June 1, 1954 L. A. CIGLIANO 2,679,931

METAL PRESSING AND PIERCING APPARATUS

Filed Oct. 29, 1948

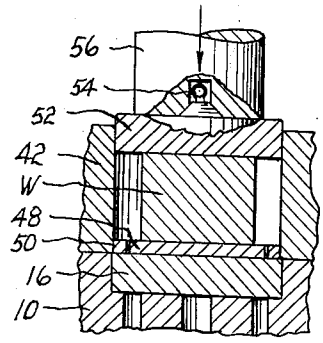


FIG. 3

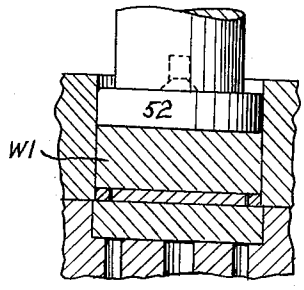


FIG. 4

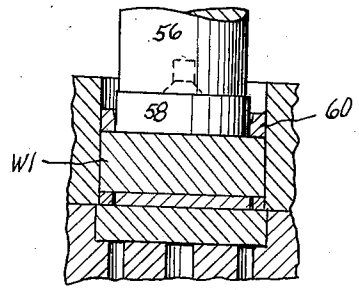


FIG. 5

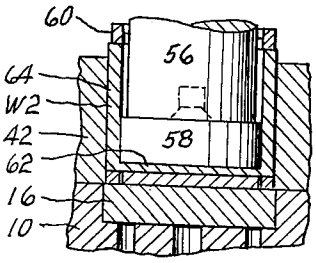


FIG. 6

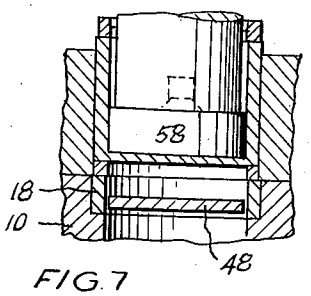


FIG. 7

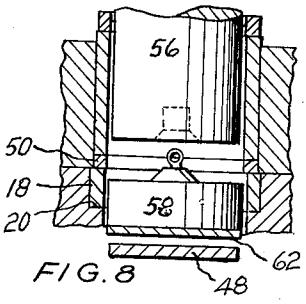


FIG. 8

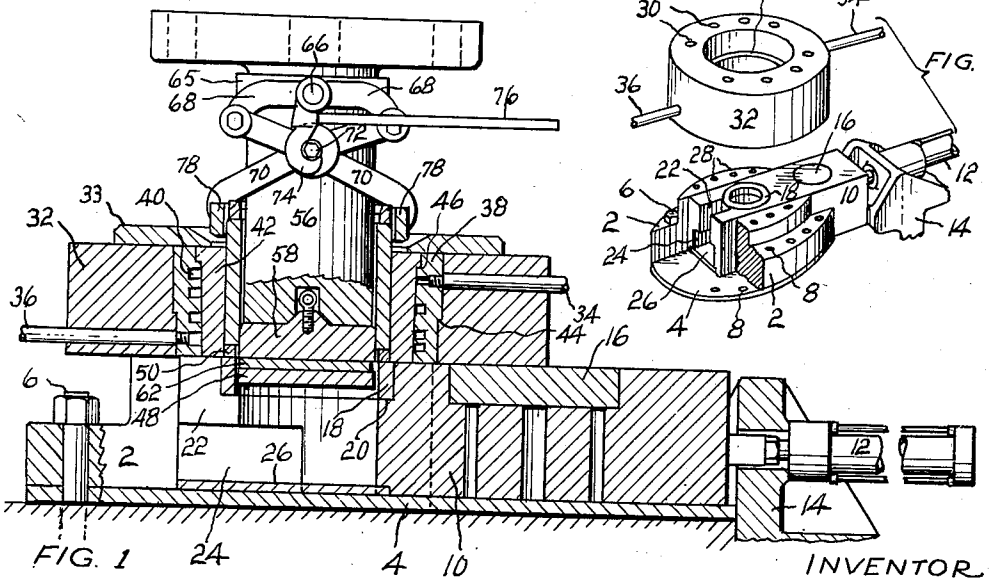


FIG. 1

FIG. 2

INVENTOR
LOUIS A. CIGLIANO
BY Romeyn A. Spare
HIS ATTORNEY.

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METAL PRESSING AND PIERCING APPARATUS

Louis A. Cigliano, East Orange, N. J., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

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5 Claims. (Cl. 207—6)

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This invention relates to metal pressing and piercing and comprises all of the features and aspects of novelty herein disclosed. An object of the invention is to provide an improved apparatus for producing sleeves or rings from a billet. Another object is to provide a method of treating a metal billet to form it into a sleeve having improved molecular structure and definite inside and outside dimensions. Another object is to produce sleeves of any selected diameter from a limited number of standard billet sizes than can be cut to length depending upon the volume of the finished sleeve. Another object is to produce sleeves or rings from billets with a minimum loss of material in the shaping operation.

To these ends and also to improve generally upon methods and apparatus for shaping metal, the invention consists in the various matters hereinafter described and claimed.

In the drawings

Fig. 1 is a vertical sectional view of the apparatus with some parts shown in side elevation.

Fig. 2 is a small scale exploded perspective view of important elements, some parts being broken away and in section.

Figs. 3 to 8 are vertical sectional views showing various steps in the forming of the sleeves.

First outlining important functions, a billet is heated and a punch squeezes it in a die to increase its diameter and decrease its length. A second punch of smaller diameter then extrudes the piece into cup shape. During these steps the bottom of the die is constituted by a shearing ring and a central disc which are solidly backed up by a disc carried by a slide shiftable under the die. An annular support on the slide is then brought under the die, releasing the central disc but not the shearing ring, and the same smaller punch punches out the bottom of the cup. The central disc, the sheared out bottom and the punch drop into a recess of the slide and are removed through a slot. All the work is done with one heating of the piece and the final sleeve has improved molecular structure suitable for a roller bearing race. There is no loss of metal other than the thin punched-out bottom of the cup. The die determines the outside diameter of the sleeve and the smaller punch determines its inside diameter. The sleeve is so much taller than the billet that it protrudes above the top of the die and is removed upwards by grippers carried by the punch ram.

A pair of spaced segments 2 rest on a circular wear plate 4 and these parts are securely bolted

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to the bed of the machine by a series of bolts 6 which pass down through registering openings 8 in the wear plate and in the outer lower portions of the segments. A slide 10 is guided between the adjacent vertical walls of the segments and can be shifted to either of two positions by a piston rod projecting from a cylinder 12 secured to a fixed bracket 14. The slide has two circular recesses in the top, one recess receiving a removable disc 16 which serves as a solid backing for certain preliminary pressing operations and the other recess supporting a sleeve or ring 18 which furnishes an annular supporting surface for a later operation of piercing.

The ring 18 is supported by a shoulder 20 on the slide, this shoulder being interrupted at one end of the slide by a narrow slot 22. Below this slot is a wider slot 24 and the two slots form a passage to facilitate the removal of certain parts involved in a piercing or shearing operation. To reinforce the slotted end of the slide, a bottom plate 26 is fastened in a recess thereof. This bottom plate also catches any loose scale and prevents it from getting underneath the slide. It also protects the wear plate from being scratched when certain parts drop through the ring 18 for removal.

The segments have inner raised portions provided with bolt openings 28 which register with bolt openings 30 in a circular die block 32 bolted to and supported on the segments. A clamping plate 33 is fastened by the bolts passing through the openings 28 and 30. An inlet pipe 34 and an outlet pipe 36 extend radially through the die block into a sleeve 38 having an internal helical groove 40 for conducting cooling liquid around an internally cylindrical die 42. The die block 32 has an annular shoulder 44 supporting a mating shoulder on the sleeve 38. The sleeve is internally tapered to fit the exterior of the die which is provided with a circular flange or shoulder 46 supported by a companion shoulder in the sleeve.

In the first operation, the slide is advanced to the left in Fig. 1 so that the disc 16 is under the center of the die and forms a solid backing. Figs. 3 and 4 show this position, the disc 16 supporting a smaller disc 48 and a closely surrounding shearing ring 50. The disc 48 and ring form a temporary solid floor for the die. A work piece W in the form of a billet of 52100 steel heated to about 2150° F. and de-scaled is laid on the disc 48 (Fig. 3). A punch or first nose piece 52 having an eye bolt 54 for lifting and lowering purposes is laid on the billet and a

punch ram 56 is forced against it. The billet is thereby flattened and increased in diameter as shown at W-1 in Fig. 4 to fill the die. The ram is then lifted and the first nose piece 52 removed and replaced by a second and smaller punch or nose piece 58 which is centered in the die by a centralizing ring 60 having a chamfered bore at one end.

As shown in Fig. 6, the second nose piece is then forced down against the work while it is still hot and a cup-shaped piece W2 is formed. This has a bottom 62 and a deep annular side wall 64 which is extruded above the top of the die carrying the centralizing ring with it. The pressure of the ram is next released and the cylinder and piston unit is actuated to shift the slide to the position shown in Figs. 1, 7 and 8. Suitable stops determine the two positions of the slide. The slide brings the sleeve or ring 18 into concentric relation to the die, and the disc 48 drops down into the recess of the slide. The punch ram is again forced down while the piece is still hot and the bottom 62 is sheared out as indicated in Figs. 1 and 8. Since the second nose piece 58 no longer has any support, it will follow the bottom 62 and drop down after it into the recess of the slide. These parts are then removed by a suitable instrument through the slot or passage at the end of the slide.

The tall shell or sleeve now completely formed is then lifted from the die by suitable grippers as follows: A ring 65 supported by the ram has two oppositely projecting pivots 66 pivotally supporting four links 68 to which two yokes 70 are pivoted. The arms of these yokes cross one another and are pivoted together at 72, one pivot being extended and normally engaged by a hook 74 pivoted at 66. A handle 76 provides for releasing the hook whereupon the raising of the press ram causes all the links and arms to swivel upon their pivots so that the lower ends of the arms 70 approach one another. Arcuate grippers 78 connecting the arms to complete the yokes partly surround and grip the upper end of the finished sleeve to lift it from the die.

I claim:

1. In apparatus for forming a sleeve from a heated work piece, a die having a cylindrical side wall and a closed bottom wall, a portion of the bottom wall comprising a central disc, a cylindrical punch engageable with the central area of the work piece, a ram engageable with the punch and forcing the punch downwardly into the work piece to extrude the latter into cup shape, a slide having a demountable solid backing member supporting the entire bottom wall of the die the slide also having a supporting ring seated therein, means for shifting the slide to remove the solid backing member and replace it with said ring, and means for further feeding the ram downwardly to force the same punch completely through and removing it through the bottom of the cup and said ring to produce a sleeve.

2. In apparatus for producing a sleeve from a heated work piece, a die having a cylindrical side wall and having a bottom wall fitted within the cylindrical wall and comprising a central removable disc and a cylindrical shearing ring, a slide beneath the bottom wall of the die and having a solid backing member slidably engaging and initially supporting both the disc and the shearing ring, a cylindrical punch engageable with the central area of the work piece, punch operating means forcing the punch into the work piece to extrude the work piece into the shape of a cup while the slide remains in said initial supporting relation, means for shifting the slide beneath and out of supporting relation with the central disc, said slide having a ring shaped insert engageable with the entire end of the shearing ring to support it and release the central disc therethrough, and said punch operating means subsequently forcing the punch through the bottom of the cup and through the shearing ring and through said annular supporting portion to produce a sleeve.

3. In apparatus for producing a sleeve from a heated work piece, a die having a cylindrical inner side wall and having a bottom wall composed of a central removable disc and a surrounding shearing ring, a slide having a demountable solid imperforate backing member beneath and supporting both the disc and the shearing ring, the slide having an annular supporting portion laterally spaced from the backing member, said annular portion having an internal diameter substantially equal to the internal diameter of the shearing ring, a cylindrical punch engageable with the central area of the work piece, a ram for forcing the punch into the work piece to extrude the work piece into a cup shape while the solid backing member supports both the shearing ring and the removable disc, means for shifting the slide to remove the solid backing member from beneath the central disc and to locate the annular supporting portion concentric with and in supporting relation with the entire end of the shearing ring to release the central disc therethrough, and means to further feed the ram and force the cylindrical punch through the bottom of the work piece and through the shearing ring and through said annular supporting portion.

4. In apparatus for producing a sleeve from a heated work piece, a pair of segments spaced apart to form a guide, a slide shiftable in said guide, a die block fixedly supported by and secured to said segments and having a cylindrical inner wall, a circular bottom wall demountably and completely received within said inner wall, said bottom wall being located above the slide and composed of a central disc and a surrounding shearing ring, the slide having a solid backing portion which simultaneously supports both the central disc and the shearing ring, a cylindrical punch engageable against the central area of the work piece in the die, a punch feeding member engageable with and forcing the punch downwardly into the work piece to extrude the work piece into the shape of an elongated cup, the slide having an annular backing portion laterally spaced from the solid backing portion and provided with a circular opening of substantially the same diameter as the diameter of the central disc, means for shifting the slide to position said annular backing portion in annular engagement with the lower end of the shearing ring, and said punch-engaging member thereafter forcing the punch down through the bottom of the cup and through the shearing ring and out through said annular backing portion.

5. In apparatus for producing a sleeve from a heated work piece, a fixed die block having an internal cylindrical wall, a circular bottom wall demountably received completely within said inner wall and comprising a central removable disc and a surrounding shearing ring, a slide slidably engaging said bottom wall and having a solid backing member beneath and initially supporting both the central disc and the shearing ring,

a cylindrical punch engageable with the central area of the work piece, a ram of lesser cross sectional area than and engageable with the punch, said ram forcing the punch into the work piece to extrude the latter into the shape of a cup while the slide supports both the disc and the shearing ring, means for laterally shifting the slide beneath and out of supporting relation with only the central disc, a supporting ring on the slide engageable with the entire end of the shearing ring to support the shearing ring and release the central disc therethrough, means to further feed the ram downwardly and thereafter force the cylindrical punch through the shearing ring and

through said annular supporting portion to produce a sleeve, and the slide having a passage beneath the annular supporting portion and open at one end and disposed transversely to the axis of the central disc for removal of the central disc and of the punch and of the punched-out bottom of the work piece.

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