

Feb. 15, 1944.

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2,342,021

APPARATUS FOR MAKING PIERCED FORGED HUBS AND THE LIKE

Filed Sept. 20, 1940

4 Sheets-Sheet 1

Fig. 1.

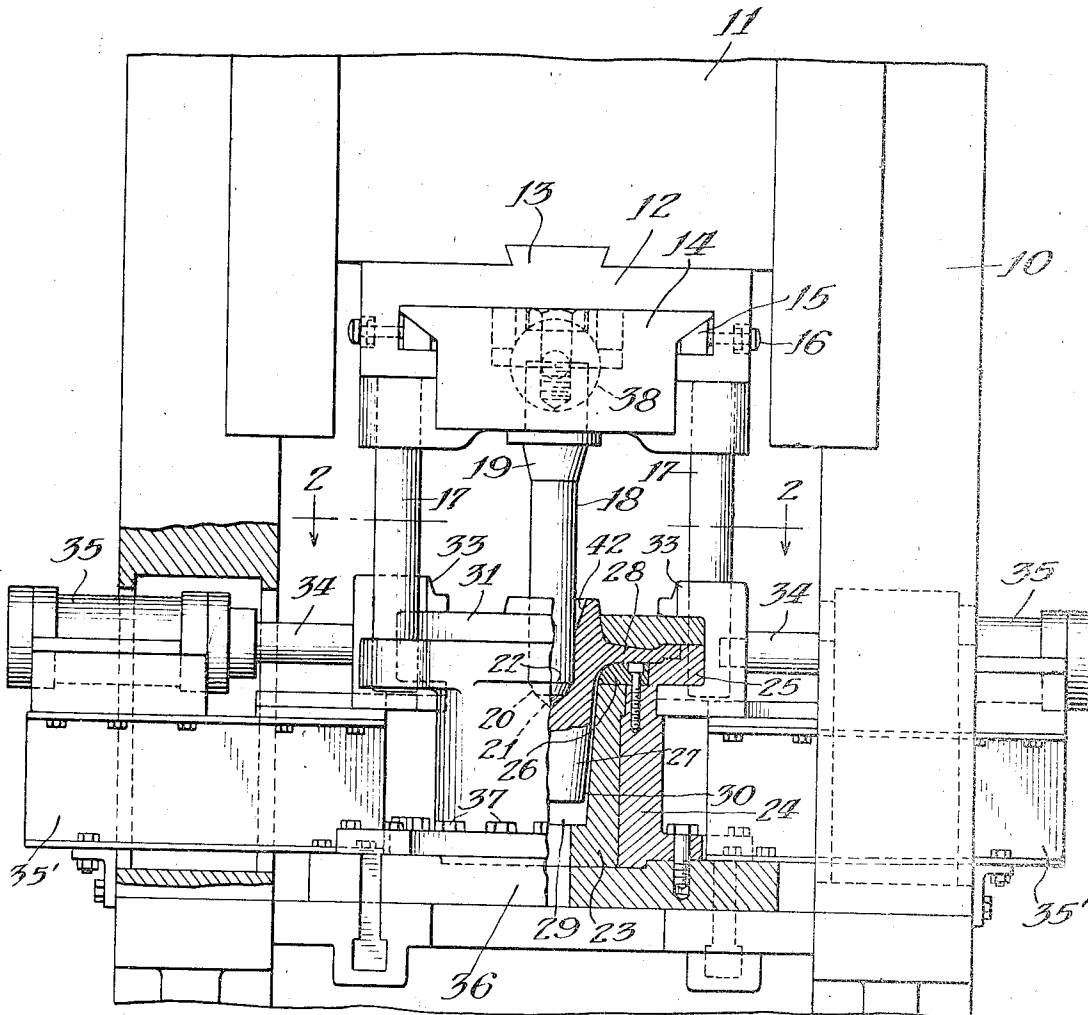
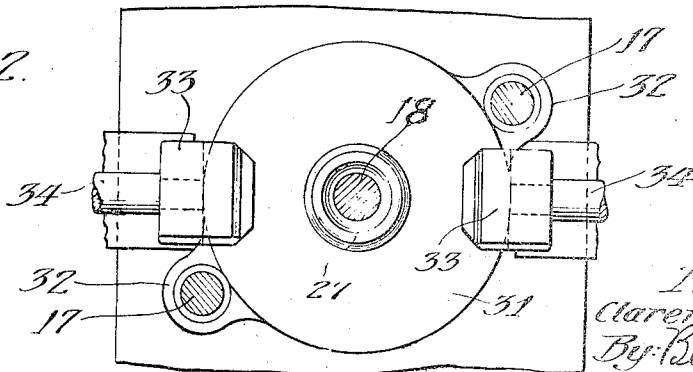


Fig. 2.



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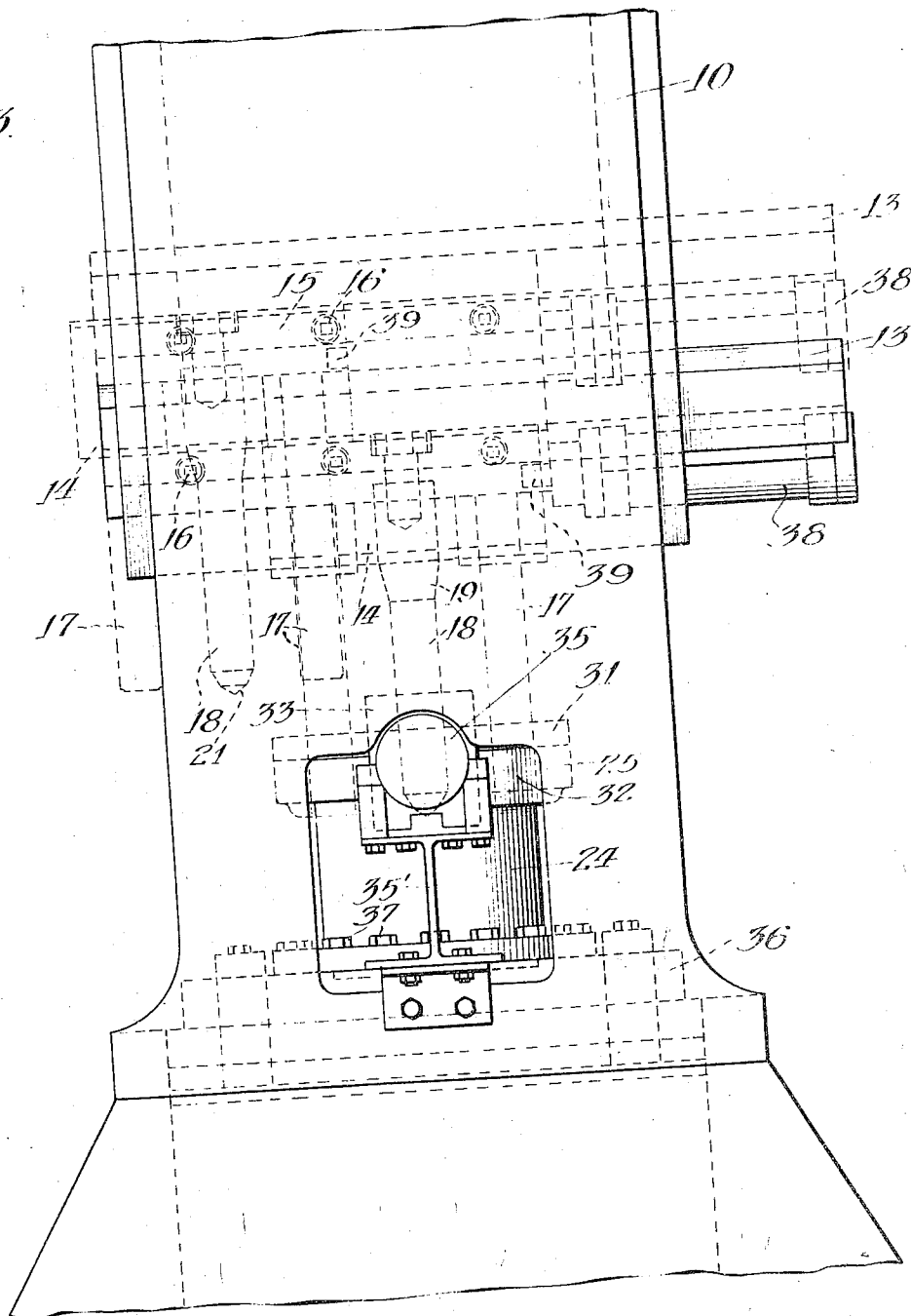
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Fig. 3.



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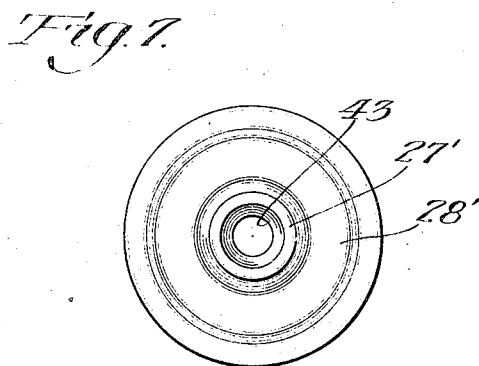
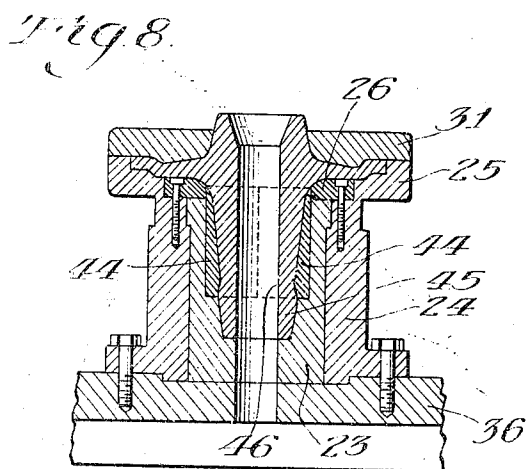
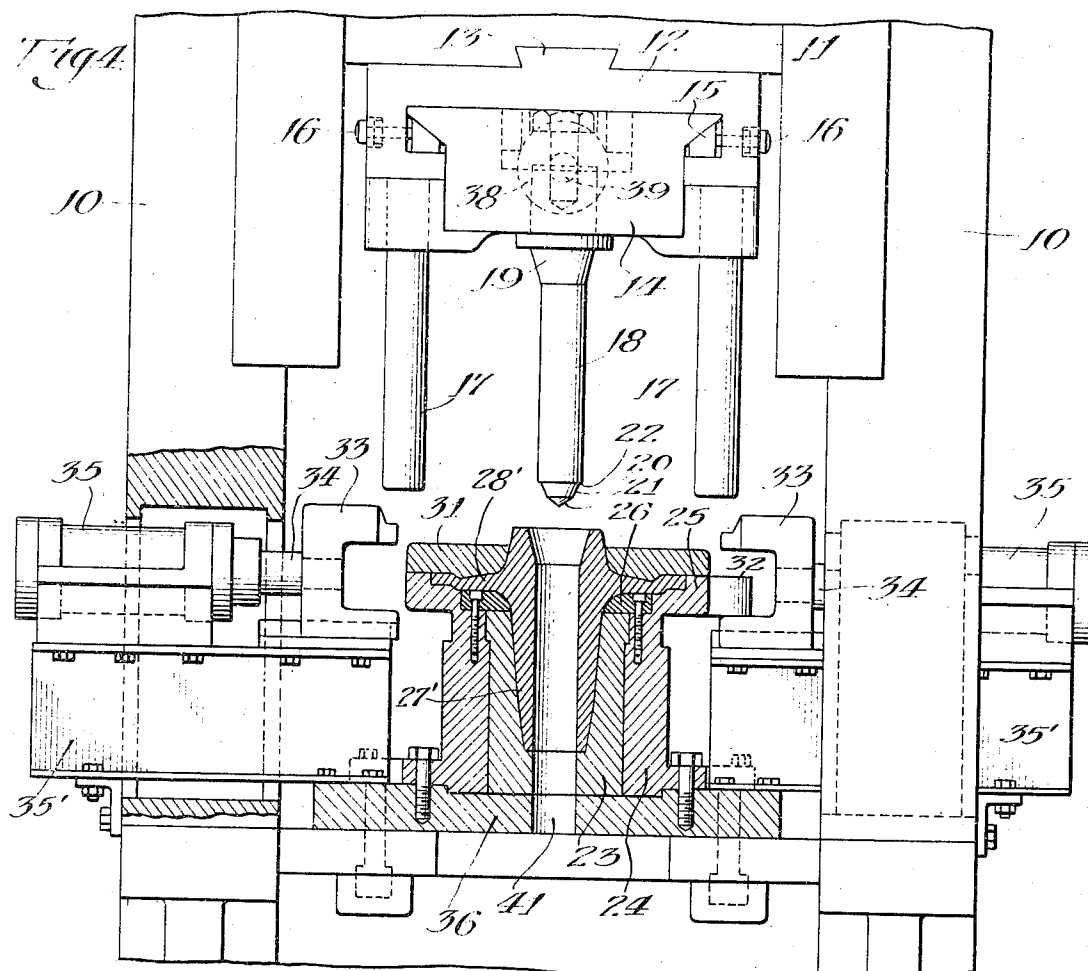
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Fig. 5.

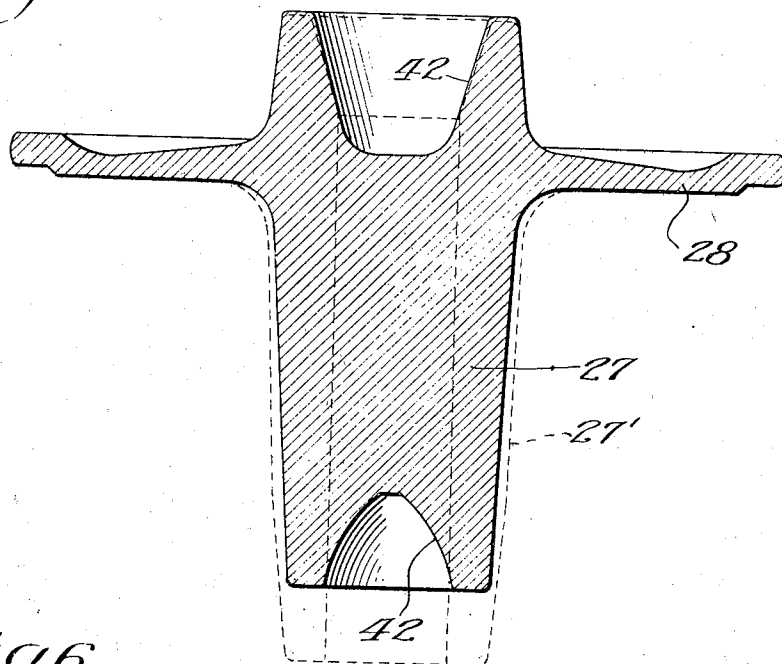
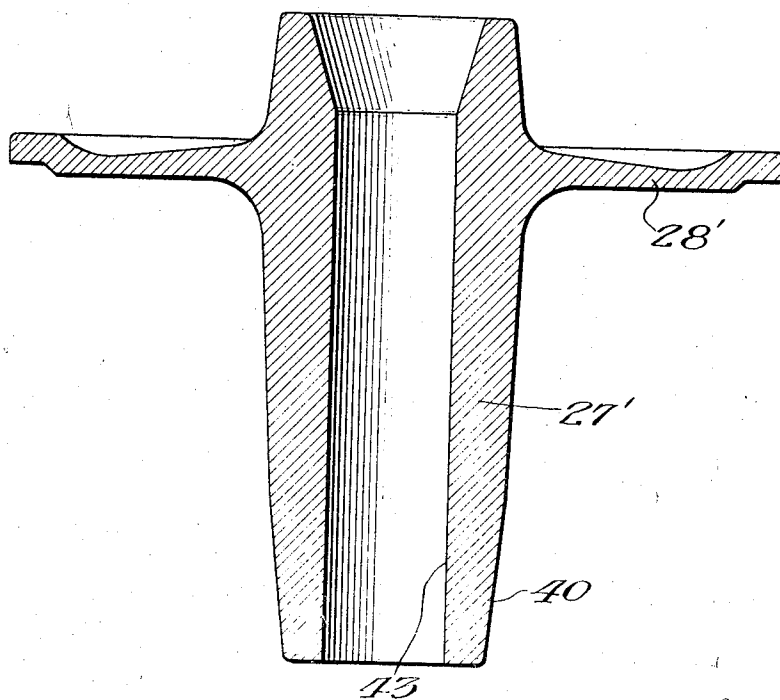


Fig. 6.



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UNITED STATES PATENT OFFICE

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APPARATUS FOR MAKING PIERCED
FORGED HUBS AND THE LIKE

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Application September 20, 1940, Serial No. 357,524

7 Claims. (Cl. 78—9)

This invention relates to an apparatus for making pierced forged hubs.

Heretofore, hubs have been produced by forging steel to the desired dimensions and form of the hub and then drilling through the hub axially and removing the metal occupying the bore. The object of this invention is to produce a hub having the desired dimensions, form and bore by forging and piercing operations, without subsequent drilling and without removing all of the metal initially occupying the bore.

Valuable advantages result from this invention. One advantage is the saving which results by using in the hub most of the metal which heretofore has been removed in the drilling of the hub to provide the bore. This enables the operator to use a blank of less initial weight for a given hub to be produced, and consequently less heating and handling is required.

Another advantage of the invention lies in the fact that the finished hub of my invention may have a 2° draft, whereas a forged and subsequently drilled hub must have at least a 4° draft or it cannot be withdrawn from the forging dies. To provide a 4° inclination of the outer surface of the hub necessitates using surplus metal in the thicker portions, which is saved to a substantial degree by my invention.

The following is an example of the weight saving resulting from use of my piercing method and apparatus and from the reduction in draft made possible thereby: To forge a solid hub such as heretofore known, a gross weight of 240 pounds was used and a net solid forging weight of 225 pounds was obtained. Drilling of the central bore removed approximately 25 pounds of metal, making the net forging weight approximately 200 pounds drilled. By the use of my invention including the reduction in draft, the forging operation can be begun by using a gross weight of 212 pounds of metal and after the forging and piercing operations have been completed, the net weight of the pierced forging is 192 pounds, only about 5 pounds of metal having been discarded. Thus the heating and handling of approximately 28 pounds of metal is saved by using my improved method and apparatus, in the example noted.

The advantages referred to are obtained by roughly forging a hub-like shape of predetermined weight, without a bore and axially shorter than the hub intended to be produced, and then subjecting the forging to a combined piercing and extruding treatment which results in forming an axial bore and in radially displacing and

spreading and axially lengthening the metal into the desired hub form and dimensions, with removal of a very small amount of metal. The forging, prior to the piercing operation, has at least a 4° draft but after the forged metal has been subjected to the displacing, spreading and lengthening resulting from the operation of my piercing apparatus, the external inclination is only about 2°, and thus the excess thickness is reduced to a minimum and all but a very small percentage of the initially heated metal has been embodied in the finished hub.

In the drawings:

Fig. 1 is a front elevation, partly in section, of apparatus for making pierced forged hubs, embodying my invention, showing the piercing tool in its downward stroke, having passed partly through the forging.

Fig. 2 is a horizontal sectional view taken in the plane of the line 2—2 of Fig. 1, showing the work cover and gripping jaws in plan elevation.

Fig. 3 is a side elevation of the apparatus shown in Fig. 1, showing the piercing tool in two positions, as hereinafter explained.

Fig. 4 is a front elevation of the apparatus, partly in section, showing the piercing tool in raised position after the completion of the operation.

Fig. 5 is an elevational view of the forging from which the finished hub is to be produced, the dotted lines indicating the said finished hub.

Fig. 6 is a sectional view of the pierced forged hub.

Fig. 7 is a plan view, on a smaller scale, of the hub shown in Fig. 6.

Fig. 8 is a vertical sectional view of part of the apparatus shown in Figs. 1, 3 and 4, but on a smaller scale, modified to produce a hub differing slightly in external contour from that shown in the other figures.

In that embodiment of my invention shown in Figs. 1 to 4, inclusive, frame members 10, 10 support a ram 11 in which is mounted the frame 12 which has a key 13 slidable in the keyway of the ram. A head 14 is mounted in the slide frame 12, being insertable in the frame 12 by a horizontal sliding action and retained by wedge members 15 adjusted by screws 16. A pair of guide rods 17 depend from the frame 12 and are movable therewith.

A punch or piercing tool 18 is mounted in the head 14. The tool 18 is cylindrical in form throughout the major portion of its length, and has a tapered upper end 19, and inwardly tapered surfaces 20 and 21 on its lower end. Said sur-

faces 20 and 21 are inclined at different angles, approximately as shown, and the surface 20 is slightly inwardly of the cylindrical wall 18 so as to form a right angle edge 22 at the bottom of the cylindrical portion of the tool.

Concentric with the tool 18 is a lower die comprising the parts 23, 24, 25 and 26 fitted and bolted together, and having a recess adapted to receive the forging 27 shown in Figs. 1 and 5, with the flange 28 of the forging supported by the die members 25 and 26, and the lower end of the forging 27 spaced from the bottom 29 of the recess as best shown in Fig. 1. The hub portion of the forging is spaced, radially, a slight distance from the recessed die member 23, there being about a 2° difference in the inclination of the forging 27 and the recess in which it is located, as indicated at 30 in Fig. 1. After the forging has been positioned in the lower die, a cover 31 (see Fig. 2) is placed on the forging, the cover resting on the flange 28. The cover is centrally apertured to accommodate the upper end of the hub portion 27. Apertured lugs 32 on the lower die members 25 are located so that they register with and receive the guide rods 17 on the slide frame 12.

The cover 31 is held on the die and the work by two sets of jaws 33 shown in clamping position in Figs. 1 and 2 and retracted in Fig. 4. The jaws 33 are rigidly connected to connecting rods 34 actuated by hydraulic, oil or other pressure means in the cylinders 35. When the jaws are in clamping position, they hold the die, the work and the cover securely together. The jaws and cylinders are supported by struts 35'. The die members 23 and 24 rest on any suitable base, such as the member 36, and are firmly fastened by bolts 37.

As shown in Figs. 1 and 4, the slide frame 12, carrying the head 14 and tool 18, is so located in the ram 11 that the tool 18 is concentric with the forging 27. The parts are maintained in this position during both the lowering and raising of the tool 18, but after the piercing operation has been completed and the tool 18 has been raised to the position shown in Fig. 4, the slide frame 12 and parts carried thereby are moved transversely of the machine, the key 13 sliding in the grooved ram 11, by pressure operated means in the cylinder 38 connected to the slide frame 12 by the connecting rod 39. Thus the head 14 and tool 18 are moved from a position above the work 27 to a position forwardly of the work.

The operation of the apparatus is as follows: The forging 27—28 shown in full lines in Fig. 5 is placed on the die members 23—26 as shown in Fig. 1, the cover 31 is placed on the forging and die, the jaws 33 are moved into clamping position by operation of the pressure operated means in the cylinders 35, the slide frame 12 carrying the head 14 and tool 18 is moved by means of the pressure operated means in the cylinder 38 to a position concentric with the forging 27—28, and then the ram 11 is operated by any suitable means (not shown) to force the tool 18 down through the forging. In Fig. 1 the tool is shown as having passed partly through the forging. The tool continues downwardly in its stroke until the shoulder 22 has reached or passed the bottom 29 of the recess in the die. This operation results in displacing the metal occupying the axial region of the forging and in spreading and lengthening the metal of the forging so that it assumes the form indicated in

dotted lines in Fig. 5 and shown in section in Fig. 6. The pierced hub, as shown in Fig. 6, then consists of a bored hub 27' having almost parallel inner and outer walls in its main body portion between the flange 28' and the tapered end 40, the inclination of the outer wall of said body portion being only about a 2° angle as distinguished from the 4° angle of the outer wall of the forging 27. Only a small slug of metal is discarded through the opening 41 which extends through the bottom of the die and the base 38. For example, if the hub shown in Fig. 6 were forged solidly in the external form shown, with only the ends recessed as shown at 42 in the forging of Fig. 5, and then drilled out to produce the bore 43 of the hub as in Fig. 6, metal weighing about 25 pounds would be discarded from the forging, whereas by using the method and apparatus herein disclosed, the discarded metal weighs only 4 to 5 pounds, and the finished hub can be made from metal of substantially less initial weight.

After the tool has reached the end of its downward stroke, the movement of the ram 11 is reversed and after the tool has been raised above the work, the slide frame 12 is moved transversely, as explained (Fig. 3), to be out of the way and to permit the cover 31 and the finished forging to be removed after the jaws 33 have been retracted.

In the modification shown in Fig. 8, the die members 23—26 are similar to those described, but a two part sleeve insert 44 is interposed between the member 23 and the forging 45, whereby a different external contour as well as a bore 46 are produced in the hub 45 by the piercing operation.

The form of the piercing tool 18 may be altered to produce bores of various sizes and tapers, but the end formation indicated at 20, 21 and 22 is well adapted to displace the metal initially occupying the bore of the hub and to radially spread and axially lengthen the forged metal, thereby producing a hub of increased density and strength, with a minimum amount of waste and at decreased cost.

Changes may be made in details of construction without departing from the scope of my invention.

I claim:

1. Apparatus for forming a wheel hub from a pre-formed forging having a boreless hub body and a flange at right angles to the axis of the body; comprising a die including a member having an elongated recess defined by a side and end wall, an opening in the end wall co-axial with said recess, said die including means for supporting said flange with the hub body disposed within said recess, a cover removably supported on said means for engaging said flange and retaining said hub body in said recess, horizontally movable C-shaped clamping jaws for removably holding said cover in position, a piercing tool, and means for moving said tool through said recess and opening for forming a bore in the hub body supported within the recess, means for guiding said tool including apertured guide lugs on the die, and guide bars supported by the moving means and movable through the apertures in the guide lugs.

2. Apparatus for forming a wheel hub from a pre-formed forging having a boreless hub body and a flange at right angles to the hub body intermediate the ends thereof defining major and

minor hub portions at opposite sides of the flange; comprising a die having a recess defined by a frusto-conical side wall and an end wall at the smaller end of the side wall, an opening in said end wall coaxial with said recess, said die including means for supporting said flange with the major hub portion disposed within the said recess, a cover engageable with said flange and the minor hub portion for retaining the forging in rigid position, apertured guide lugs on said die, a ram supported for movement toward and from the die, a piercing tool carried by the ram for movement through and coaxially of said recess and opening, and guide bars supported by the ram and movable through the apertures in said guide lugs.

3. Apparatus for forming a wheel hub from a pre-formed forging having a boreless hub body and a flange at right angles to the axis of the body, comprising a die member having a recess defined by a side wall and an end wall having an opening co-axial with the recess, said die including means for engaging said flange and supporting said hub body within said recess in spaced relation to said side and end walls, a forging piercing tool supported for movement through said recess and opening, the piercing end of said tool including a frusto-conical surface merging into a conical end portion for displacing the metal of said hub body into contact with said recess and end walls, and a cutting edge at the base of said frusto-conical surface for forming a bore in said hub body.

4. Apparatus for forming a wheel hub from a preformed forging including a boreless hub body, comprising a recessed die including means for supporting the hub body therein, a vertically movable ram positioned above the die, a slide frame horizontally movable on the ram, a head member releasably and adjustably supported by the slide frame, a work piercing tool supported by the head member, cooperating means on the frame and die for restraining said piercing tool to rectilinear movement axially of said recessed die, means for moving the slide frame transversely of the ram to position the tool into and out of

operative alinement with the die, and means for moving the ram, slide frame, and tool vertically to force the tool through the boreless hub body when operatively alined with the die.

5. Apparatus for forming a wheel hub from a preformed forging including a boreless hub body and a flange at right angles to the axis of the hub body; comprising a frame, a die having a recess therein and including means for engaging the flange to support the hub body within said recess, a centrally apertured cover plate for engaging and holding the flange on said flange engaging means, clamps horizontally movable in said frame for removably holding said cover plate in position, and a piercing tool supported by said frame above said die for movement through the hub body supported therein.

6. Apparatus for forming a wheel hub from a preformed forging including a boreless hub body and a flange at right angles to the axis of the hub body intermediate the ends thereof and defining major and minor hub portions; comprising a die including a member having a vertical recess defined by a substantially frusto-conical side wall and an end wall at the smaller end of the side wall, a cylindrical opening in the end wall coaxial with said recess, said die including a second member surrounding the first member and having a flange portion for engaging and supporting said forging flange with said major hub portion suspended within said recess, a third member supported by said first and second members for additionally supporting said forging flange, a cover plate removably engaged with said second member for engaging said forging flange and said minor hub portion for holding said forging in rigid position, and a piercing tool positioned above said die for movement axially through said recess to provide a bore in said hub body and eject a slug of metal through said opening.

7. Apparatus according to claim 6 wherein said side wall is defined in part by a longitudinally split two part sleeve removably supported within a recess in said first member.

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