Aug. 7, 1923. 1,464,146

L. H. E. BÉGOT

METAL PIERCING APPARATUS

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Fig. 1.

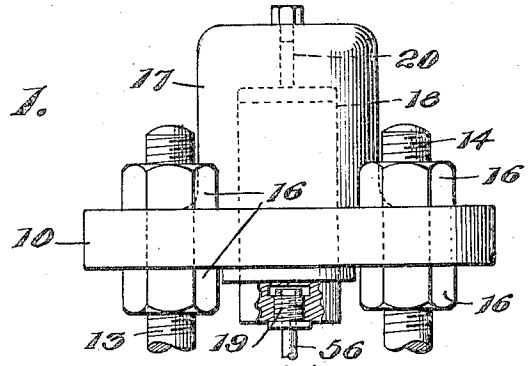
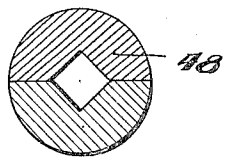


Fig. 5.



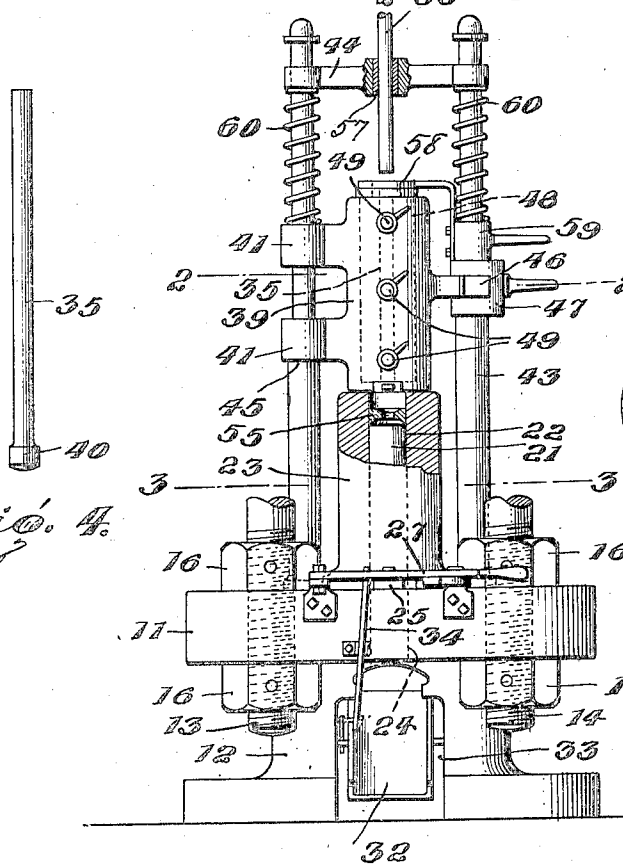


Fig. 4.

Fig. 6.

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Fig. 2.

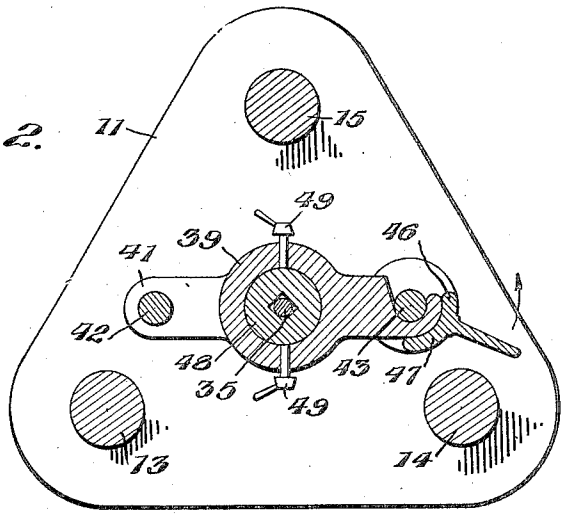

Fig. 3.

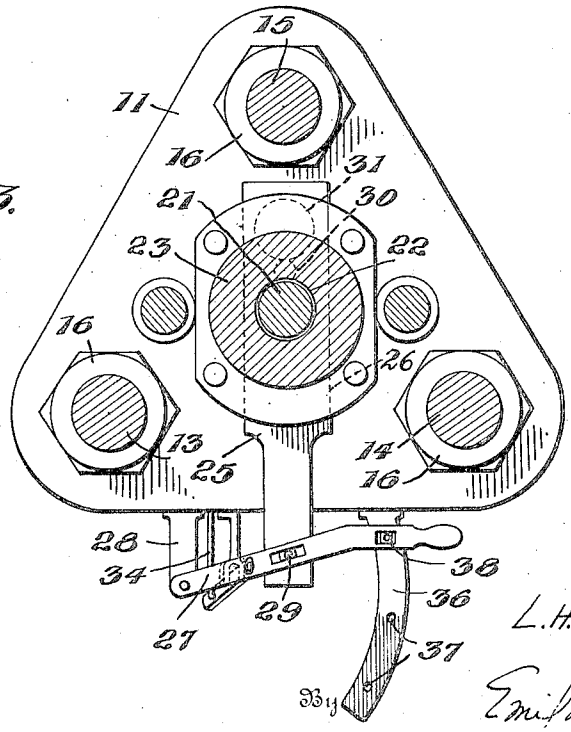

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Fig. 7.

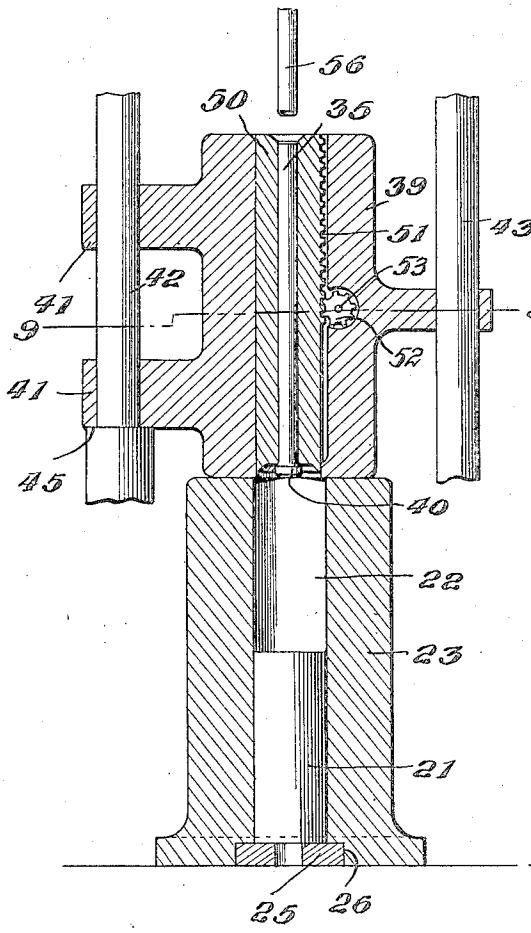
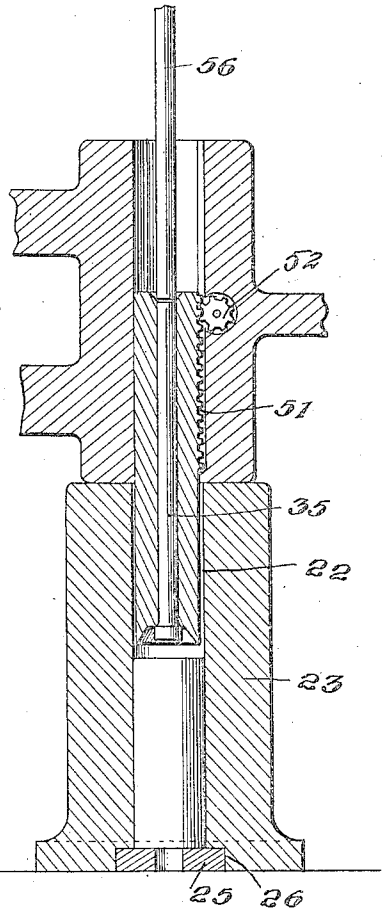


Fig. 8.



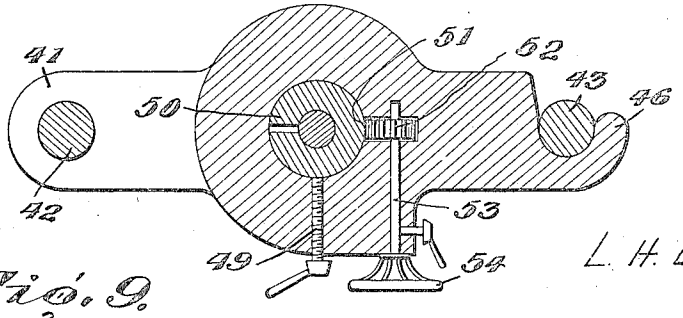


Fig. 9.

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UNITED STATES PATENT OFFICE.

LOUIS HIPPOLYTE EDMOND BÉGOT, OF PARIS, FRANCE.

METAL-PIERCING APPARATUS.

Application filed September 20, 1921. Serial No. 501,975.

To all whom it may concern:

Be it known that I, LOUIS HIPPOLYTE EDMOND BÉGOT, a citizen of the Republic of France, residing at Paris, France, have invented certain new and useful Improvements in Metal-Piercing Apparatus, of which the following is a specification.

The present invention relates to apparatus for piercing holes in metal bars or billets; and its object, stated briefly, is the provision of a high-speed apparatus of the general type or character indicated, in which the piercing or hole-forming operation is based on the deformation of the metal produced by the action thereon of a pin or analogous element having a flat working surface.

More particularly, the invention resides in the provision of certain improved features hereinafter fully described; such improvements relating primarily to the manner in which the pin or other piercing element is supported and guided during its movement, to the means provided for operating said pin, and to the construction and arrangement of parts whereby both the pin and the pierced bar or billet are discharged from the apparatus at the completion of the operation. In connection with the pin supporting and guiding means above referred to, the invention contemplates the provision of an element which is designed to be moved with the pin during a portion of its working stroke, thereby maintaining the rigidity necessary to effective and accurate piercing, this being one of the most important features of the invention. Other and further improvements are comprised in the invention and will become apparent as the description proceeds.

In the accompanying drawings:

Figure 1 is a front elevation of a hydraulic press, with the invention applied thereto, parts of the structure being shown in section and other parts broken away for clearness of illustration.

Figs. 2 and 3 are horizontal sections taken, respectively, on lines 2—2 and 3—3 of Fig. 1.

Fig. 4 is a detail view of the piercing pin.

Fig. 5 is an enlarged cross-section of a guide bushing for the pin.

Fig. 6 is a similar view of another form of bushing.

Figs. 7 and 8 are enlarged, fragmental vertical sections showing the preferred mounting for the pin, and representing the pin and its associated bushing in two different positions.

Fig. 9 is a horizontal section on line 9—9, Fig. 7.

It is to be understood that while the disclosure in said drawings illustrates what may be regarded for all present purposes as the preferred embodiment of the invention, no limitation to the precise structural features of such disclosure is contemplated, as the invention is obviously susceptible of modifications and changes within its scope as hereinafter claimed.

Referring in detail to the drawings, the invention has been represented in Fig. 1 as applied to a hydraulic press. This press may be of any preferred or conventional type and comprises, in the present instance, upper and lower heads or platforms 10 and 11, the latter mounted on a suitable base or pedestal 12, which are connected together by three threaded bars or columns 13, 14 and 15 which pass through openings in the platforms and are equipped with lock nuts 16 at opposite sides of the platforms. As here shown, the platforms are substantially triangular, and the holes for the bars or columns are located adjacent the apices of their several angles. A cylinder 17 is mounted on the upper platform and contains within it a hydraulic ram 18 of suitable construction having a threaded socket in its open lower end to removably receive a sleeve or bushing 19, the motive fluid passage being located in the upper portion of the cylinder above the ram where it is indicated diagrammatically at 20. Devices of any desired character may be employed to regulate the supply and discharge of the fluid; but since they form no part of the invention, they have not been illustrated.

The bar or billet to be pierced, and which is indicated at 21 in Figs. 1 and 3, is disposed within the bore 22 of a cast-iron cylindrical work holder 23 mounted centrally upon the lower platform 11 immediately above an opening 24 formed vertically therethrough, said opening and bore being coaxial and of the same diameter. The lower end of the billet normally rests upon and is supported by a horizontal slide 25 which is movable endwise through a guide passage 26 formed by cutting away the bottom face of the work holder. This slide is operated by means of a lever 27 which is

pivoted at one end to a lug 28 fixed to the platform 11 and which has a loose, pivotal connection intermediate its ends at 29 with the free end of the reduced forwardly-extending portion or stem of the slide; and the latter is provided adjacent its rear end with two openings 30 and 31. The rear opening 31 (see Fig. 3) is of the same diameter as the bore 22 and opening 24 and, in one position of the slide, is adapted to register therewith, so as to permit the pierced bar or billet to be discharged from the press into a tilting pan or receiver 32 which is mounted in a passage 33 formed through the pedestal 12 and is connected to be operated by lever 27 by means of cranks 34. The front opening 30 is much smaller than the opening 31 and is, in fact, of the same diameter as the pin 35 or analogous element or tool used to pierce the bar. This pin is adapted to be forced clear through the bar and through the opening 30, which has previously been brought into axial alinement with the work holder bore 22 and discharge opening 24, and then falls into the pan 32 which is tilted so as to discharge it into a receptacle (not shown) in front of the press. Thereafter the slide is moved still further forward until its rear opening 31 registers with the bore 22 and opening 24, thus permitting the then completely pierced bar to fall through opening 24 into the pan, which is then tilted to discharge it at the back of the press.

It will be seen, therefore, that the slide 25 has three distinct positions, in one of which the solid part of the slide is below the bore 22, and in the second and third of which the openings 30 and 31, respectively, register with said bore and, hence, with the discharge opening 24. To enable these positions to be readily and accurately determined, the lever 27 is mounted to move along a horizontal guide projection 36 secured to platform or table 11 and provided with three perforations or recesses 37 for engagement by a tooth 38 or the like carried by the lever.

The piercing pin 35, or other tool, is normally arranged in a holder 39, and is formed at its lower end with an enlargement or head 40 having a flat, or substantially flat, working face, as represented in Fig. 4. Holder 39 preferably takes the form of an elongated cylinder or sleeve which is provided at one side with a pair of eyes 41 by means of which it is hinged to one of a pair of upright steel posts 42 and 43 fixed in some suitable manner at their lower ends to the platform 11 and connected adjacent their upper ends by a sliding cross-piece 44. The post 42 is formed with a circumferential shoulder 45 upon which the lower eye 41 rests, while the holder sleeve 39 is adapted to rest, when in working position, upon the top of the work holder 23. At the opposite side from the eyes 41, the said holder 39 is provided with a hook 46 which is adapted to engage the post 43 and is releasably held in such engagement by a locking sleeve 47 rotatably mounted on said post.

The bore of the pin-holding sleeve 39 is designed to receive a guide or bushing 48 which rests upon the bottom wall of the bore and is removably secured in place by means of a plurality of screws 49 extending through openings in said sleeve. This bushing may comprise two separate counterpart sections or members, as represented in Fig. 5, which are held together by the clamping action of the screws 49; or, if preferred, a split, tubular bushing 50, such as is illustrated in Fig. 6, may be employed. The latter bushing, in its most advantageous form, may be equipped with a vertical rack 51 (Figs. 7, 8 and 9) secured to the upper portion of its outer wall in some suitable manner in position for engagement by a pinion 52 disposed in a recess in the holder 39 and mounted on a horizontal shaft 53 operated by a hand wheel 54. Either form of bushing may, of course, be used with the holder, but when the rack-and-pinion device is employed, the clamping screws 49 have no function, since the purpose of said device is to enable the bushing to be lowered, as hereinafter explained. It will be understood, moreover, that bushings with bores of different diameters may be used interchangeably, to receive different sized piercing pins, according to the diameter of the bore which is to be pierced in the work. Where the bushing used is of the two-part type, or where the split bushing is used without the rack-and-pinion device and is held in fixed position by means of the clamping screws 49, it is advisable to utilize a perforated centering disk 55 (Fig. 1) which is arranged within the bore of the work holder 23 on top of the bar or billet, said disk having its central opening of a size to enable the head 40 of the pin to pass therethrough and flared to facilitate such passage.

The working stroke of the piercing pin or tool is effected by means of a plunger 56 in the form of a long, and comparatively-thin rod or pin. This element 56 has its upper end secured in the bushing 19 screwed into the lower end of the hydraulic ram 18, so that when the latter descends it will carry the pusher pin with it; it being understood that different sizes of pusher pins can be used to conform to the diameters of the piercing pins employed. The lower portion of the pusher pin extends through a guide sleeve or bushing 57 having a bore of the same diameter as said pin which is removably fitted in an opening formed centrally through the cross-piece 44; and immediately below said pin and bushing there is nor-

mally supported on the top of the piercing pin bushing a perforated stop plate 58 carried by a sleeve 59 which is rotatably mounted on post 43 and rests upon and is supported by the locking sleeve 47. The stop plate is used to initially limit the descent of the cross-piece 44, which strikes against it; but said plate can thereafter be swung to one side or the other by turning its carrier sleeve 59, thus permitting a slight additional downward movement of the cross-piece. The latter is yieldingly held in raised position by means of a pair of expansible coil springs 60, which encircle the upper portions of the posts 42 and 43 and are interposed one between the cross-piece and the upper eye 41, and the other between said cross-piece and the carrier sleeve 59.

In operation, the pin holder 39 is first unlocked, by turning sleeve 47 in a direction to disengage the hook 46, and then said holder is swung outward. The pusher pin 56 is next inserted upwardly through the bushing 57 in the cross-piece 44 and engaged at its threaded upper end in the bushing or socket 19. The pin holder being located at that time to one side of the work holder, the bore 22 of the latter can readily be lubricated; and after that has been done, the bar or billet, which is preferably though not necessarily in a heated state, is deposited in said bore and the centering disk 55 placed upon its top, assuming that the movable bushing represented in Figs. 7–9 is not being used. The piercing pin 35 is then inserted upwardly through the bore of the guide bushing in the holder 39, and then the latter is swung back into working position in the press and locked by means of the sleeve 47; after which the stop plate 58, which had previously been swung to one side, is moved back into position upon the top of said guide bushing. The press is then ready to operate.

When the water or other motive fluid is admitted through the passage 20 into the top of the cylinder 17, the ram 18 will be forced downward, carrying with it the pusher rod or pin 56 which will be caused to strike against the top of the piercing pin and, as the descent of the ram continues, will force said pin through its guide bushing and through the perforated centering disk 55 against the top of the work, in which it will form a central opening or bore. The bar or billet, as previously stated, is preferably heated and, hence, somewhat expanded; and the diameter of the bore 22 of its holder is so calculated as to be approximately three or four millimeters greater than that of the billet, the latter being elongated by the piercing action.

Just before the piercing pin reaches the end of its stroke, and while it still has a slight distance to travel, in practice, about five millimeters, the lower end of the bushing 57 in the cross-piece 44, or more properly the cross-piece itself, strikes against the stop plate 58 and thus arrests the movement of the parts. The pressure fluid is thereupon shut off, the stop plate swung to one side, and the lever 27 moved from its first to its second position. This brings the small opening 30 in the slide 25 into line with the bore 22 and discharge opening 24, and at the same time tilts the pan 32 forwardly. The pressure fluid is then turned on again, and the piercing pin is forced entirely through the billet and drops through opening 24 into the pan which delivers it to the collecting receptacle in front of the press. Thereupon, the lever 27 is moved from its second to its third position and, in so doing, brings opening 31 into registration with opening 24 and rocks pan 32 backwardly. The pierced billet then drops into the pan and is discharged at the back of the press.

When the structure illustrated in Figs. 7–9 is employed, the bushing 50 is lowered, after the billet has been inserted in its holder, until the concave lower end of the bushing strikes the top of the billet; Fig. 7 indicating the initial position of the parts and Fig. 8 their position just before the bushing completes its movement. The ram is then operated to force the piercing pin through the billet in the manner above described, the aforementioned concave end of the bushing engaging between the walls of the holder bore and the bushing and thus acting to center the bushing. This arrangement, as will be apparent, serves to guide and brace the piercing pin during its working, thus maintaining it perfectly rigid while the piercing operation is taking place.

I claim as my invention:—

1. Apparatus for forming holes through metal articles, comprising a holder for the work; a pusher pin disposed above and in line with the axis of the work; operating means for said pin; and a piercing pin disposed in line with the pusher pin between the same and the work and adapted to be forced completely through the work by the pressure exerted upon it by the pusher pin.

2. Apparatus for forming holes through metal articles, comprising a holder for maintaining the work stationary during the hole-forming operation; a piercing pin disposed in line with the axis of the work and having a flat end face for action upon the work; and pressure-exerting means for pushing the entire pin endwise completely through the work.

3. Apparatus for forming holes through metal articles, comprising a work holder; a piercing tool disposed in line with the axis of the work; pressure-exerting means for pushing the entire tool endwise completely through the work; and means engaging said

tool to maintain it rigid during the piercing operation.

4. Apparatus for forming holes through metal articles, comprising a work holder; a piercing tool disposed in line with the axis of the work; pressure-exerting means for pushing the entire tool endwise completely through the work; and a bushing having an axial bore in which the tool is slidably mounted.

5. Apparatus for forming holes through metal articles, comprising a work holder; a piercing tool disposed in line with the axis of the work; means for exerting pressure upon said tool to force it endwise completely through the work; a bushing having an axial bore through which the tool moves during the piercing operation; and means for initially moving said bushing into position to engage the upper end of the work so as to maintain said tool rigid during said operation.

6. Apparatus for forming holes through metal articles, comprising a work holder to receive the article; a tool holder thereabove; a bushing mounted in the tool holder and movable into the work holder to engage the adjacent end of the article; a tool mounted in said bushing; and means for exerting pressure upon said tool to push it completely through the article.

7. Apparatus for forming holes through metal articles, comprising a work holder to receive the article; a tool holder thereabove; a bushing mounted in the tool holder; a tool mounted in said bushing in line with the axis of said article; a pusher element located above said bushing in line with said tool; and means for exerting pressure upon said pusher element to move the same into said bushing and thereby force the tool out of the bushing and completely through the article.

8. Apparatus for forming holes through metal articles, comprising a work holder; a pair of posts between which it is located; a tool holder located above the work holder and hinged at one side to one post to swing out of and into position in alinement with the work holder; means on the other post for engagement with said tool holder to releasably lock the same in such position; and means for exerting pressure upon a tool in said tool holder, when the latter is in its locked position, to push said tool endwise out of its holder into and through the work.

9. Apparatus for forming holes through metal articles, comprising a holder; a piercing pin disposed in line with the axis of the work; a pusher pin disposed in line with the piercing pin; and operating means for the pusher pin to cause the same to engage said piercing pin and force it through the work.

10. Apparatus for forming holes through metal articles, comprising a holder; a piercing pin disposed in line with the axis of the work and having a flat face at one end for action on the work; a pusher pin to engage the other end of the piercing pin and force the latter through the work; and operating means for the pusher pin.

11. Apparatus for forming holes through metal articles, comprising a platform having a discharge opening; a work holder on the platform to support an article immediately above said opening; mechanism for piercing the work; a slide operating between the holder and the platform and having an opening which is normally out of registration with the platform opening, but which is adapted to be brought into registration therewith to permit the pierced article to be discharged from the holder through said platform opening; and a tilting receptacle beneath said opening to receive the pierced article therefrom and discharge it beyond the apparatus.

12. Apparatus for forming holes through metal articles, comprising a platform having a discharge opening; a work holder on the platform to support an article immediately above said opening; mechanism for piercing the work; a slide operating between the holder and the platform and having an opening which is normally out of registration with the platform opening, but which is adapted to be brought into registration therewith to permit the pierced article to be discharged from the holder through said platform opening; a tilting receptacle beneath said opening to receive the pierced article therefrom and discharge it beyond the apparatus; and a common operating device for shifting said slide and tilting said receptacle.

13. Apparatus for forming holes through metal articles, comprising a platform having a discharge opening; a work holder on the platform to support an article immediately above said opening; a piercing tool; means for forcing it completely through the article in the holder; and a slide operating between the holder and the platform and having a pair of openings, one of the diameter of the piercing tool and the other of the diameter of the pierced article, said slide openings being normally out of line with the platform opening, but adapted to be successively alined therewith to permit the successive discharge of the piercing tool and the pierced work through the platform opening.

14. Apparatus for forming holes through metal articles, comprising a platform having a discharge opening; a work holder on the platform to support an article immediately above said opening; a piercing tool; means for forcing it completely through the article in the holder; a slide

operating between the holder and the platform and having a pair of openings, one of the diameter of the piercing tool and the other of the diameter of the pierced article, said slide openings being normally out of line with the platform opening, but adapted to be successively alined therewith to permit the successive discharge of the piercing tool and the pierced work through the platform opening; and a receptacle below said platform tiltable in one direction to discharge the piercing tool at one side of the apparatus, and in the other direction to discharge the pierced article at the opposite side.

15. Apparatus for forming holes through metal articles, comprising a platform having a discharge opening; a work holder on the platform to support an article immediately above said opening; a piercing tool; means for forcing it completely through the article in the holder; a slide operating between the holder and the platform and having a pair of openings, one of the diameter of the piercing tool and the other of the diameter of the pierced article, said slide openings being normally out of line with the platform opening, but adapted to be successively alined therewith to permit the successive discharge of the piercing tool and the pierced work through the platform opening; a receptacle below said platform tiltable in one direction to discharge the piercing tool at one side of the apparatus, and in the other direction to discharge the pierced article at the opposite side; and a common operating means for shifting said slide and tilting said receptacle.

In testimony whereof I affix my signature.

BÉGOT, LOUIS HIPPOLYTE EDMOND.