Feb. 2, 1937. E. H. FINDLAY 2,069,231

HAND PUNCH

Filed Feb. 23, 1935 2 Sheets-Sheet 1

Fig. 1

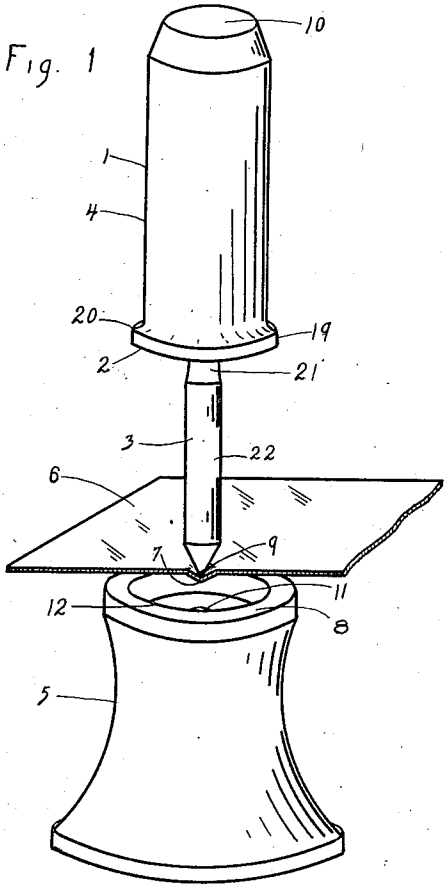


Fig. 2

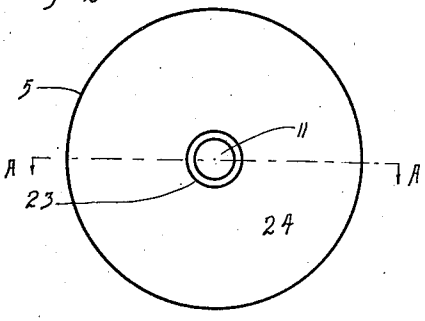


Fig. 3

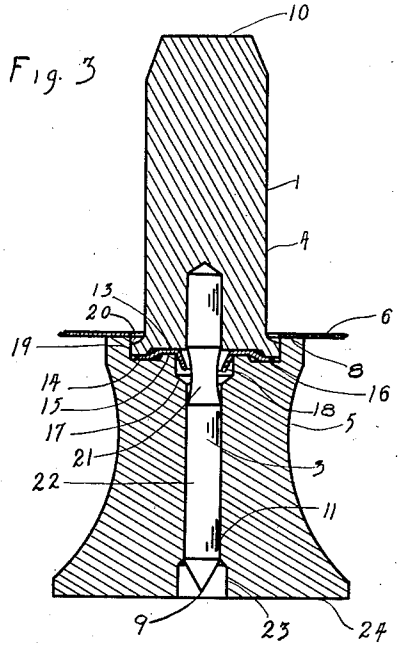
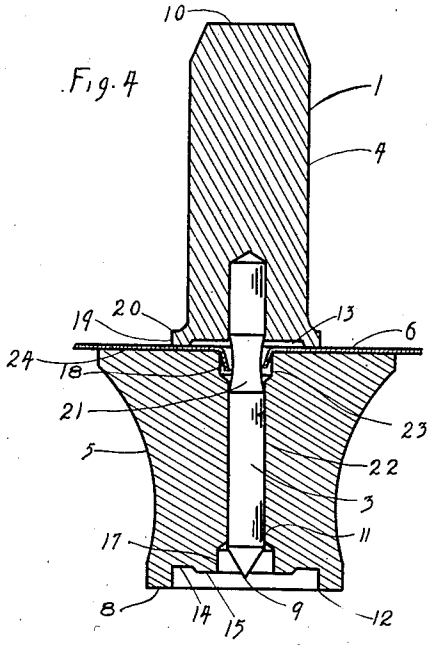


Fig. 4



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HAND PUNCH

Filed Feb. 23, 1935 2 Sheets-Sheet 2

Fig. 5

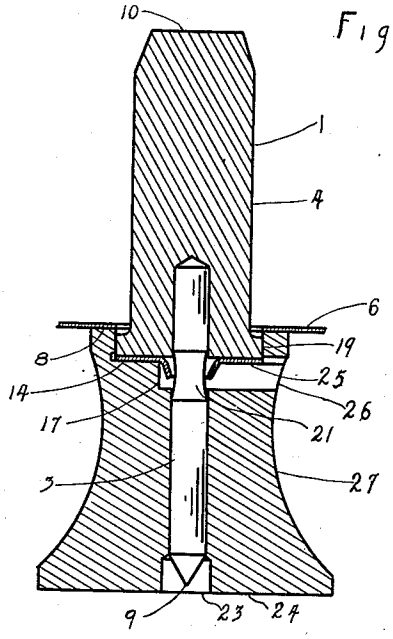


Fig. 7

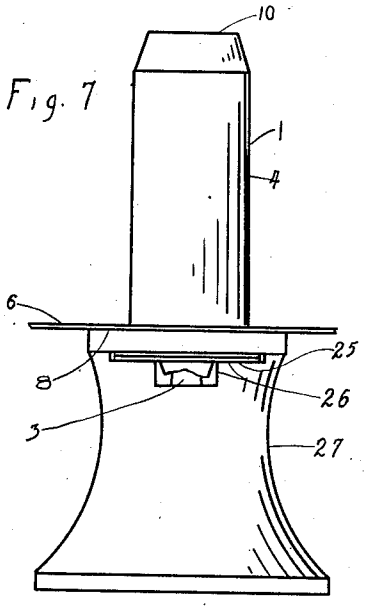
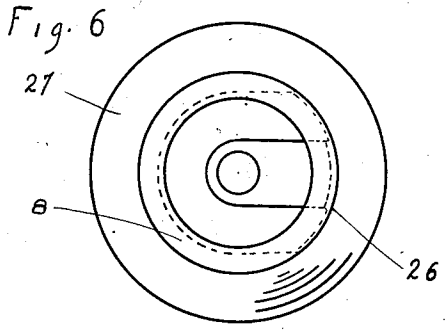


Fig. 6



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UNITED STATES PATENT OFFICE

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HAND PUNCH

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9 Claims. (Cl. 1.64—29)

My invention relates to a device for punching holes in a material such as sheet metal, gasket material, etc.

Particularly the invention is applicable to a hand punch where the driving force is applied by a hammer.

The most commonly used hand punches of the existing art are broadly classified as either hollow punches or as shear type punches. Hollow punches consist of a single piece of steel hollowed and sharpened at one end. The tool is placed upon the material to be punched, which in turn has been laid upon a wood or lead block. The head of the punch is then struck with a hammer and the sharpened portion is forced through the material, removing a portion thereof. The result is to produce a punched hole having a relatively rough edge with the material immediately surrounding the hole distorted into a conical shape.

The shear type punch is usually composed of a punch and a die, the die being machined to receive the punch. The material to be punched is placed over the die. By tapping the material with a hammer the outline of the shearing edges of the die is located and the punch may then be placed on the material and as nearly as possible over the die. A blow delivered upon the head of the punch forces the punch and the material below it into the die in such a manner that the material removed has been sheared between the shearing edges of the tool. The punch must then be driven through the die so as to force out the punching or blank and at the same time remove the punch from the material.

This type of punch has a distinct advantage over the hollow punch in that the material in which the hole has been cut is not appreciably distorted and the edges of the punched hole are relatively smooth. A second advantage is that the shear type punch and die may be sharpened without causing a reduction in the size of the hole that it is capable of punching, whereas the cutting edge of the hollow punch suffers a considerable reduction in diameter when sharpened with the grinding tools usually available.

However a disadvantage of the shear type punch is that unless a perfect alignment between the punch and the die is maintained during the punching operation the shearing edges will be rapidly broken away. It is apparent that when punching the thicker material it would be extremely difficult to secure the exact location of the die upon the upper surface of the material and thereby obtain the alignment between the punch and die that is necessary in order to prevent the damaging of their shearing edges.

My invention has for an object the provision of an improved tool by means of which holes may be punched accurately and expeditiously in sheet materials without appreciable deformation of the material surrounding the punched hole.

Another object of my invention is to provide a tool for punching holes in sheet material whereby the shearing edges of the tool are accurately aligned during the punching operation.

Another object of my invention is to provide a punch from which the blank can readily be extracted.

Another object of my invention is to provide a punch and die from which the material in which the hole has been punched can be readily removed after the punching operation is completed.

In the accompanying drawings;

Figure 1 is a perspective view of the tool showing a section of the material to be punched resting upon the die and the punch in position at the beginning of the actual punching operation.

Figure 2 is an end view of the die.

Figure 3 is a sectional view taken upon the line A—A of Figure 2 showing the shearing operation completed and the entire tool ready for removal from the material punched.

Figure 4 is a sectional view taken upon the line A—A of Figure 2 showing the punch forming the material around the guide pin in preparation to the shearing operation.

Figure 5 is a vertical section of the tool in a modified form.

Figure 6 is a top view of the die only.

Figure 7 is an elevation taken at right angles to the section shown in Figure 5.

Similar numerals refer to similar parts throughout the several views.

The shank or handle 1 with the shearing edge 2 and the guide pin 3 constitute the punch 4. The die 5 is machined to receive the guide pin 3 and the shearing edge 2 of the punch 4. By using more than one guide pin or a guide pin other than of circular cross section the tool may be designed to punch any shape hole desired, however, for practical purposes I will confine my description to a tool designed for punching holes of circular cross section.

After marking on the material 6 the point 7 which locates the center of the hole to be punched, the material 6 is placed on the surface 8 of the die 5, the point 7 being approximately over the center of the die 5. The punch 4 is then placed over the material 6 with the point 9 of the guide

pin 3 resting upon the material 6 at the point 7 as shown in Figure 1. Striking the head 10 of the punch 4 with a hammer drives the pin 3 through the material 6; the tapered portion of the guide pin 3 guiding said guide pin into the hole 11 of the die 5 and thereby producing a perfect alignment between the shearing edges 2 and 12 of said punch and die respectively. The guide pin 3 is then pushed through the material 6 until the shearing edge 2 of the punch 4 contacts the material 6. A second blow upon the head 10 of the punch 4 shears the material between the shearing edge 2 of the punch 4 and the shearing edge 12 of the die 5.

Referring to Figure 3, the face of the punch 4 is provided with an annular recess 13 concentric to the guide pin 3. The die 5 is provided with a recess 14 and an annular ridge 15 both being concentric to the guide pin 3. The ridge 15 is of such size and shape as to fit loosely into the recess 13 of the punch 4 so that as the blank 16 is forced into the die 5, said blank will be formed between the faces of said punch and die into the shape shown by the cross section of said blank in Figure 3.

The die 5 is provided with a second and deeper recess 17 concentric to the guide pin hole 11 and of such size and shape that the burr 18 on the blank 16, surrounding the guide pin 3, will fit loosely into said recess, said burr being produced by the guide pin 3 piercing the material 6.

The shank 1 of the punch 4 is of less diameter than that of the shearing edge 2 thus forming a shoulder 19 whose width in an axial direction is considerably less than the depth of the recess 14 of the die 5. Thus when the punch 4 has forced the blank 16 into the die 5 and formed it into the shape shown in Figure 3 the upper edge 20 of the shoulder 19 is below the face 8 of the die 5 and consequently the shoulder 19 has passed completely through the hole punched in the material 6. The material 6 is therefore disengaged from the punch 4 and said material can be easily lifted from the entire tool assembly which is comprised of the punch 4 and the die 5.

Although the procedure of punching the hole has been described in several operations the punching can readily be accomplished in three operations. The first being the placing of the point of the guide pin on the material at the mark which locates the center of the hole to be punched, the material resting upon the die. The second operation consists of driving the guide pin of the punch through the material and into the die so that the shearing edges of the punch and die are perfectly aligned and contact the material to be punched. The third and final operation consists of driving the punch through the material and at the same time forming the blank as shown in Figure 3. The hole in the material has been punched by these operations and the shoulder 19 of the punch has entirely cleared the material 6 so that said material can be readily lifted from the tool.

The object of the annular recess 13 and the raised portion 15 in the faces of the punch 4 and the die 5 respectively is to form an annular groove in the blank 16 so that the circumference of said blank will be reduced. Thus the blank 16 has been shrunk away from the walls of the die 5 and, adhering to the guide pin 3 of the punch 4, will be easily extracted from the die 5 when said punch is withdrawn from said die.

As the guide pin 3 pierces the material 6 a portion of the material must be displaced by said guide pin, consequently a burr 18 is formed which presses tightly around said pin and causes said blank to adhere thereto. To facilitate the removal of the blank 16 from the guide pin 3 after the punch 4 has been withdrawn from the die 5 a portion of the pin 3 immediately adjacent the shank or handle 1 has a less cross sectional area than the remaining portion. The reduced cross sectional area is shown as 21 in the accompanying drawings. Thus when the punch 4 is removed from the die 5 the blank 16 falls away from the face of the punch 4 until the burred edge 18 of the hole pierced by the guide pin 3 in the blank 16 contacts the enlarged portion 22 of the guide pin 3. The space created by the blank 16 falling away from the face of the punch 4 allows the workman the necessary clearance to grasp the blank 16 and slip it from the guide pin 3.

When punching certain kinds of materials the burred edge 18 of the hole pierced by the guide pin 3 does not form tightly around said guide pin but has a tendency to cling to the walls of the recess 17 causing the blank 16 to remain in the die 5 as the punch 4 is withdrawn. In view of this fact I have found it advantageous when punching these materials to form the burr 18 in a preliminary operation.

For this purpose I have provided the recess 23 in the face 24 of the die 5. The recess 23 is of slightly less cross-sectional area than the recess 17 and is in the opposite end of the die 5. Both recess 17 and recess 23 are concentric to the guide pin-hole 11. The material to be punched is placed on the face 24 of the die 5 the center of the hole to be punched being approximately over the center of the die 5. With the point 9 of the guide pin 3 resting on the material 6 the head 10 of the punch 4 is struck with a hammer thus driving the guide pin 3 through the material 6 into the die 5 as shown in Figure 4. The recess 23 forms the downwardly burred edge of the material 6 around the guide pin 3, so that when the die 5 is withdrawn from the guide pin 3, said die inverted and the punching operation completed as described in the preceding paragraphs, the burred edge 18 will fit loosely into the recess 17 and will not offer a resistance to the extraction of the blank 16 from the die 5.

For the smaller diameter punches the diameter of the hole to be punched is but very little larger than the diameter of the guide pin, which must be of a size that will insure the sufficient rigidity, consequently sufficient space is not available for the annular recess 13 and annular ridge 15 shown in Figure 3.

In view of this fact I have provided a modified form of the tool as shown in Figure 5, Figure 6 and Figure 7. The modifications pertain only to the means whereby the blank punched from the material is extracted from the die.

The modified form of my invention differs from the one shown in Figure 1 in that the blank which is punched from the material can be removed from the die through an opening machined in the side of said die.

The face of the punch 4 does not have a recess machined therein and the die 5 does not have the annular ridge 15. Therefore the blank 25 will be relatively flat except for the burr 18 produced by the guide pin 3 piercing the material 6.

A T shaped slot 26 is machined in the side of the die 27, said slot being parallel and adjacent to the face 8 of the die 27 and communicating with the recesses 14 and 17 of the die 27. The

width of the upper portion of the slot **26** is slightly greater than the diameter of the recess **14**, while the width of the lower portion of said slot is equal to the diameter of the recess **17**.

The punching operations are the same as previously described for the tool as shown in Figure 1.

After the material **6** is lifted from the tool at the completion of the shearing operation the punch **4** can then be withdrawn from the die **27**. Since the blank **25** has not been shrunk but remains relatively flat the edges of said blank will contact the side walls of the recess **14** and said blank will slip from the pin **3** and remain in the die **27** as the punch **4** is removed therefrom. Said blank can then be easily removed by tipping the die sideways with the entrance of the slot **26** directed downward. The slot **26** having a cross-section similar but slightly larger than that of the blank **25** will allow said blank to fall from the die **27**.

Should the blank **25** adhere to the guide pin **3** and be extracted from the die **27**, as the punch **4** is removed therefrom, the reduced section **21** of the guide pin **3** will allow said blank to fall away from the face of the punch **4** and said blank can then be readily slipped from the guide pin **3**.

I claim as my invention:

1. In a tool for punching holes the combination of a punch member having a shoulder at one end which provides a circular shearing edge of a diameter greater than the remainder of said punch member, a guide pin secured in said punch member, said guide pin being concentric with said shearing edges of said punch member, a groove in said guide pin immediately adjacent to the face of said punch member; a die member provided with a recess to receive said punch member, a second recess concentric to said first recess and adapted to receive said guide pin, said second recess having an enlarged portion adjacent the entrance thereto, an annular ridge located in said first recess and concentric thereto; an annular depression in the face of the punch member, said depression being concentric to said guide pin and adapted to receive said annular ridge provided in said die member; a third recess in said die member adapted to receive said guide pin and having an enlarged section adjacent the exit thereof.

2. In a tool for punching holes the combination of a punch member, a die member adapted to receive said punch member, a pin member adapted to guide said punch into said die, a recess adapted to receive said pin member when said punch is engaged with said die, said recess having an enlarged portion at the entrance thereto; a second recess adapted to receive said pin member said recess also having an enlarged portion at the entrance thereto.

3. In a tool for punching holes the combination of a punch member, a die member adapted to receive said punch member, a pin member adapted to guide said punch into said die, a recess adapted to receive said pin member, when said punch is engaged with said die, said recess having an enlarged portion at the entrance thereto.

4. In a tool for punching holes the combination of a punch member having a shoulder at one end thereby providing a shearing edge larger than the remainder of said punch member; a die member having a recess which provides the shearing edge of said die, said recess being of a depth not less than the width of said shoulder on said punch member plus the thickness of the material which is to be punched.

5. In a tool for punching holes the combination of a punch member, a die member adapted to receive said punch member and a pin member secured in said punch and adapted to guide said punch into said die, said pin member having a less cross sectional area immediately adjacent said punch.

6. In a tool for punching holes the combination of a punch member, a die member having a recess adapted to receive said punch member, a pin member adapted to guide said punch member into said die member, a slot in said die member, said slot communicating with said recess and having a width in excess of the width of said recess.

7. In a tool for punching holes, the combination of a punch member having a shoulder at one end which provides a circular shearing edge of a diameter greater than the remainder of said punch, a guide pin secured in said punch, said guide pin being concentric with said shearing edges of said punch; a die member provided with a recess to receive said punch, a second recess concentric to said first recess and adapted to receive said guide pin, said second recess having an enlarged portion adjacent to the entrance thereto, a third recess in said die member adapted to receive said guide pin and having an enlarged section adjacent to the exit thereof, a slot in said die member communicating with said first recess and the enlarged portion of said second recess.

8. A cutting tool comprising a punch member, a die member adapted to receive said punch member, a pin member adapted to guide said punch member into engagement with said die member, said pin member having a section of reduced cross sectional area.

9. A cutting tool comprising a punch member, a die member having a recess adapted to receive said punch member, a pin member adapted to guide said punch member into said die member, said die member having an opening in the side thereof and communicating with said recess.

EDWARD H. FINDLAY.