

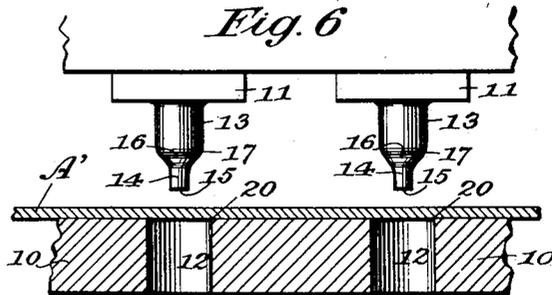
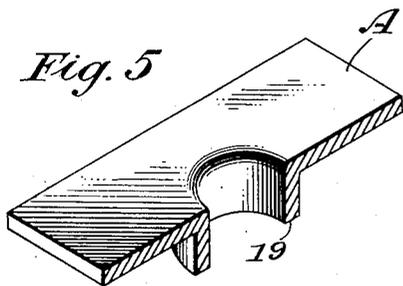
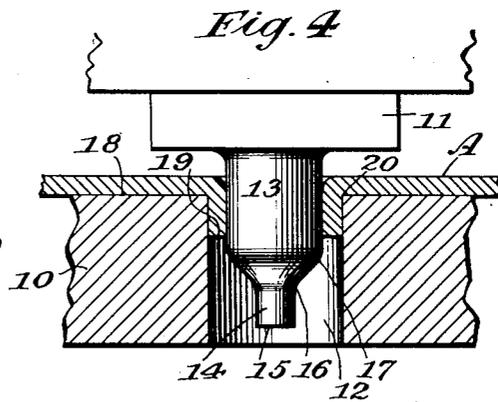
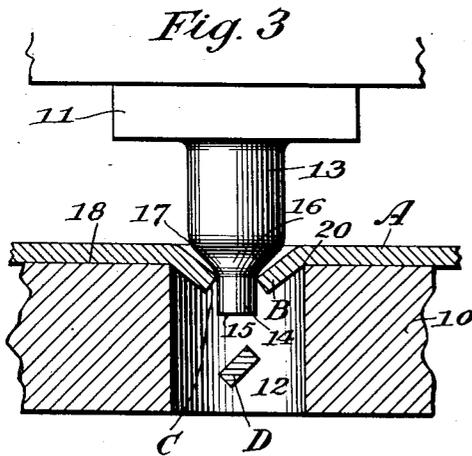
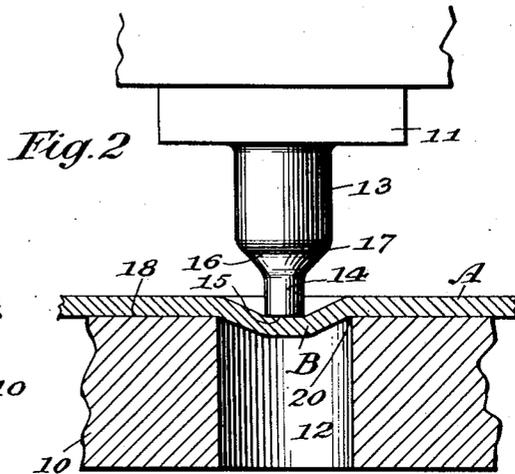
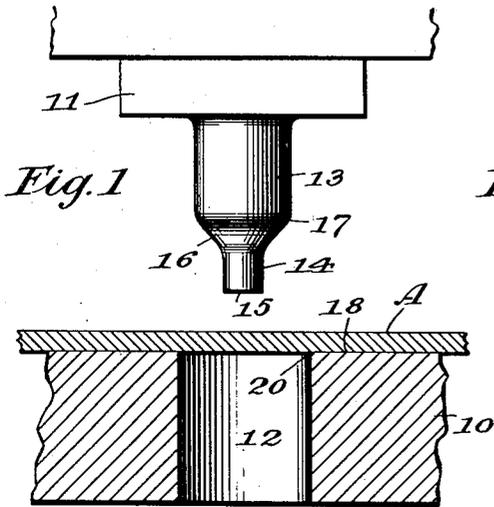
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TOOL FOR DRAWING TUBULAR BOSSES

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TOOL FOR DRAWING TUBULAR BOSSES.

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This invention relates to a tool for drawing or striking up bosses from sheet metal, and has more particular reference to a tool for drawing or striking up bosses from a strip or plate of sheet metal by displacing the metal outward from a surface of the plate to form a hole therethrough and to provide an annular projection or tubular boss thereon, as, for example, a bearing boss every part of the outer edge of which is preferably approximately equidistant from the surface of said strip or plate of sheet metal.

An object of the invention is to provide an inexpensive, improved, and practical tool for efficiently drawing or striking up tubular or bearing bosses from sheet metal.

Heretofore it has been usual, when drawing or striking up bearing bosses to first pierce, and afterwards draw or strike up the metal.

It is a more specific object of the present invention to provide a tool for drawing or striking up annular projections or tubular bosses from sheet metal, which contemplates the performance of the following operations: first, displacing or drawing the sheet metal a predetermined amount; next, cleanly piercing the sheet metal; and finally, finishing the metal displacing or drawing operation to form a boss.

A further specific object is to provide a tool as stated, which contemplates partially displacing or drawing the sheet metal, then piercing the partially displaced or drawn sheet metal, and finally completing the shaping of the tubular boss by further displacing and expanding the partially displaced or drawn metal to enlarge the opening made therein by removal of the piercing.

A further specific object is to provide a tool for providing hollow bearing bosses upon sheet metal, which contemplates the consecutive and uninterrupted performance of the operations mentioned in the sequence as set forth.

A further specific object is to provide an improved tool for producing an annular projection or tubular boss upon sheet metal, which will consist of a male and a female member movable relatively to each other, the

male member having relatively immovable elements, and the female member comprising a simple die.

And a still further specific object is to provide an improved tool for simultaneously producing a plurality of annular projections or tubular bosses upon sheet metal, which will consist of a unit having a plurality of male members and a unit having a plurality of complementary female members, all of said members having the features of the invention, the units being movable relatively to each other and each having relatively immovable members.

With the above objects in view, as well as others which will appear as the specification proceeds, the invention will now be fully described and will hereinafter be specifically claimed, it being understood that the disclosure herein is merely illustrative and not intended to be in any way limiting.

In the accompanying drawing forming a part of this specification,

Fig. 1 is a view of the improved tool by means of which the novel method can be practiced, the male member or punch being shown in elevation and the female member or die being shown in section, there being a sectioned strip or plate of sheet metal upon the female member or die and the male member or punch being above and spaced from the strip;

Fig. 2 is a view corresponding with the disclosure of Fig. 1, except that the male member or punch is shown as having descended to displace or draw the sheet metal a distance into the opening of the female member or die, say, for example, a distance slightly less than that at which the piercing of the sheet metal is accomplished;

Fig. 3 is a view corresponding with the disclosure of Figs. 1 and 2, except that the male member or punch has further descended to pierce the sheet metal, the removed piercing being shown as when falling from the female member or die, and the metal to provide the hollow boss being situated as when the final operation to produce the boss is about to start;

Fig. 4 is a view corresponding with the dis-

closures of Figs. 1, 2 and 3, except that the male member or punch has fully descended to produce the formed tubular boss;

Fig. 5 is a perspective view detailing a strip or plate of sheet metal having an annular projection or tubular boss as provided by the tool and method of the invention, the strip or plate being sectioned to better disclose the boss; and

Fig. 6 is a view corresponding with the showing of Fig. 1, disclosing a plurality of male members or punches and a plurality of female members or dies adapted to simultaneously produce upon a strip or plate of sheet metal, and in accordance with the principles of the invention, a plurality of annular projections or tubular bosses.

With respect to the drawing and the characters and numerals of reference thereon, A is a strip or plate of sheet metal resting upon a female member or die 10, and 11 is a male member or punch adapted to cooperate with the female member or die to produce an annular projection or tubular boss upon the sheet metal A.

The male and female members are adapted to be mounted in a suitable press (not shown) so that the male member can be reciprocated to centrally enter the opening 12 of the female member to accomplish the boss forming operation.

The male member or punch 11, as disclosed, consists of a tool having an upper cylindrical portion 13, and a lower, reduced cylindrical portion providing a drawing and piercing element 14 of said male member 11, the outer or lower end 15 of which drawing and piercing element is preferably flat or blunt, and is desirably at an angle slightly less than 90° to the element 14 in order that said element will not stick to metal being operated upon. The cylindrical portion 14 is situated centrally of the cylindrical portion 13 and aligns therewith, and the annular shoulder 16, between the portions 13 and 14, is beveled or inclined preferably in about the manner disclosed, said annular shoulder extending from the drawing and piercing element 14 outwardly and upwardly, terminating in the portion 13 at the location 17. The annular shoulder 16 provides a final metal drawing element of the male member or punch.

The female member or die 10 desirably has a flat surface 18 adjacent the male member or punch 11. The opening 12 is of a uniform diameter somewhat larger than the diameter of the portion 13 of the male member, and the wall of said opening 12 is adapted to be concentric with the portions 13 and 14 of the male member 11 when said male member is within said opening.

The manner in which the tool functions to carry out the method will be obvious from the drawing. When the male member

is moved from its position of Fig. 1 to its position of Fig. 2, the portion of the sheet metal over the opening 12 of the female member is uniformly and gradually drawn or displaced into said opening, as indicated at B. When the male member further descends, as, for example, to its position of Fig. 3, the central portion of the drawn or displaced part B of the sheet metal is cleanly pierced, as at C, reference character D disclosing a piercing of metal dropping through the opening 12. When the male member is then moved to its position of Fig. 4, the drawn or displaced part B of the sheet metal is uniformly, gradually, and finally drawn, displaced, or shaped to provide the finished annular projection or tubular boss.

As the male member moves from non-operating position to its position in Fig. 2, the flat or blunt face 15 of the drawing and piercing element 14 applies its pressure uniformly and stresses the sheet metal over the opening 12 to cause it to "flow" into the opening 12 in about the manner disclosed. Then as the male member descends further, say, for example, almost to its position of Fig. 3, the stressing action upon the sheet metal becomes greater than the metal can stand, and the result is that the drawing and piercing element 14 cleanly removes piercing D of sheet metal from the approximate center of the stressed portion B at the time slightly within the opening 12. As the male member moves then to its final boss forming location, the finishing operation upon the boss will not crack or split the metal at the location where the piercing D became removed, for the reason that the metal for the boss has already started to flow in the general direction it is now urged by the annular shoulder 16. The stressing action upon the portion of the sheet metal aligning with the opening 12 is necessarily greater at the commencement of the displacement of said metal than it is after the drawing of the metal B is well on its way and the partially drawn metal has been pierced. Clearly, there is no liability of cracking or splitting the metal B before the piercing operation. The sheet metal can easily flow into the opening 12 at the start of the drawing or displacing operation by reason of the fact that the surface of the female member having the sheet metal is flat and offers no resistance to the metal flow so that there can be a drawing pull effective upon the sheet metal about the full circumference of said opening 12 to freely draw, displace, or stretch the metal into the opening. Then when the piercing is accomplished, there is in the opening 12 a partially drawn supply of metal, of thickness not much less than it was originally, to provide the tubu-

lar boss. The drawing operation having been accomplished to a considerable extent prior to the piercing operation, the final drawing and displacing of the metal to provide the finished boss does not crack or split said metal. Evidently, the major part of the final drawing operation consists in stretching the metal adjacent the opening whence the piercing D was removed up to the diameter of the portion 13 of the male member.

It is evident that the piercing D is removed from the approximate center of the partially displaced or drawn metal B, so that all points of the outer end 19 of the finished tubular or bearing boss are spaced at approximately the same distance from the sheet metal strip or plate. Also, the drawing and piercing element having cleanly pierced the metal, and the annular shoulder 16 having uniformly and gradually expanded the partially displaced or drawn metal B, said outer end 19 is flat, continuous and smooth.

During the travel of the male member from its position of Fig. 3 to its position of Fig. 4, the adjacent circumferential edge or corner 20 of the opening 12 of the female member cooperates with the annular shoulder 16 as it advances to draw and expand the partially displaced or drawn metal B, said edge or corner 20, in effect, constituting a bending edge or corner about which the annular projection or tubular boss is formed, shaped or bent.

The portion 14 of the male member will be of diameter best suitable to accomplish the result desired upon sheet metal to be provided with bosses. The portion 13 will be of diameter to fit into a finished tubular or bearing boss, and the annular shoulder 16 will have that slant or inclination best suiting it to the performance of its intended service. The opening 12 will be of diameter greater than the diameter of the portion 13 an amount sufficient to allow the finished tubular or bearing boss to fit between said portion 13 and the wall of said opening 12, preferably in quite snug engagement with said portion 13 and said wall. See Fig. 4.

It is to be especially noted that the male member is composed of working elements which are immovable relatively to each other, and that the female member is a simple die.

In Fig. 6 I have disclosed a plurality of male members 11 and female members 10 adapted to be mounted in a suitable press (not shown,) all of the male members 11, as well as all of the female members 10, being immovable relatively to each other.

Clearly, this arrangement makes provision for the simultaneous production of a plurality of annular projections or tubular bosses upon the sheet metal A', each member 10 cooperating with a complemental member 11 in the manner fully set forth.

A great advantage of the construction of Fig. 6 lies in the fact that a plurality of satisfactory bosses can be simultaneously produced upon sheet metal without necessity for the really accurate and difficult aligning of the punches and dies required when providing bosses by employment of tools and methods which utilize disappearing or compound dies, mainly for the reason that the portions 14 need not be at the accurate centers of the openings 12, it being sufficient that said portions 14 be at the approximate centers of said openings.

What I claim is:

1. A tool comprising a female member adapted to have placed thereon a strip of metal from which a tubular boss is to be struck, and a male member having an end portion adapted to provide a drawing and piercing element and an annular shoulder extending outwardly of said element and away from said female member, the outer end of said end portion being at an angle slightly less than 90° to said drawing and piercing element, and the opening in said female member being of diameter greater than the largest diameter of said annular shoulder and including a circular bending edge, said element and edge being adapted to cooperate to cause metal to define a tubular boss to be displaced from the plane of said strip into the opening of said female member, said element being adapted to pierce said displaced metal, and said annular shoulder and said edge being adapted to cooperate to complete the shaping of the tubular boss after the piercing is accomplished by further displacing and expanding the metal for the boss and within the opening of the female member to enlarge the opening in said metal defined by said element.

2. A tool adapted to produce a tubular boss upon sheet metal, comprising a male member having relatively immovable elements including a drawing and piercing element and a shoulder extending outwardly of and away from said drawing and piercing element, the outer end of said drawing and piercing element being at an angle slightly less than 90° to said element, and a female member comprising a simple die the opening of which is of diameter greater than the largest diameter of said shoulder and includes a bending surface adapted to cooperate with said drawing and piercing element and shoulder.

3. A compound tool adapted to simultaneously produce a plurality of tubular bosses upon sheet metal, comprising a plurality of relatively immovable male members each having relatively immovable elements including a drawing and piercing element and a shoulder extending outwardly of and away from said drawing and piercing element, the outer end of said drawing and piercing ele-

ment being at an angle slightly less than 90° adapted to cooperate with the drawing and
to said element, and a plurality of relatively piercing element and shoulder of said 10
immovable female members each comple-
mental to a male member and comprising complementary male member.
5 a simple die the opening of which is of Signed at Bridgeport, in the county of
Fairfield and State of Connecticut, this 13th
diameter greater than the largest diameter day of February A. D. 1926.
of the shoulder of the complementary male
member and includes a bending surface

ANDREW L. RIKER.