

May 25, 1943.

G. F. WALES

2,320,205

APPARATUS FOR PERFORATING SHEET MATERIAL

Filed March 27, 1942

3 Sheets—Sheet 1

Fig. 1.

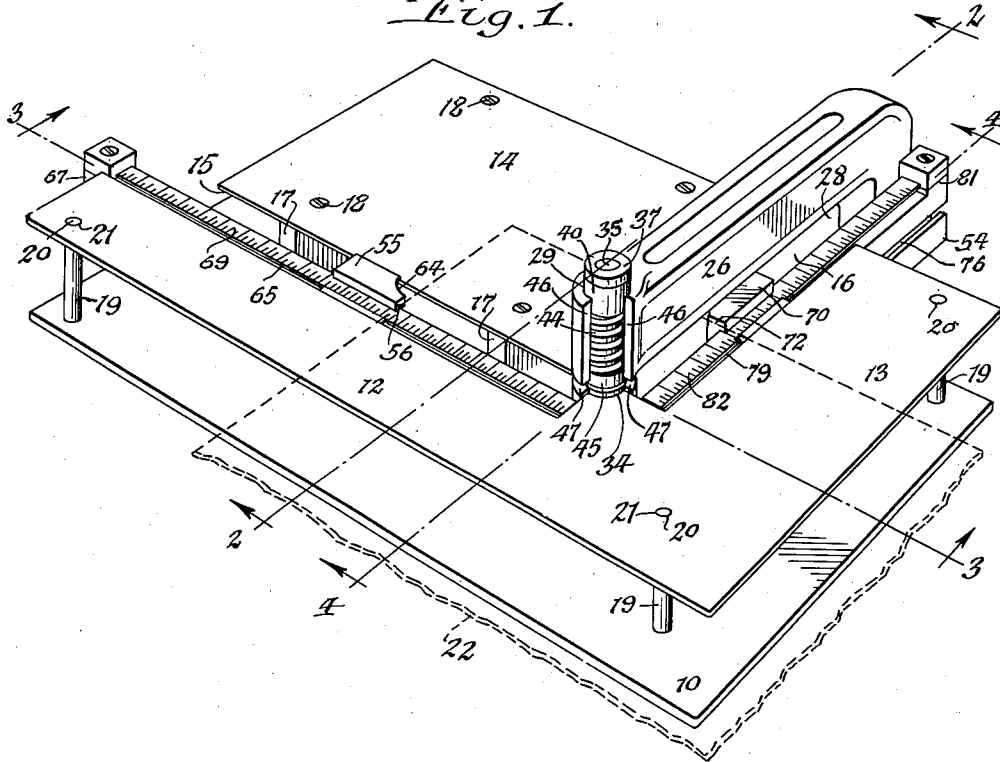
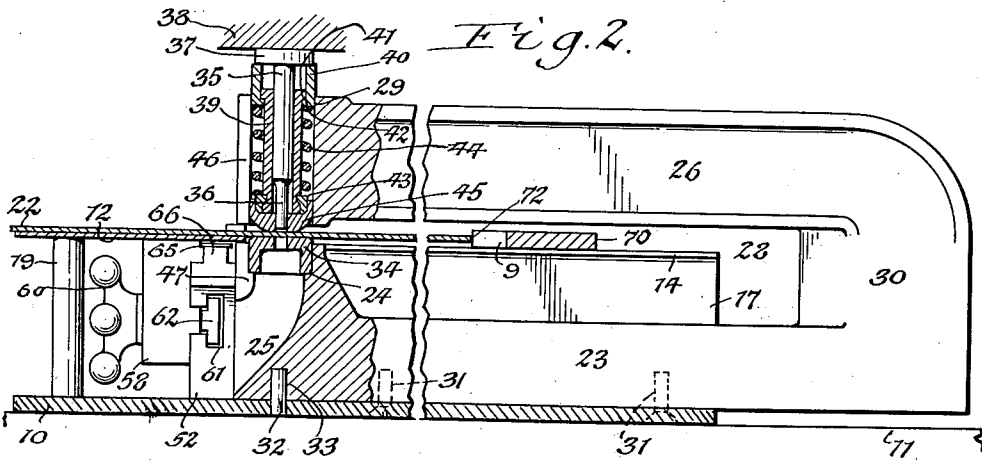


Fig. 2.



INVENTOR  
George J. Wales  
BY *Popper & Popper*  
ATTORNEYS

May 25, 1943.

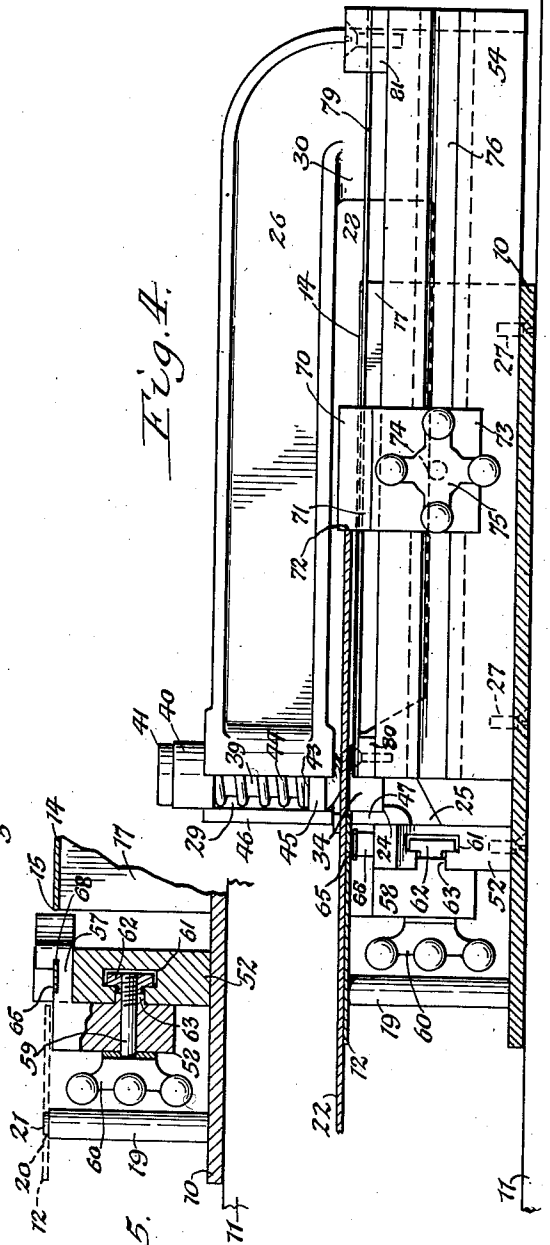
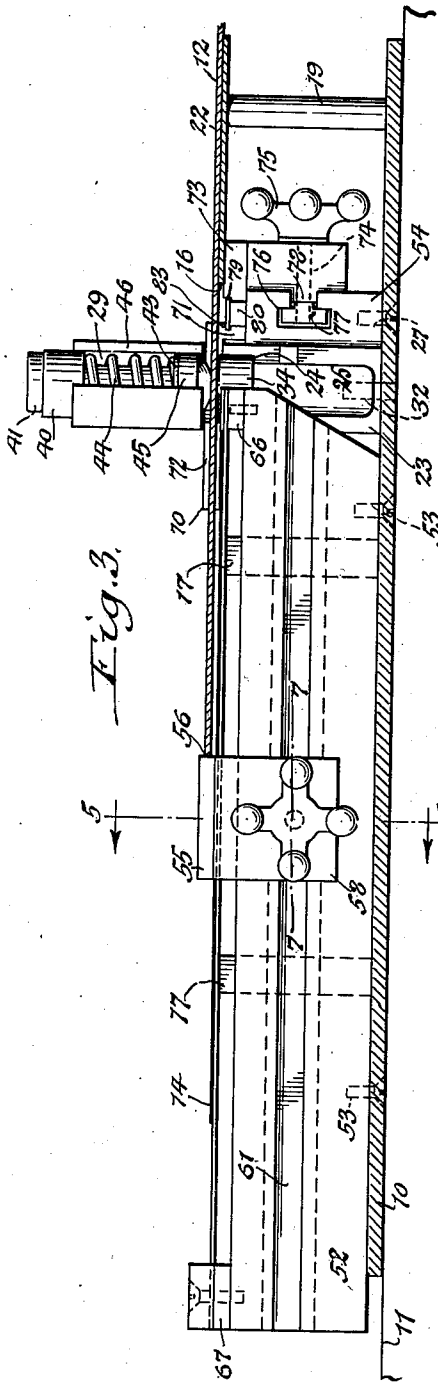
G. F. WALES

2,320,205

APPARATUS FOR PERFORATING SHEET MATERIAL

Filed March 27, 1942

3 Sheets-Sheet 2



INVENTOR  
George F. Wales  
BY *Robert Popp*  
ATTORNEYS

May 25, 1943.

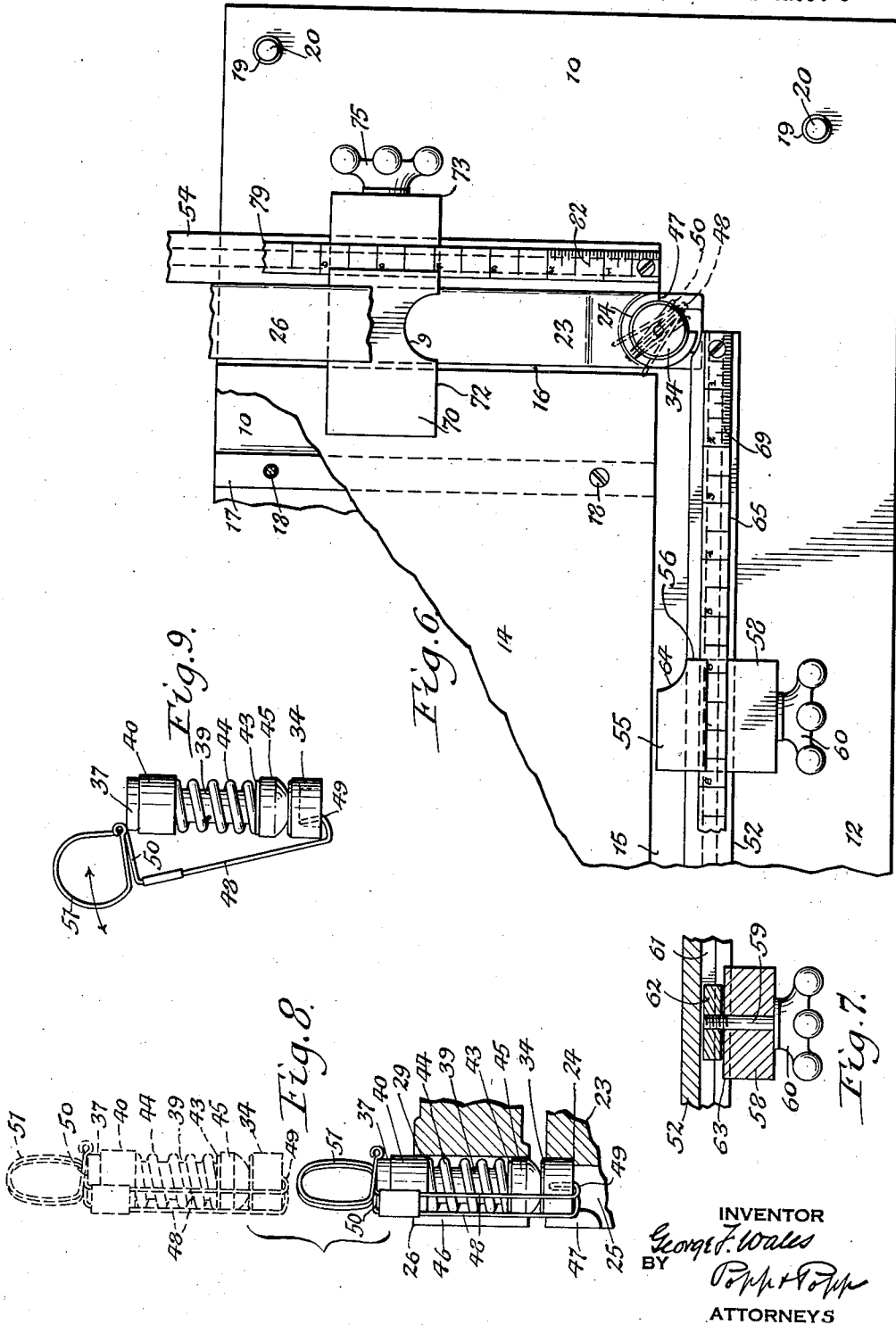
G. F. WALES

2,320,205

APPARATUS FOR PERFORATING SHEET MATERIAL

Filed March 27, 1942

3 Sheets-Sheet 3



# UNITED STATES PATENT OFFICE

2,320,205

## APPARATUS FOR PERFORATING SHEET MATERIAL

George F. Wales, Kenmore, N. Y.

Application March 27, 1942, Serial No. 436,431

22 Claims. (Cl. 164—94)

This invention relates to an apparatus for perforating sheet material and more particularly to an apparatus which permits one or another of a plurality of punch and die assemblies to be used in a holder and quickly mounted in and removed therefrom in an assembled condition and thus permit of readily changing from one size of perforation in a workpiece to another and also enable either a large or a small number of holes of a given size to be produced economically and expeditiously.

Apparatus for perforating sheet material, as heretofore constructed, usually required considerable time for changing one size of punch and die members and stripping means for another size of the same and this is objectionable when different sizes of holes must be formed at relatively short intervals and few in number and thus requires frequent change in the punch and die assembly.

One of the objects of this invention is to provide a perforating apparatus in which the punch and die are so constructed that the same may be mounted on the holder of a perforating apparatus as a unit and also removed therefrom as a unit and to permit of readily and selectively using whatever size of these members may be required for perforating sheet material with holes of different sizes.

Another object of this invention is to so construct the holder of the perforating apparatus to permit of quickly mounting a punch and die assembly on a holder and removing the same therefrom.

A further object of this invention is to provide a yoke or coupling device which is adapted to detachably connect the punch and die assembly and facilitate the application of the same to the holder as well as the removal of the same therefrom and also retain the members of the punch and die assembly in their properly associated relation while not in use in the holder.

In the accompanying drawings:

Fig. 1 is a perspective view of a perforating apparatus embodying this invention.

Fig. 2 is a vertical transverse section, taken on line 2—2, Fig. 1 and showing parts broken away to shorten this figure.

Fig. 3 is a vertical longitudinal section, taken on line 3—3, Fig. 1.

Fig. 4 is a longitudinal section, taken on line 4—4, Fig. 1.

Fig. 5 is a fragmentary transverse section, taken on line 5—5, Fig. 3.

Fig. 6 is a top plan view of the apparatus with parts broken away.

Fig. 7 is a fragmentary horizontal section, taken on line 7—7, Fig. 3.

Fig. 8 is a fragmentary vertical section of the shoe and horn of the holder showing the mem-

bers of a punch, die and stripper assembly connected by a coupling or yoke for convenience in mounting the same in the holder or removing the same therefrom and also retaining these members in assembled condition when not in use.

Fig. 9 is a side view of a punch, die and stripper assembly and a coupling device or yoke showing the manner of applying the latter to and removing the same from the punch, die and stripper assembly.

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

In its general organization this apparatus comprises a punch, die and stripper assembly, a holder for supporting said assembly, a frame which is connected with said holder and adapted to support the workpiece to be perforated, gage means whereby the workpiece is positioned relative to the punch, die and stripper assembly, and a coupling for retaining the members of the punch, die and stripper in an associated relation.

The frame of the apparatus preferably includes a horizontal base plate 10 which is adapted to rest on the bed plate 11 of a press, and a horizontal supporting table or supporting plate arranged above the base plate and in spaced relation thereto. The supporting table preferably comprises an L-shaped outer section having a longitudinal arm 12 arranged lengthwise over the front part of the base plate and a transverse arm 13 arranged over a side part of the base plate and a rectangular inner section 14 arranged in the angle of the outer table section and over the respective parts of the base plate and separated from the outer section by an L-shaped slot having a longitudinal part 15 arranged between the rear longitudinal edge of the longitudinal arm 12 of the outer table section and the opposing longitudinal front edge of the rear table section 14, and a transverse part 16 arranged between the opposing transverse edges of the transverse table arm 13 and the rear table section 14, as best shown in Figs. 1 and 6.

The rear section 14 of the supporting table is spaced from the rear part of the base plate by spacing bars 17 interposed between the same and permanently connected therewith by any suitable means, such, for example, as screws 18. The front section of the supporting table is detachably supported in spaced relation to the front part of the base so as to render the adjacent parts readily accessible when necessary, this being preferably accomplished by a plurality of posts 19 permanently secured at their lower ends to the supporting base and each provided at its upper end with a reduced pin 20 engaging with

an opening 21 in the adjacent part of the front table section, as best shown in Figs. 1, 5 and 6.

Vertically in line with the plane of the transverse slot 16 in the supporting table is arranged a perforating unit whereby holes are punched in the workpiece, such as a sheet 22 of metal or other material. In general this perforating unit which is constructed and operates similar to that shown in Letters Patent of the United States, No. 2,268,787, granted to myself January 6, 1942 and, briefly described, is as follows:

The perforating unit which is embodied in the present invention includes a holder having a lower shoe or base 23 which is provided on its upper side of its front end with an upwardly opening tubular die seat or socket 24 and a slug chute 25 leading from the lower side of this seat to the front side of the shoe, and an upper horn or arm 26 which is separated from the shoe by a forwardly opening gap 28 and provided at its front end above the die seat with a vertical guideway or opening 29 and connected at its rear end with the corresponding end of the shoe by an upright arm 30. The holder has its shoe resting on the base plate 10 below the slot 16 and has its horn arranged above this slot and the upper side of the supporting table and has its arm 30 arranged in rear of this slot and the rear edges of the base plate and supporting table, so that the workpiece when placed upon the table will extend into the gap of the holder, as shown in Figs. 2, 3 and 4.

The holder is secured to the frame by screws 31 connecting the base 11 with the shoe 23 and the holder is located in the desired position on the frame by a locating pin 32 mounted on the base plate and engaging a locating opening 33 formed in the shoe axially in line with the center of the die seat 24 and the guide opening 29, as shown in Figs. 2, 3 and 6. The die seat 24 receives a tubular perforating die 34 which cooperates with the bit of a punch for forming a hole in the workpiece which is placed between this die and punch. The slug removed from the sheet workpiece, such as sheet metal, is received by the chute 25 and discharged from the apparatus.

The numeral 35 represents the vertical body of the punch, the lower end of which forms a cutting bit 36 cooperating with the upper edge of the opening in the die 34 during the perforating operation. At its upper end the punch body is provided with a head 37 which is adapted to be engaged by the ram 38 of the press and moved downwardly together with the punch body for causing the bit to perforate the workpiece.

The numeral 39 represents a guide sleeve or tube which is arranged centrally within the guide opening 29 of the horn 26 and in which the body of the punch slides vertically. The upper part of the guide sleeve is arranged within an upper collar or guide ring 40 which slides vertically within the upper part of the guide opening 29. The upper end of the upper collar engages with the underside of the punch head 38 and its lower end is free to slide downwardly on the guide sleeve an undetermined extent but the extent of upward movement of the upper collar relative to the guide sleeve is limited by a downwardly facing annular stop shoulder 41 formed on the upper part of the periphery of the guide sleeve and an upwardly facing annular shoulder 42 arranged internally on the lower part of the upper collar and engaging the shoulder 41 of the guide sleeve.

The numeral 43 represents a lower collar se-

cured to the periphery of the guide sleeve at the lower end thereof. Between the upper and lower collars 40 and 43 a stripper spring 44 of helical form surrounds the guide sleeve and bears at its upper and lower ends against the upper and lower collars 40, 43, respectively, and is preferably under an initial tension when these collars are spaced apart their fullest extent.

As shown in Figs. 2, 3, 4, 8 and 9, a guiding and stripping disk 45 for the front end of the punch is employed which bears with its upper side against the lower end of the guide sleeve 39 and adapted to rest with its rounded underside on top of the workpiece which is to be perforated. At its central part this guide disk is provided with a guide opening which receives the bit 36 of the punch body and positively guides the same in its movement toward and from the workpiece. The periphery of this guide disk slides on the bore of the guide opening 29 in the horn.

When no workpiece is present between the punch guide disk 45 and the die 34, the punching unit merely floats in the guide opening 29 and drops by gravity so that the punch guide disk rests on the die. Upon now pushing a workpiece between the die and the punch guide disk, the latter together with the punch and stripper elements will be lifted by the wedge action of the workpiece against the lower rounded side of the disk 45. During the subsequent descent of the ram 38 the same upon engaging the head of the punch will cause the lower cutting or bit end of the punch body to move downwardly in the punch guide and stripper disk 45 and into engagement with the workpiece and cut out a slug from the latter so as to form a hole therein. As the body and head of the punch descend this head by engaging the top of the upper collar 40 also depresses the latter and compresses the stripper spring 44 a greater extent and when the pressure of the ram is removed from the top of the head and body of the punch the resilience of this spring lifts the upper collar 40 and also the punch supported thereon and strips the bit of the latter from the hole which has been formed in the workpiece.

It frequently occurs that only a relatively small number of perforations of a given size are required in a workpiece or different workpieces and that changes in the size of the perforating units are necessary at relatively short intervals for the work in hand, as, for example, when producing groups of perforated parts having different sizes of holes for experimental purposes, and only a comparatively few parts having a particular size of opening are required in each group.

Changing the punch, die and associated parts of perforating apparatus, as heretofore constructed, usually required considerable time and therefore made the cost unduly high for producing only a few perforations of a given size at a time and different perforations of other sizes at relatively short intervals, inasmuch as the change of perforating units from one size to another required considerable disassembling and reassembling of parts of the apparatus other than those directly involved in the production of a certain size of opening in the workpiece.

Exchanging means have therefore been provided which embody features of the present invention and permit of removing the die and punch elements, for producing one size of hole, as a complete assembly from the holder upon which they are mounted while in use and re-

placing the same by a complete assembly of die and punch elements of another size while each of these assembled elements are associated in an operative position relative to one another. These means are so organized that the exchange in the sizes of the die and punch elements while thus assembled may be effected quickly and conveniently and without disturbing any parts of the holder upon which they are mounted while the apparatus is in operation.

The preferred form of the means and the preferred method of operation for thus mounting and dismounting an assembly of punch and die elements is as follows:

The numeral 46 represents a slot formed in the front part of the horn 26 and extending vertically from end to end of the guide opening 29 and also extending radially from the bore of this guide opening to the exterior of the horn on the front side of the same, as shown in Figs. 1, 2, 3, 4, 6 and 8. Vertically in line with the slot 46 the front part of the shoe 23 is provided with a similar slot 47 which extends vertically from the upper end to the lower end of the die seat 24 and the upper part of the chute 25 and also extending radially from the inner side or bore of the die seat and chute to the exterior of the shoe on the front side of the same, as shown in Figs. 2, 3, 4 and 8. The die seat or socket 24 and the guide opening 29 are both of circular form and the slots 46, 47 communicating therewith have a width less than the respective diameters of said seat and opening, as shown in Fig. 6.

If desired the upper side of the punch head 39 and the underside of the die may be engaged by the thumb and finger of a hand and pressed together so that the several elements of the die and punch unit are firmly held together while superposed as a stack or pile and lifted out of the seat 24 and guide opening 29 and deposited in any desired place adapted to receive the same in this assembled relation. The thumb and a finger of a hand are permitted to thus grasp the die and punch and remove the same from the die seat 24 and punch guide 29 due to the slots 46 and 47 in the horn and shoe forming a passage through which that digit of the hand which engages with the die is moved upwardly and out of the top of the guide opening 29 and thus maintain a reliable hold on the assembled die and punch elements while removing the same from the holder and depositing the same in a storage place while not in use.

Insertion of a die and punch unit while its elements are stacked in this assembled position may be effected by the fingers of a hand by reversing the procedure just described relative to the removal of these elements from the shoe and horn of the holder.

Instead of using the digit of a hand for thus removing a die and punch assembly from the die seat and punch guide of a holder and also restoring the same thereto this is preferably accomplished by a manually operated snap-on means or a retaining or carrying device which not only serves to effect the removal of this die and punch assembly from the holder and its restoration thereto, but also enables this assembly to be hung on a nail or placed on some other support for storage while the same is not in use. Although this retaining device may be variously constructed that shown in Figs. 6, 8 and 9 has been found satisfactory in service and is constructed as follows:

The numeral 48 represents the body of the sling, yoke, tool or retaining device which in its operative position is arranged vertically along the front part of the outer side of the die and punch and the stripper elements assembled as a unit therewith, 49 a lower jaw preferably of upwardly turned hook shape arranged at the lower end of the retainer body and engaging with the hollow inner side of the die, 50 an upper jaw projecting laterally from the upper end of the body and engaging with the head of the punch, for example the top thereof, and 51 a fingerpiece or handle preferably of ring form connected with the upper end of the body, as best shown by full lines in Fig. 8 and by dotted lines in Fig. 6.

This particular form of retainer or carrier is made from spring wire so that the jaws of the same are resiliently maintained in their normal operative position. In order to apply this retainer to the die and punch elements while the latter are mounted on the shoe and horn of the holder the retainer is moved bodily inward through the slots 47 and 46 of the shoe and horn and the lower jaw is engaged with the underside of the die, as shown in Fig. 9. Then the upper jaw is engaged with the top of the punch head, as shown in Figs. 2 and 8, during which operation the resilient wire, of which the retainer is constructed, is sprung the requisite extent to permit of such engagement of the retaining device to the die and punch assembly.

After the retaining device has been thus applied to the die and punch elements this assembly is lifted from the position in which the die and punch elements are arranged on the seat 24 of the shoe and in the guide opening 29 in the horn, as shown by full lines in Figs. 2 and 8, to a position above the horn, as shown by dotted lines in Fig. 8. The die and punch elements while thus held in an assembled position by the retaining device may now be stored in any suitable manner, ready for subsequent use, for which purpose the ring shaped handle may be attached to a supporting nail or hook on a wall or the like. During this operation of removing the assembled die and punch elements by the retaining device from the shoe and horn of the holder, the lower parts of the retaining device move upwardly through the slots 47 and 46 in the shoe and horn and do not change their relation to the die and punch elements but remain attached thereto and form a unitary group therewith.

In actual practice a single holder of this character will have associated therewith a plurality of sets or units of perforating elements each of which comprises a die and punch of a given size and a retaining device which is used for inserting the same into the holder and removing the same therefrom, and also to maintain the same in an assembled position when not in use, the size of the companion die and punch of each set being different from all the others. By this means it is possible for an operator to quickly and conveniently change the apparatus for perforating one size of hole to perforating holes of other sizes as circumstances require and also perforate a comparatively small number of pieces as readily as a large number, thereby saving time and effecting a material reduction in the cost of work which requires relatively frequent changes in the size of holes.

Various gaging means may be employed for placing the workpiece while resting on the supporting table in the proper position for produc-

ing a hole in the desired location by cooperation of the punch and die. The gaging means shown in Figs. 1-7 are more particularly organized for gaging a workpiece of rectangular form or one which has a longitudinal edge and a transverse edge forming a right angle corner. In this case the gaging means are constructed as follows:

The numeral 52 represents a longitudinal gage rail arranged horizontally between the supporting base plate and the longitudinal arm 12 of the outer supporting table section in front of the slot 15 between this arm and the inner table section and secured to the supporting base plate by screws 53.

The numeral 54 represents a transverse gage rail arranged horizontally between the supporting base plate and the transverse arm 13 of the outer table section in front of the slot 16 between the transverse rear edge of this arm and the corresponding edge of the inner table section 14 and secured to the base plate by screws 27. The front ends of these gage rails terminate adjacent to the front end of the holder shoe and the rear ends of these rails terminate near the corresponding edges of the base plate 10, as shown in Figs. 1, 2, 3 and 4.

The numeral 55 represents a longitudinal end gage block which is arranged above the plane of the longitudinal arm 12 of the supporting table and movable on a longitudinal line intersecting the axis of the die and punch elements for the purpose of bringing an end gage face 56 on the front side of this block toward and from said axis. This longitudinal end gage block is provided on its underside with a neck 57 which projects downwardly through the longitudinal slot 15 in the supporting table and rides on top of the gage rail 52 and is adjustable lengthwise thereon by means of an adjusting block 58 slidable against the front side of this rail and connected with the neck 57, and means for clamping the adjusting block on this rail comprising a clamping screw 59 passing through said block and having its outer end provided with a handle 60 bearing against the outer side of this block and its inner threaded end projecting into a longitudinal T-slot or undercut 61 in the front side of the gage rail 52, and a T-screw nut 62 arranged in said T-slot 61 and receiving said threaded end of the clamping screw. Upon loosening the screw 59 and nut 62 the clamping block and longitudinal end gage block 55 can be adjusted lengthwise toward and from the axis of the die and punch and after such adjustment this gage block may be held securely in place by tightening this screw and nut and thus enable the operator to place the longitudinal end edge of the workpiece 22 to engage with the gage face 56 for properly locating the workpiece in this direction relative to the perforating elements.

The gage block 55 may be additionally guided on the rail 52 and held against vertical displacement thereon by means of a guide rib 53 arranged on the inner side of the clamping block 58 and sliding horizontally in the outer narrow part of the T-slot 61, as shown in Figs. 2, 4, 5 and 7.

The longitudinal gage rail terminates at its inner or front end 64 in line with the axis of the perforating elements, as shown in Fig. 6, and the gage block 55 is capable of sliding on this gage rail for bringing its gage face 56 either transversely in line with this perforating axis or lengthwise at a distance therefrom to suit the required location of the hole to be made in the work. In order to permit the gage block 55 to be moved into a position in which its gage face 56

is exactly in line with the perforating axis the inner front corner of the gage block 55 is provided with a rounded notch 64 which is adapted to receive the adjacent circumferential parts of the die and stripper disk and thus clear the same.

For the purpose of enabling the operator to locate the longitudinal end gage 56 accurately, quickly and conveniently with reference to the perforating axis measuring means are provided which preferably comprise a longitudinal measuring strip 65 arranged horizontally above the longitudinal gage rail 52 and secured at its opposite ends to spacing blocks 66, 67 on the inner and outer ends of this rail, as best shown in Fig. 3. The rear edge of this measuring strip engages with a slit 68 for maintaining the measuring strip and the longitudinal gage block 55 in the proper position relative to each other. On its upper side the measuring strip is provided with measuring graduations or scale of numbers 69 adapted to be traversed by the gage face 56 of the gage block for locating this gage face in the required position to form the hole in the proper place in the workpiece.

The numeral 70 represents a transverse end gage block which is arranged above the plane of the transverse table arm 13 and the inner table section 14 and movable on a transverse line which is arranged at right angles to the line of movement of the gage block 55 and intersects the axis of the perforating die and punch. This transverse gage block is provided on its underside with a neck 71 which projects downwardly through the transverse slot 16 in the supporting table and rides on top of the transverse rail 54 for the purpose of bringing the gage face 72 on the front side of this block into the desired position relative to the perforating axis. This transverse gage block is held in its adjusted position on the transverse rail 54 by clamping means which include an adjusting block 73 connecting with the gage block 70 and bearing against the front side of the transverse gage rail 54, a clamping screw 74 passing through the clamping block 73 and having its outer end provided with a handle 75 bearing against the outer side of said clamping block 73 while its inner threaded end projects into a horizontal T-slot or undercut 76 arranged lengthwise in the rail 54, and a screw nut 77 slidable lengthwise in the T-slot 76 and receiving the threaded end of said clamping screw 74. Upon loosening the clamping screw and nut 74 and 77 the gage block 70 may be moved transversely toward and from the perforating axis and after this adjustment tightening of the clamping screw and nut 74, 77 will hold the transverse gage block in the desired position for engaging its rear gage face 71 with the rear edge of the workpiece so that the hole will be produced therein by the perforating elements in the proper place. For additionally guiding the transverse gage block on the transverse rail and preventing lifting of the transverse gage block from the transverse rail the transverse clamping block 73 is provided with a horizontal guide rib 78 which slides in the outer part of the T-slot 76 in the transverse rail, as shown in Fig. 3.

The transverse rail 54 terminates at its inner or front end in line with the axis of the perforating elements, as shown in Fig. 6, and the transverse gage block is capable of sliding on this gage rail for bringing its gage face 72 either in line with the perforating axis or transversely at a distance therefrom depending on the requisite location of the perforation in the workpiece. In

order to permit the transverse gage block to bring its gage face exactly in line with the perforating axis the front side of the transverse gage block is provided with a notch 9 which is adapted to receive the adjacent circumferential parts of the die and stripper disk and clear the same. Measuring means are provided for conveniently and quickly locating the transverse gage block in the proper place for forming a hole in the desired location in the workpiece. The means for this purpose preferably comprise a transverse measuring strip 79 arranged horizontally above the transverse rail but spaced thereby by connecting the opposite ends of this strip with spacing blocks 80, 81 on the front and rear ends of the transverse rail, as shown in Fig. 4.

On its upper side the measuring strip is provided with a longitudinal scale or row of graduations 82 with which the gage face on the transverse gage block is adapted to be alined for locating this block in accordance with the position on the workpiece where the same is to be perforated.

Lifting of this transverse measuring strip is prevented by engaging the rear edge of the same with a slit 83 in the adjacent part of the transverse gage block, as shown in Fig. 3.

When getting this apparatus ready preparatory to punching holes in a predetermined location on a workpiece the longitudinal end gage and transverse end gage are adjusted to the required position so that the workpiece when engaging the same will be properly located relative to the perforating axis to produce a hole in the desired place in the workpiece. This adjustment is effected conveniently by temporarily removing the L-shaped section of the supporting table. The operator also selects the appropriate die and punch assembly and places the same in the socket 24 and guideway 29 of the holder. Thereafter the operator pushes the workpiece between the die and guide disk 45 while the base plate 10 of the apparatus is resting on the bed 11 of the press and then causes the ram 38 to descend and move the punch against the workpiece whereby a hole is produced in the latter by cooperation of the die and punch.

It will be noted from the foregoing description that this invention in general comprises a unitary holder mounted on a base plate having adjustable gauging means, said holder having a lower base, a die seat in said base, an upper arm joined to said lower base, a punch guide element opening in said upper arm in concentric relation to said lower die seat, and provision for operatively applying successively various cooperating punch and die element combinations including a die member, a cooperating punch, a stripping guide for said punch, said punch and die element combinations being held together by a removable yoke which binds said cooperating elements into an individual group, said yoke being capable of being applied to said punch and die combinations while they are in operative position in said holder, for removal of same, and said yoke being capable of inserting said combination of elements into said holder in proper operating relation.

Moreover this invention includes a quick change punching device such as described herein, having a unitary holder mounted on a base plate having adjustable work gauging means which serves as a basic operating unit, to which various punch and die element pairs may be

interchangeably mounted, a multiplicity of snap-on yokes, each of which binds one combination of punch and die elements together when said combination is outside of said operating unit, in such manner that any one of said combinations may be readily inserted in proper operating position into said operating unit and the yoke removed during the operating, after which the yoke may be snapped back on to the cooperating punch and die elements for removal of same from said operating unit.

This invention involves a method of changing punch and die elements in a unitary holder having a lower arm with a die element seat and an upper arm with a punch element guideway in concentric relation to one another, including provision in said holder for the insertion of a sling which while gripping said punch and die elements may be used to assemble or remove same from holder.

In this method of changing the punch and die elements as a basic operating unit these elements are seized by a snap-on means which is used to remove said elements from said unit in the same relative position in which they operate and retain them in said position until required again at which time said elements and snap-on means are inserted into said operating unit and the snap-on means removed and laid aside until required for removal of said elements upon completion of the work.

As a whole this perforating apparatus is very simple and compact in its construction, the same is strong and durable and not liable to get out of order and the same enables the work for which it is specially designed to be performed expeditiously and economically.

I claim as my invention:

1. A perforating apparatus comprising perforating elements to form a hole in a workpiece, a frame upon which said perforating elements are mounted and which includes a table for supporting the workpiece and provided with a slot, and means for gaging the workpiece including a gage block arranged above the table and adapted to be engaged by the workpiece and provided with a neck projecting downwardly through said slot, a rail mounted on the frame below said table, and means for adjustably connecting said neck with said rail and effecting longitudinal adjustment of said gage block relative to said perforating elements.

2. A perforating apparatus comprising perforating elements to form a hole in a workpiece, a frame upon which said perforating elements are mounted and upon which the workpiece is adapted to be supported, means for gaging said workpiece including a rail mounted on said frame and a gage adjustably mounted on said rail, and measuring means for locating said gage relative to said perforating elements including a strip mounted on said rail and provided with graduations which are traversed by said gage.

3. A perforating apparatus comprising perforating elements to form a hole in a workpiece, a frame upon which said perforating elements are mounted and upon which the workpiece is adapted to be supported, means for gaging said workpiece including a rail mounted on said frame and a gage adjustably mounted on said rail, and measuring means for locating said gage relative to said perforating elements including a strip mounted on said rail and provided with graduations which are traversed by said gage, and said



gage being provided with a slit in which said strip is adapted to slide.

4. A perforating apparatus comprising perforating elements for forming a hole in a workpiece, a frame upon which said perforating elements are mounted and upon which the workpiece is adapted to be supported, means for gaging said workpiece including a rail mounted on said frame and a gage adjustably mounted on said rail, and measuring means for locating said gage relative to said perforating elements including a strip mounted on said rail and provided with graduations which are traversed by said gage, and said gage being provided with a notch to receive a part of said perforating elements and permit the gage to clear said elements.

5. A perforating apparatus comprising perforating elements for forming a hole in a workpiece, a frame having a lower base part upon which said perforating elements are mounted and an upper removable table part adapted to support the workpiece, gage means having a gage face arranged above said removable support and adapted to be engaged by said workpiece, and adjusting means whereby said gage means are adjusted relative to said perforating elements and which are arranged below said upper removable table part.

6. A perforating apparatus comprising perforating elements for forming a hole in a workpiece, a frame having a lower base upon which said perforating elements are mounted and an upper table comprising an inner rectangular fixed section and an outer removable L-shaped section which is separated from said inner table section by two slots extending at right angles to one another from said perforating elements, gage means for gaging said workpiece including two gage blocks arranged respectively adjacent to said slots and having gage faces above said table adapted to be engaged by different edge portions of said workpiece, and adjusting means whereby each of said gage blocks is moved relative to said perforating means and which has a movable part arranged below the table and a connection between said movable part and the respective gage block extending through the adjacent slot.

7. A perforating apparatus comprising a holder, perforating elements removably mounted on said holder, and a tool adapted to couple said elements so that they are locked against movement relative to each other in all directions and permit of removing the same from said holder and to apply the same thereto in an assembled position.

8. A perforating apparatus comprising a holder, perforating elements removably mounted on said holder, and a tool adapted to engage said elements and permit of removing the same from said holder and applying the same thereto in an assembled position, said tool comprising a body adapted to be arranged along the outer side of said perforating elements and lower and upper jaws arranged on lower and upper ends of said body and adapted to engage the bottom and top of said perforating elements.

9. A perforating apparatus comprising a holder provided on its lower part with a die seat and on its upper part with a guide opening in line with said seat, perforating elements assembled in the form of a stack and including a lower tubular die arranged in said seat and an upper punch cooperating with said die and arranged in said guide opening, and a tool for removing said perforating elements from said seat and guide open-

ing and restoring the same thereto comprising a body adapted to be arranged along the outer side of said assembled perforating elements, a lower hook shaped jaw arranged at the lower end of said body and engaging with the interior of said die from the lower side thereof, and an upper jaw arranged at the upper end of said body and engaging with the upper part of said punch.

10. A perforating apparatus comprising a holder provided on its lower part with a die seat and on its upper part with a guide opening in line with said seat, perforating elements assembled in the form of a stack and including a lower tubular die arranged in said seat and an upper punch cooperating with said die and arranged in said guide opening, and a tool for removing said perforating elements from said seat and guide opening and restoring the same thereto comprising a body adapted to be arranged along the outer side of said assembled perforating elements, a lower hook shaped jaw arranged at the lower end of said body and engaging with the interior of said die from the lower side thereof, an upper jaw arranged at the upper end of said body and engaging with the upper part of said punch, and a handle arranged on the upper part of said body for manipulating the tool.

11. A perforating apparatus comprising a holder provided on its lower part with a die seat and on its upper part with a guide opening in line with said seat, perforating elements assembled in the form of a stack and including a lower tubular die arranged in said seat and an upper punch cooperating with said die and arranged in said guide opening, and a tool for removing said perforating elements from said seat and guide opening and restoring the same thereto comprising a body adapted to be arranged along the outer side of said assembled perforating elements, a lower hook shaped jaw arranged at the lower end of said body and engaging with the interior of said die from the lower side thereof, and an upper jaw arranged at the upper end of said body and engaging with the upper side of said punch.

12. A perforating apparatus comprising a holder provided on its lower part with a die seat and on its upper part with a guide opening in line with said seat, perforating elements assembled in the form of a stack and including a lower tubular die arranged in said seat and an upper punch cooperating with said die and arranged in said guide opening, and a tool for removing said perforating elements from said seat and guide opening and restoring the same thereto comprising a body adapted to be arranged along the outer side of said assembled perforating elements, a lower hook shaped jaw arranged at the lower end of said body and engaging with the interior of said die from the lower side thereof, and an upper jaw arranged at the upper end of said body and engaging with the upper part of said punch, said tool being constructed of resilient material.

13. A perforating apparatus comprising a holder having a lower seat and an upper guide opening arranged in line with said seat and slots extending from end to end of said seat and guide opening and from the bore of the same to the outer side of said holder, a die engaging said seat and a punch element arranged in said guide opening, said slots being adapted to permit the passage of a tool from the exterior of the holder into and out of engagement with said die and punch element for inserting the same as a unit into said

seat and opening and removing the same therefrom.

14. A perforating apparatus comprising a holder having a lower seat and an upper guide opening arranged in line with said seat and slots extending from end to end of said seat and guide opening and from the bore of the same to the outer side of said holder, a die engaging said seat and a punch element arranged in said guide opening, said slots being adapted to permit the passage of a tool from the exterior of the holder into and out of engagement with said die and punch element for inserting the same as a unit into said seat and opening and removing the same therefrom, said seat and opening being of circular form and said slot having a width less than the diameter of said seat and opening.

15. The hereindescribed method of assembling and disassembling parts of a perforating apparatus having a holder provided with a lower seat, an upper guide opening arranged in line with said seat, slots extending from end to end of said seat and opening and from the bore of said seat and opening to the exterior of said holder, a die engaging said seat and a punch element arranged in said opening; said method consisting in reaching into the slot of said seat, engaging the underside of said die and lifting the die and punch element in unison out of said seat and opening and lowering the same therein while movement is transmitted to said die and punch element through said slot.

16. The hereindescribed method of assembling and disassembling and maintaining in an assembled condition parts of a perforating apparatus having a holder provided with a lower seat, an upper guide opening arranged in line with said seat, slots extending from end to end of said seat and opening and from the bore thereof to the exterior of said holder, a die removably engaging said seat, and a punch element removably guided in said opening; said method comprising passing through said slots a tool having a body and lower and upper jaws, arranging said body along the outer side of said die and punch element, engaging said lower and upper jaws respectively with said die and punch element, moving said tool upwardly through said slots and lifting said die and punch element therewith as an assembled unit out of said seat and opening, retaining said die, punch element and tool in an assembled unit while thus removed from the holder, and moving said die and punch element downwardly into said seat and opening and the tool downwardly in said slots while the same are assembled as a unit, and then disengaging said tool from said die and punch element and passing the same outwardly through said slots.

17. A quick change punching device comprising a unitary holder having a lower base, a die seat in said base, an upper arm joined to said lower base, a punch guide element opening in said upper arm in concentric relation to said lower die seat, and provision for operatively applying successively various cooperating punch and die element combinations including a die member, a cooperating punch, and a stripping guide for said punch, said punch and die element combinations being held together by a removable yoke which binds said cooperating elements into an individual group, said yoke being capable of being applied to said punch and die combinations while they are in operative position in said holder, for removal of same, and said yoke being capable of

inserting said combination of elements into said holder in proper operating relation.

18. A quick change punching device comprising a unitary holder mounted on a base plate having adjustable gauging means, said holder having a lower base, a die seat in said base, an upper arm joined to said lower base, a punch guide element opening in said upper arm in concentric relation to said lower die seat, and provision for operatively applying successively various cooperating punch and die element combinations including a die member, a cooperating punch, a stripping guide for said punch, said punch and die element combinations being held together by a removable yoke which binds said cooperating elements into an individual group, said yoke being capable of being applied to said punch and die combinations while they are in operative position in said holder, for removal of same, and said yoke being capable of inserting said combination of elements into said holder in proper operating relation.

19. In a quick change punching device such as described herein, having a unitary holder which serves as a basic operating unit, to which various punch and die element pairs may be interchangeably mounted, a multiplicity of snap-on yokes, each of which binds one combination of punch and die elements together when said combination is outside of said operating unit, in such manner that any one of said combinations may be readily inserted in proper operating position into said operating unit and the yoke removed during the operating, after which the yoke may be snapped back on to the cooperating punch and die elements for removal of same from said operating unit.

20. In a quick change punching device such as described herein, having a unitary holder mounted on a base plate having adjustable work gauging means which serves as a basic operating unit, to which various punch and die element pairs may be interchangeably mounted, a multiplicity of snap-on yokes, each of which binds one combination of punch and die elements together when said combination is outside of said operating unit, in such manner that any one of said combinations may be readily inserted in proper operating position into said operating unit and the yoke removed during the operating, after which the yoke may be snapped back on to the cooperating punch and die elements for removal of same from said operating unit.

21. The herein described method of changing punch and die elements in a unitary holder having a lower arm with a die element seat and an upper arm with a punch element guideway in concentric relation to one another, including provision in said holder for the insertion of a sling which while gripping said punch and die elements may be used to assemble or remove same from holder.

22. The herein described method of changing punch and die elements in a basic operating unit by seizing said elements with a snap-on means which is used to remove said elements from said unit in the same relative position in which they operate and retain them in said position until required again at which time said elements and snap-on means are inserted into said operating unit and the snap-on means removed and laid aside until required for removal of said elements upon completion of the work.