

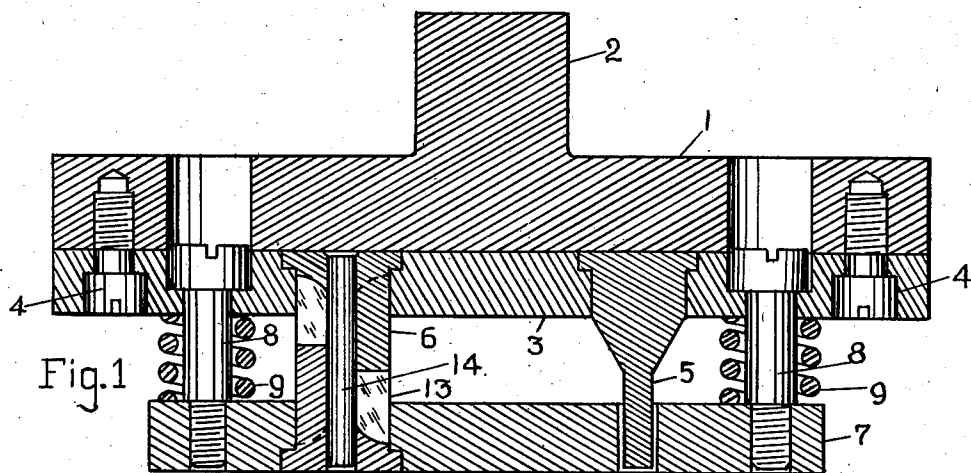
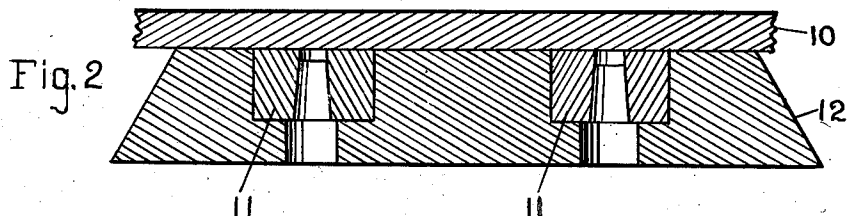
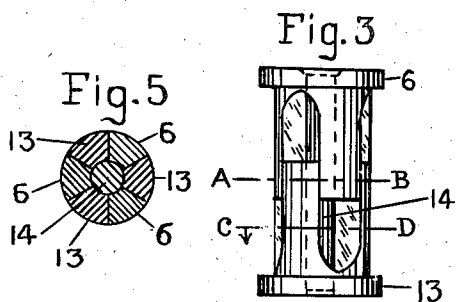
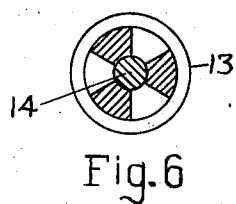
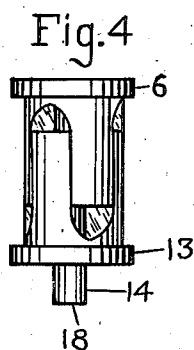
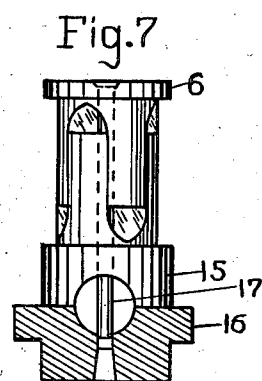
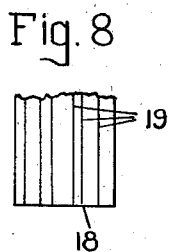
Feb. 15, 1938.

J. A. SMITH

2,108,619

PIERCING DIE

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INVENTOR.
BY *Jacob A. Smith*
Jones, Eddington, Amos & Seibold
ATTORNEYS:

UNITED STATES PATENT OFFICE

2,108,619

PIERCING DIE

Jacob A. Smith, River Forest, Ill.

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18 Claims. (Cl. 164—124)

My invention relates to dies for piercing, blanking, or performing other operations on sheets, rods, bars, or special shapes.

As piercing dies are commonly constructed, it is not practical to pierce materials having a thickness greater than the diameter of the punch, due to the fact that a considerable portion of the punch is unsupported. Being unsupported, the slender piercing portion of the punch is free to upset or buckle, which it will do if the thickness of the material pierced slightly exceeds the diameter of the punch.

The primary object of my invention is to provide a die in which the punch is firmly supported as near as possible over its entire length, making it impossible for it to upset or buckle, compelling it to travel in a straight line, thereby enabling it to pierce much thicker material than has heretofore been possible, thus opening up a new field in the production of parts on a punch press.

Another object of my invention is to provide a support for bars, rods, and special shapes which will prevent deformation during the piercing operation.

Another object is to provide a punch and die construction which lends itself to interchangeability and economical manufacture.

Still another object of my invention is to provide a punch easily withdrawn from the material pierced.

Further objects will appear from the description which follows, and the appended claims.

In the drawing, in which my invention is illustrated,

Figure 1 is a vertical section of a punch holder as commonly constructed for use in a punch press, showing at the right a punch of common construction and at the left a punch of my improved design, the section being taken through the central axis of the punches;

Fig. 2 is a cross section of the mating dies and bolster taken on the central axis of the dies, and showing a piece of material in position for piercing;

Fig. 3 is a side elevational view of the punch support which is the vital feature of my invention, shown at its open position, the punch itself being entirely within;

Fig. 4 is a side elevational view of the same punch support in closed position, which is its position at the end of the piercing stroke, the punch protruding slightly more than the thickness of the stock it is to pierce;

Fig. 5 is a sectional view of the punch and punch support taken on plane A—B of Fig. 3;

Fig. 6 is a sectional view taken on plane C—D of Fig. 3;

Fig. 7 is a side elevational view of the punch, punch support, and die as arranged for piercing round rods, whereby not only the punch is supported, but also the metal to be pierced is supported against deformation due to the piercing operation; and

Fig. 8 is a development of the cylindrical surface of a portion of the piercing end of the punch, showing the direction of the machining or tooling marks relative to the longitudinal axis of the punch.

Referring to the drawing in detail, the construction shown comprises a punch holder 1 having a shank 2 by which the holder is located and clamped in the ram of the press, a punch pad 3 secured to 1 by cap screws 4, a punch 5 which is of common construction, the upper half 6 of my novel punch support secured in pad 3, a stripper plate 7 retained in spaced relation to pad 3 by screws 8 and springs 9, the screws 8 being free to move upward in pad 3 and punch holder 1. 10 is a portion of the material to be pierced, and 11, 11 are piercing dies supported in die pad 12 which is held in a bolster (not shown) on the punch press table. The lower half 13 of my novel punch support is secured in stripper plate 7. Punch 14 is a tight sliding fit in 6 and 13, and is slightly upset at its upper end so as to retain it in part 6.

Referring to Fig. 7, the shouldered end 15 of the lower half of the punch support and the upper end of the piercing die 16 are cross-bored to support a round rod while being pierced by punch 17, the drawing showing the relative positions of the punch, upper and lower punch holders and die at the end of the piercing stroke. Punch support 15 is secured in stripper plate 7 and, therefore, is firmly held in the position shown during the entire piercing stroke, supporting the rod against deformation while being pierced. The cross bore for supporting the work may have a hexagonal or other section conforming to the section of the rod or bar to be pierced. For piercing castings, forgings, or other material of non-uniform cross section, the upper end of the die and the lower end of the punch support may be formed to substantially surround and enclose the material to be pierced, formed, or sheared, thereby supporting the material against deformation during the piercing operation.

On deep piercing, the withdrawal of the punch from the material becomes a problem, as the punch tends to stick in the material due to the

material, which is elastic, closing in on the fine circular ridges and grooves made in the piercing portion of the punch when ground on a cylindrical grinder or turned in a lathe. These ridges and grooves may be microscopic, but nevertheless they may cause sufficient friction between the punch and the material to prevent the withdrawal of the punch without breakage.

The commercial drill rod commonly used for punches is usually cylindrically ground in a centerless grinder and, therefore, has the circular ridges and grooves which make it unsuitable for deep piercing.

To overcome this difficulty, I use a punch the piercing portion of which has been drawn or forced through a sizing die of hard material. By this method the circular ridges and grooves are removed, and the tool marks remaining, running parallel with the longitudinal axis of the punch as indicated by tool marks 19, on the developed surface of the punch (Fig. 8), 18 being the piercing end of the punch.

My method of supporting the punches not only makes it possible to pierce deeper holes than has heretofore been possible, but also enables a more accurate center distance between holes to be maintained, and a more accurate size of hole. Due to the bending of the punches, it has been commercial practice to make the diameter of the hole in the die larger than the diameter of the punch by an amount equal to 10% of the thickness of the material to be pierced.

With punches supported by my punch supports, as described, the difference in diameter between the punch and the hole in the die can be reduced to only 2% of the thickness of the material.

Since in a pierced hole one side of the hole in the material is the punch diameter, and the other side of this hole is the diameter of the hole in the die, the hole pierced has had a considerable taper when pierced with a punch of common construction. Since my invention reduces the clearance necessary between punch and die from 10% to only 2%, the hole pierced with my supported punch will have but little taper.

The use of my novel punch, punch support, and work support is not limited to single holes but is applicable to multiple, gang, and combination dies for piercing any number of holes and performing other operations at the same stroke of the press or in sequence.

My invention, while primarily applicable to punch presses, is also applicable to bulldozers, forging machines, broaches, and other machines having a movable ram and stationary bolster support.

I realize that many variations in detail can be made without departing from the spirit of my invention, and, therefore, I am not limiting my invention to the construction shown.

I claim:

1. In a die set for piercing, forming, blanking, or shearing, a punch, and two interlocking members having overlapping portions having a dovetail telescopic engagement with each other, said overlapping portions engaging and radially supporting said punch.

2. In a die set for piercing, forming, blanking, or shearing, a punch having a slender reduced portion and two interlocking members having overlapping portions having a dovetail telescopic engagement with each other, said over-

lapping portions engaging and radially supporting said reduced portion.

3. In a die set for piercing, forming, blanking, or shearing, a punch supported at its piercing end by a member in a stripper plate and at its opposite end by a member in the punch holder, said members interlocking and having overlapping portions having a dovetail telescopic engagement with each other, said overlapping portions engaging and radially supporting said punch during the entire stroke.

4. In a die set for piercing, forming, blanking, or shearing, a punch supported by interlocking members entirely surrounding and radially supporting the punch at its ends and at portions of its middle section, said interlocking members having overlapping portions having a dovetail telescopic engagement with each other, said overlapping portions engaging and radially supporting said punch.

5. In a die set for piercing, forming, blanking, or shearing, interlocking members capable of a sliding movement relative to each other and entirely surrounding the punch at its extremities and at portions of its middle section, said interlocking members having overlapping portions having a dovetail telescopic engagement with each other, said overlapping portions engaging and radially supporting said punch.

6. In a die set for piercing, forming, blanking, or shearing, interlocking members capable of a sliding movement relative to each other and entirely surrounding the punch at its extremities and at middle portions, the remaining middle portions of the punch also being supported by said members over a considerable part of its circumference, said interlocking members having overlapping portions having a dovetail telescopic engagement with each other, said overlapping portions engaging and radially supporting said punch.

7. In a die set for piercing, forming, blanking, or shearing, a punch longitudinally supported by interlocking members, said members having a telescopic action and having overlapping portions having a dovetail telescopic engagement with each other, said overlapping portions engaging and radially supporting said punch.

8. In a die set for piercing, forming, blanking, or shearing, a punch supported radially and longitudinally by interlocking members, said members having a telescopic action and having overlapping portions having a dovetail telescopic engagement with each other, said overlapping portions engaging and radially supporting said punch.

9. In a die set for piercing, forming, blanking, or shearing, a punch, and a member secured in a punch holder and having projecting prongs mating with prongs on a member secured to the stripper plate, said prongs having a telescopic action and having an internal bore fitting and corresponding in cross section to the punch.

10. In a die set for piercing, forming, blanking, or shearing, a punch, and interlocking telescopic members supporting the punch longitudinally at all points above the material upon which the operation is being performed and having overlapping portions having a dovetail telescopic engagement with each other, said overlapping portions engaging and radially supporting said punch.

11. In a die set for piercing, forming, blanking, or shearing, a punch holder, a stripper plate,

and a punch enclosed by telescopic members closely fitting the punch and supporting said punch longitudinally over its entire length and radially at several points of its circumference and over a considerable portion of its length, one of said members being secured in the punch holder and another in the stripper plate, said telescopic members having overlapping portions having a dovetail telescopic engagement with each other, said overlapping portions engaging and radially supporting said punch.

12. In a die set for piercing, blanking, or shearing, a first member for supporting the material upon which the operation is being performed, said member conforming to a portion of the figure of the material, and a second member conforming substantially to the remaining portion of the figure of the material, the first and second members acting to confine the material during the operation to prevent deformation.

13. In a die for piercing, blanking, or shearing, a first member for supporting the material upon which the work is being performed, said member conforming to a portion of the figure of the material, a second member conforming substantially to the figure of the remaining portion of the material, and means for pressing firmly together the first and second members in proper alignment during the operation.

14. In a die set for piercing, blanking, or shearing, a punch, a first member supporting said punch and having a head conforming to a portion of the figure of the material upon which the operation is being performed, a second member arranged to support said material and conforming substantially to the remaining portion of the figure thereof, means for maintaining pressure between the first and second members during the operation and permitting easy removal of the material after the operation, and a die member.

15. A punch construction comprising a punch, and means for supporting the punch against buckling comprising a member having a head provided with an opening therein in which the lower end of the punch fits and slides and having spaced arms extending upwardly from the head portion and embracing the punch to hold it against buckling and the second member having a head provided with an opening therein in which the upper end of the punch fits and having spaced arms extending downwardly therefrom and embracing the punch to hold it against buckling, the arms of one head entering the spaces between the arms of the other head.

16. A punch construction comprising a punch, means for supporting the punch against buckling comprising a member having a head provided with an opening therein in which the lower end of the punch fits and slides and having spaced arms extending upwardly from the head portion and embracing the punch to hold it against buckling and the second member having a head provided with an opening therein in which the upper end of the punch fits and having spaced arms extending downwardly therefrom and embracing the punch to hold it against buckling, the arms of one head entering the spaces between the arms of the other head, and a spring pressed stripper to which the lower head is secured.

17. A punch construction comprising a punch, and means for supporting the punch against buckling comprising a member having a head provided with an opening therein in which the lower end of the punch fits and slides and having spaced arms extending upwardly from the head portion and embracing the punch to hold it against buckling and the second member having a head provided with an opening therein in which the upper end of the punch fits and having spaced arms extending downwardly therefrom and embracing the punch to hold it against buckling, the arms of one head entering the spaces between the arms of the other head, said lower head having a broad base for engagement with the material operated on.

18. A punch construction comprising a punch, means for supporting the punch against buckling comprising a member having a head provided with an opening therein in which the lower end of the punch fits and slides and having spaced arms extending upwardly from the head portion and embracing the punch to hold it against buckling and the second member having a head provided with an opening therein in which the upper end of the punch fits and having spaced arms extending downwardly therefrom and embracing the punch to hold it against buckling, the arms of one head entering the spaces between the arms of the other head, said lower head having a work supporting surface conforming to the surface contour of the upper side of the work, and a die member having an opening in alignment with said first opening through which the punched material is forced and having a work supporting surface conforming to the surface contour of the lower side of the work.

JACOB A. SMITH.