatus and remove the same therefrom.

For example as shown in Figure 9, three notching units 75, 76, and 77 are employed for supporting the punches and dies on the templet in the proper position for punching the notches in the work piece along the rear longitudinal edge, while the units 74 and 78 support the punches and dies for producing the notches at the front corners of the sheet which, because of gaps 52 in these front units 74 and 78, leave the front part of the notching mechanism unobstructed for the free introduction of the sheet to be notched and the removal thereof.

Although the form shown in the drawings represents a practical embodiment of my invention it is to be understood that the same may be varied as to details and still contain the essence of my improvements as summed up in the following claims.

What I claim and desire to secure by Letters Patent of the United States is:

1. A sheet material notching apparatus for use between the bed and ram of a press, comprising a holder having a lower base and upper head, an angular shaped die mounted on the base and a punching device removably mounted as a unit on said head, comprising an angular shaped punch whose internal angular surface bears against a cooperating external angular surface on said head, a cap attached to said head having an internal angular surface bearing against the external outer surface of said punch, in such manner as to provide an angular shaped guideway between said head and cap in which the punch is slidable vertically so that in its lowermost position the lower outer edges of said punch cooperate with the upper inner edges of said angular shaped die to cut materials inserted therebetween and a spring means for lifting said punch above said die sufficiently to permit the insertion of the material to be operated upon.

2. A sheet material notching apparatus for use between the bed and ram of a press, comprising a holder having a lower base and upper head, an angular shaped die mounted on the base and a punching device removably mounted as a unit on said head, comprising an angular shaped punch whose internal angular surface bears against a cooperating external angular surface on said head, a cap attached to said head having an internal angular surface bearing against the external outer surface of said punch in such manner as to provide an angular shaped guideway between said head and cap in which the punch is slidable vertically so that in its lowermost position the lower outer edges of said punch cooperate with the upper inner edges of said angular shaped die to cut materials inserted therebetween and a spring means for lifting said punch above said die sufficiently to permit the insertion of the material to be worked upon, said spring means comprising one or more devices, each having a spring under compression between two bearing pins retained in a vertically formed slot extending through said angular shaped punch, said bearing pins projecting laterally from either side of said punch and slidably engaging pockets formed in said upper head and cap in such manner that the projecting ends of the lower pin engage seats in said pockets.

3. A sheet material notching apparatus for use between the bed and ram of a press comprising a holder having a lower base and upper head, a notching die member mounted on said base and

a punching device mounted and guided on said head as a punching unit, which unit is capable of being freely assembled with said head and removed therefrom, and including a punch cooperating with said die member and a punch lifting means for maintaining a space between said punch and die when the apparatus is in an inoperative position, said base being provided with means for discharging the cutaway portion of the material comprising a downwardly inclined surface for receiving said cutaway portion and emitting it from said apparatus said base being provided with means for rigidly attaching the apparatus to the bolster plate of a press or to a template, said base also being provided with means for locating said die assemblage in relation to other like devices.

4. A sheet material notching apparatus for use between the bed and ram of a press comprising a holder having a lower base and upper head, a notching die member mounted on said base and a punching device mounted and guided on said head as a punching unit, which unit is capable of being freely assembled with said head and removed therefrom, and including a punch cooperating with said die member and a punch lifting means for maintaining a space between said punch and die when the apparatus is in an inoperative position, said base being provided with means for discharging the cutaway portion of the material comprising a downwardly inclined surface for receiving said cutaway portion and emitting it from said apparatus said base being provided with means for rigidly attaching the apparatus to the bolster plate of a press or to a template, said base also being provided with means for locating said die assemblage in relation to other like devices, comprising pilot pins projecting downwardly below the lower face of the base for mounting on templates said pins being in a definite relation to the cutting edges of the punch and die and means for firmly attaching said assemblage to said template or to the bolster of a press.

5. A sheet material notching apparatus for use between the bed and ram of a press, comprising a plurality of notching devices adapted to rest on said bed and each comprising a complete unit independent of the bed and ram and having a holder, a lower die member, and an upper punch cooperating with said die member, and a template for definitely locating the several holders relatively to each other so that the die and punch of each holder register at one of the places where a notch is to be cut in a sheet, said templet being secured to the underside of the several holders and provided with a plurality of pilot openings each of which receives a pilot pin arranged on the underside of each holder in definite relation to the cutting edges of said punch and die.

6. A sheet material notching apparatus for use between the bed and ram of a press comprising a plurality of holders, each having a lower base and upper head, notching die members mounted on said bases, and punching devices mounted and guided on said heads as punching units, and spring lifting means for raising the punches from said sheet, said holders being provided with throats to permit the insertion of a sheet of material between said die members and punching units and the withdrawal of same.

7. A sheet metal press including a holder having a base and a head, a die mounted on said base, a punch slidable on said head toward and from said die and having its opposite ends of like construction and capable of being inverted for presenting either of said ends to said die, and means for moving said punch away from said die comprising a slot formed in said punch, a pocket formed in said head adjacent to said slot and spring pressed elements arranged in said slot and pocket and adapted to bear against opposite ends of said slot and pocket and capable of moving said punch away from said die upon engaging either end of said punch with the die.

8. A sheet metal press including a holder having a base and a head, a die mounted on said base, a punch slidable on said head toward and from said die and having its opposite ends of like construction and capable of being inverted for presenting either of said ends to said die, and means for moving said punch away from said die comprising a slot formed in said punch, a pocket formed in said head adjacent to said slot, bearing pins arranged in said slot and pocket and adapted to engage with opposite ends thereof for limiting the extent of separation of said bearing pins in said slot and pocket, and a spring interposed between said bearing pins and adapted to be compressed upon moving the punch toward said die and engaging either end of said punch with said die.

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