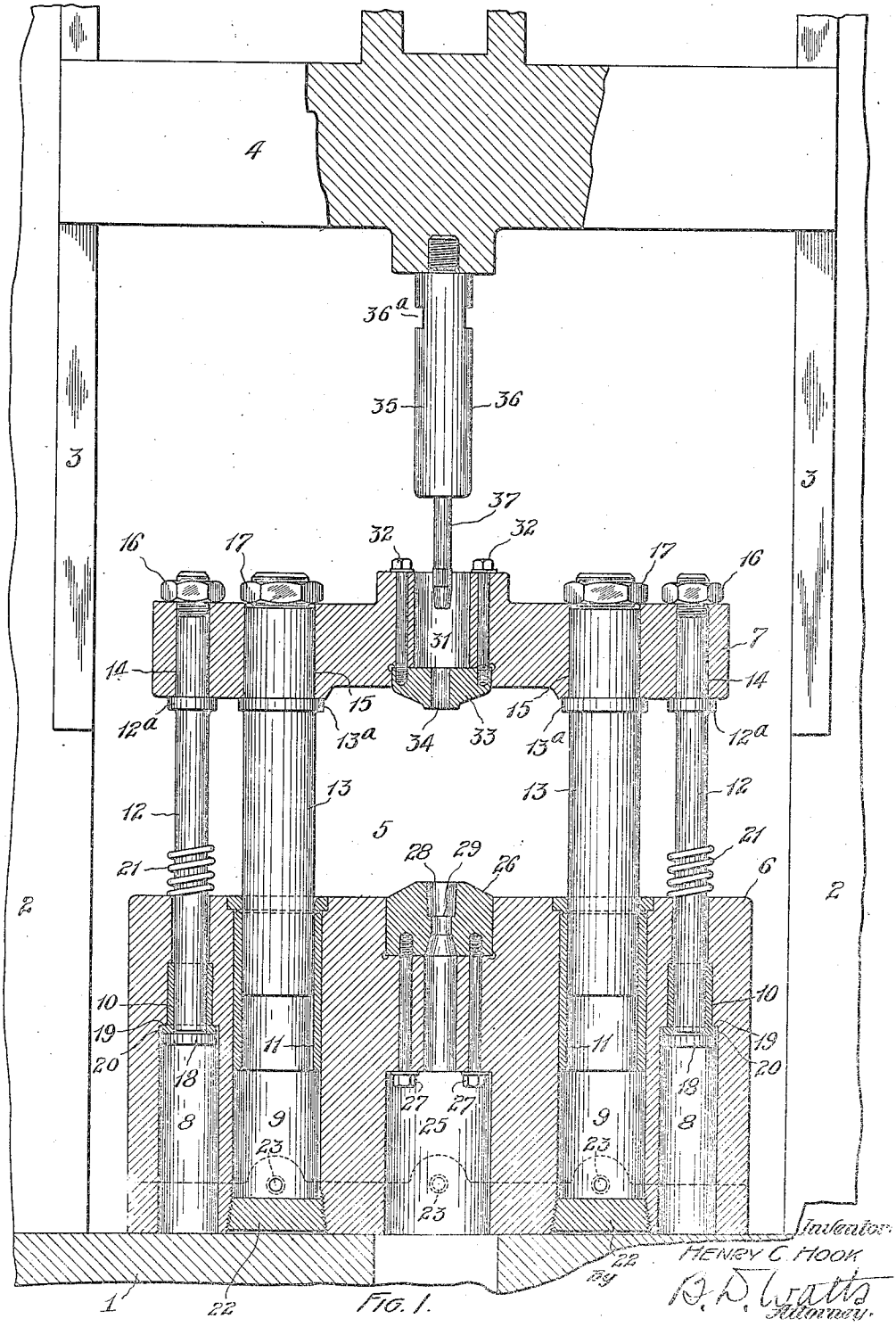
June 12, 1923. 1,458,294

H. C. HOOK

SWAGING APPARATUS

Filed Dec. 15, 1920 3 Sheets-Sheet 1



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SWAGING APPARATUS

Filed Dec. 15, 1920 3 Sheets-Sheet 2

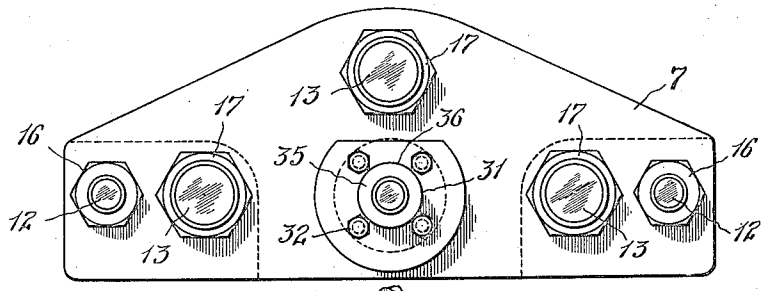


FIG. 4

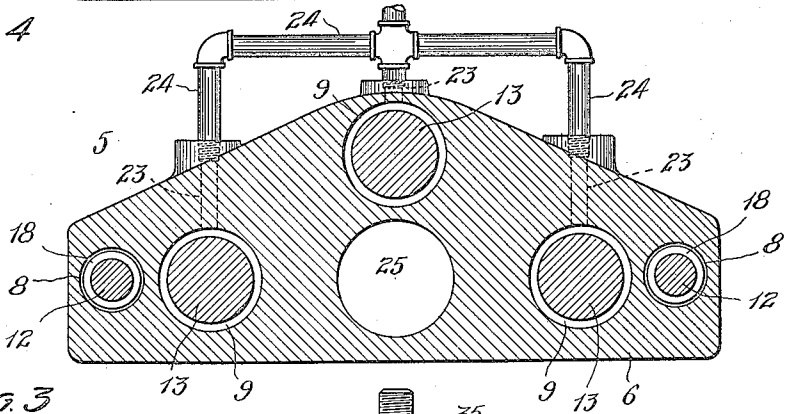


FIG. 3

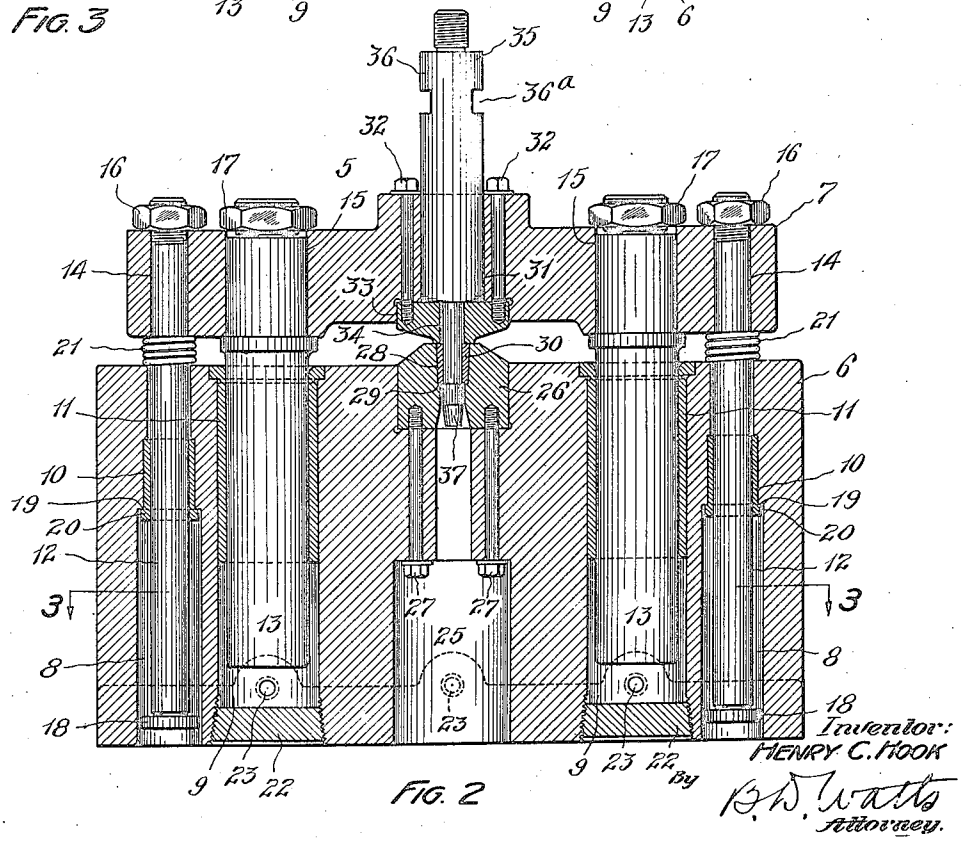


FIG. 2

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SWAGING APPARATUS

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FIG. 6

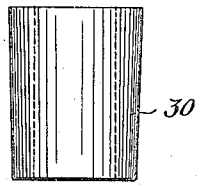


FIG. 7

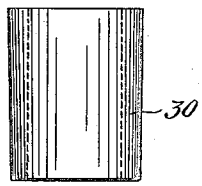
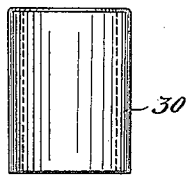


FIG. 8



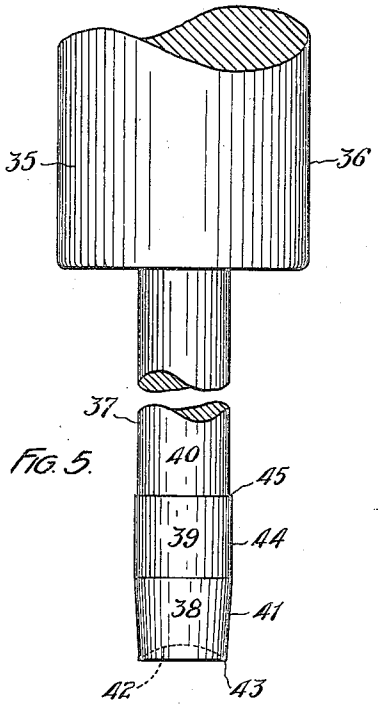


FIG. 5.

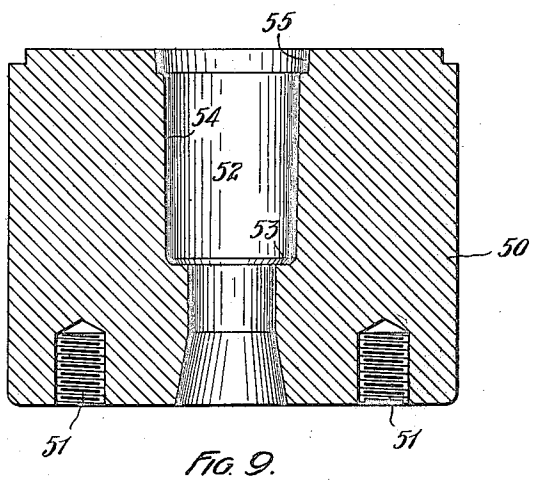


FIG. 9.

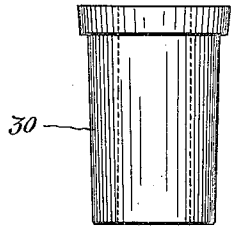


FIG. 10

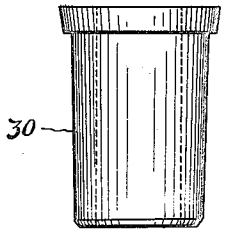


FIG. 11

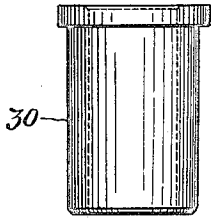


FIG. 12

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Patented June 12, 1923. 1,458,294

UNITED STATES PATENT OFFICE.

HENRY C. HOOK, OF WINDSOR, VERMONT, ASSIGNOR, BY MESNE ASSIGNMENTS, TO ALUMINUM MANUFACTURES, INCORPORATED, OF CLEVELAND, OHIO, A CORPORATION OF DELAWARE.

SWAGING APPARATUS.

Application filed December 15, 1920. Serial No. 430,901.

To all whom it may concern:

Be it known that I, HENRY C. HOOK, a citizen of the United States, residing at Windsor, in the county of Windsor, State of Vermont, have invented a certain new and useful Improvement in Swaging Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

This invention relates to apparatus for compressing metallic articles and is especially concerned with apparatus for swaging tubular bearing blanks.

One object of the invention is to construct an improved apparatus for swaging tubular articles.

Another object is to construct a punch adapted to swage a tubular work blank and thereafter to remove the blank from its supporting member.

Another object is to construct new and improved apparatus for densifying and compressing the metallic structure of bearings.

Another object is to construct new and improved apparatus for cold working bearings and producing a permanent set therein, as a step in their manufacture.

With these and other objects as will be pointed out, in view, I will now for purpose of illustration describe my invention as embodied in a preferred form of apparatus reference being made in the following specification to the accompanying drawings forming a part thereof.

Fig. 1 is a front elevation of my preferred form of swaging apparatus, parts being shown in section and other parts being broken away.

Fig. 2 is a view similar to Fig. 1 but with the moving parts represented as at the end of the stroke opposite that shown in Fig. 1, all press parts having been omitted.

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2.

Fig. 4 is a top plan view of the upper member or plate.

Fig. 5 is an enlarged side elevation of the preferred form of swaging punch.

Figs. 6 and 7 are side elevations respectively of a bearing before and after swaging in the die shown in Figs. 1 and 2.

Fig. 8 is a side elevation of the swaged bearing machined to finished size.

Fig. 9 is an enlarged sectional view of a modified form of die.

Figs. 10, 11 and 12 are views similar to Figs. 6, 7, and 8 of a bearing designed for and swaged in the die shown in Fig. 7.

In the drawings, 1 designates the bolster plate of an ordinary punch press, which also has uprights 2 with guide portions 3, and a reciprocating head 4. Mounted upon bolster plate 1 is a swaging fixture 5 comprising a body 6 and a plate 7. The body 6 which may be made of cast iron has a plurality of vertical circular openings, extending entirely therethrough.

The two openings 8 and the three openings 9 are provided with antifriction bearings 10 and 11 pressed in or otherwise suitably secured therein. Within these bearings, rods 12 and plungers 13 respectively have sliding engagement.

The rods and plungers, which have shoulders 12^a and 13^a respectively formed for engagement with one side of plate 7, are secured in holes 14 and 15 respectively of the plate 7 by light pressed fits and by nuts 16 and 17 respectively which thread on the ends of the rods and plungers and clamp the plate against the shoulders. In this manner the plate 7, rods 12 and plungers 13 operate as a unit.

The free ends of the rods 12 are headed as at 18 for engagement with an inwardly extending shoulder or stop 19 in opening 8 whereby the upward movement of the rod and consequently of the plate 7 is limited. In the apparatus shown a flange 20 formed at the end of the bearing 10 is interposed between the shoulder 19 and head 18 to cushion the contact between the head and shoulder. A coiled spring 21 encircling rod 12 serves to absorb some of the shock caused by contact of parts of the plate 7 with parts of the body 6 and to maintain plate 7 normally out of contact with body 6.

Plungers 13 have a close, substantially air tight, sliding fit in bearings 11. The opposite open ends of openings 9 are closed with plugs 22 having substantially air tight threaded engagement within the openings

thus converting them into closed chambers. Near the lower end of each such chamber connection is made thru openings 23 and pipes 24 with a reservoir (not shown) containing air or other fluid under pressure. When this fluid is permitted to enter the chambers, it presses on the ends of plungers 13 and raises the latter and plate 7 to the extent permitted by heads 18 on rods 12.

Opening 25 in body 6 is enlarged at its upper end to form a supporting seat for a female die 26 which is secured therein by bolts 27. This die is centrally bored having downwardly tapered walls 28 and a substantially horizontal supporting ledge 29 as is clearly shown in Figs. 1 and 2. Upon this ledge 29, bearing blanks 30, Fig. 2 are supported during swaging operations.

Directly opposite die 26 and similarly secured in the opening 31 of plate 7 by bolts 32 is a compression die 33 adapted to engage with the end of bearing blank 30 and compress it lengthwise in die 26. This action takes place only near the lower end of the stroke of plate 7 as is seen in Fig. 2.

Above plate 7 and secured to the reciprocating head 4 of the press is attached a swaging punch 35 provided with an enlarged shank portion 36 having wrench engaging flat surfaces 36^a and a reduced portion 37. The punch is formed with an enlarged shank 36 and a smaller portion 37 made up of three portions 38, 39 and 40. Portion 38 which constitutes the end of the punch has a tapered outer surface 41. The end surface 42 of the punch being concave forms a circular cutting edge 43 where it meets the outer surface 41, the function of the cutting edge being to remove metal, sand, etc., from the bore of bearing blanks 30. The tapered surface 41 merges into the cylindrical surface 44 of portion 39. The portion 40 which is of slightly smaller diameter than portion 39, forms an appreciable shoulder 45 at its junction with portion 39.

In operation, as the press head 4 moves to the upper end of its stroke it carries punch 35 out of contact with plate 7 and die 33 while fluid pressure exerted upon plungers 13 raises plates 7 to the position shown in Fig. 1. Downward movement of head 4 causes contact of the enlarged portion 36 of punch 35 with die 33, thus carrying plate 7 down against the fluid pressure in cylinders 9 and bringing portion 37 of punch 35 into engagement with blank 30 in die 26. Cutting edge 43 removes sand and scale from the bore of the blank and a layer of metal of a thickness dependent upon the relative sizes of the punch and bore of the blank. The tapering walls 41 expand the blank radially outward and to some extent cause a lengthwise flow of the metal of the blank. Cylindrical portion 39 with its wall 44 compress the blank against the sustaining walls 28 and 29 of the die 26, and tend to give the blank a permanent size and deformation. Flash, or excess metal in the form of fins is formed on the lower end of the blank and may be formed on the upper end depending upon the relative sizes of punch and blank.

The length of punch 35 is such that when the portion 39 has passed thru the blank the compression die 33 may engage with the blank and force it down into die 26. This compression tends to decrease the bore of the blank so that together with the contraction due to the elasticity of the metal, the blank seats on shoulder 45 and fits closely enough to portion 40 of the punch to be lifted from the die when the press, on its upward stroke, removes the punch from the die. The blank is stripped from the punch by die 33 when plate 7 reaches the upper end of its stroke. Another blank may be inserted in die 26 before the punch again descends.

In Figs. 6, 7, and 8, I have illustrated three stages in the manufacture of bearings by my process. Fig. 6 shows a blank as cast, or cast and treated preparatory to swaging. Fig. 7 shows the blank after swaging, the outer diameter being enlarged by the punch and the bore being cleaned out and enlarged by the punch. Fig. 8 represents the blank after the bore, exterior and ends have been machined to finished dimensions.

It will be noted that the die has approximately the same diameter at the top as the larger end of the blank, thus providing a support for the blank in the first stages of the swaging operation and thereby preventing cracking or breakage of the blank. With the exception of the top of the die, its diameter is slightly greater than that of the blank to provide for radially outward expansion of the blank.

A comparison of the dimensions of the blank in Figs. 6 and 7 shows that the blank as cast is compressed lengthwise and expanded radially outward at substantially all points except at the larger end. The expansion is however not great. The bore of the cast blank, Fig. 6 has been enlarged during swaging as shown in Fig. 7, due in part to removal of material by the cutting edge of the punch and in part to outward expansion of the blank by the punch. It will be noted that the expansion caused by the punch is much greater than is provided for by the size of the die, the result being a considerable compression of the metal of the blank.

After swaging only light cuts of metal from the exterior and interior surfaces are necessary to bring the bearing to finished dimensions.

In Fig. 9 I have shown a modified form of die designed for bearings having a flange at one end. This die 50 has holes 51 for

engagement with bolts 27 to secure it in body 5. The bored opening 52 is formed with a bottom wall 53 for supporting a blank and tapered side walls 54, the bottom and side walls being connected by a short inclined wall 55 which forms a chamfered or beveled surface on the bearing blank. At the top of opening 52 an enlargement 56 is formed in which a correspondingly shaped flange on the blank is adapted to seat and be shaped.

Figs. 10, 11, and 12 are views similar to Figs. 6, 7, and 8 but illustrating the form of bearing produced in the modified die.

A punch similar to that shown in Fig. 5 may be employed with this modified die and bearing.

It will be noted that the form of bearing here shown does not fit so closely in the die before swaging as in the preceding case, the strengthening flange apparently affording some support to the blank which in the preceeding illustration was provided entirely by the die walls and thus preventing breakage due to swaging.

The dimensions of outside diameter and bore of the cast blank and the swaged blank respectively indicate that the metal of the blank has been compressed considerably by the punch.

It will be understood that all of the dimensions are given by way of illustration and that changes in any or all of them as may be necessary or advisable with these or other forms of bearings are comprehended by my invention. Furthermore although I have described a specific form of apparatus I do not wish to have my invention limited thereto, the scope of my invention being defined by what is claimed.

What is claimed:

1. In an apparatus for swaging tubular articles in combination with a die having downwardly tapered side walls and a bottom wall adapted to support a tubular article, of a punch having an enlarged portion adapted to cause radial expansion of a tubular article in the die, and a shoulder adapted to remove said article from the die.

2. In an apparatus for swaging tubular articles in combination with a die having side and bottom walls adapted to support a tapered tubular article, a punch, having a cutting edge formed at one end thereof, and an enlarged portion adapted to cause radial expansion of a tubular article in the die and to remove the expanded article from the die.

3. In an apparatus for swaging tubular articles, in combination with a die adapted to support a tapered tubular article for a swaging operation, a punch, having a cutting edge formed at one end thereof and adapted to remove material from the bore of a tubular article in the said die, an enlarged portion adapted to cause outward radial enlargement of the said article, and a reduced portion, the said enlarged portion being adapted to remove a tubular article from the said die.

4. In an apparatus for swaging tubular articles in combination with a body member having a female die adapted to support a tubular article, a swaging punch adapted to enter the bore of the said tubular article, and a compression die adapted to exert compression force on the said tubular article while the latter is in the said female die, the said swaging punch being adapted to bring the said compression die into engagement with the said tubular article subsequent to engagement therewith of the swaging punch.

5. In an apparatus for swaging tubular articles in combination with a body member having a female die adapted to support a tubular article, a plate movably secured to the body member, a compression die carried thereby and adapted to engage a tubular article in the said die, and a swaging punch adapted to enter the bore of the said tubular article, the swaging punch having an enlarged portion remote from the free end thereof, the said enlargement being adapted to move the compression die into engagement with the said tubular article while the latter is in the female die, and subsequent to the engagement of the swaging punch with the said article.

6. In an apparatus for swaging tubular articles in combination with a body member having a female die adapted to support a tubular article, a plate movably secured to the body member, an annular compression die carried thereby and adapted to engage a tubular article in the said die, and a swaging punch comprising a portion adapted to pass through the said annular compression die and to enter the bore of the said tubular article, and an enlarged portion adapted to bring the said annular compression die into engagement with the said tubular article in the female die subsequent to the engagement therewith of the swaging punch.

7. In an apparatus for making tubular bearings composed of antifriction metal the combination of a punch and die, the said die being adapted to support tubular bearings against lengthwise and radially outward pressure and the said punch being adapted to enter the bore of the bearing, to force the metal of the bearing against the die, and to remove the bearing from the die.

8. In an apparatus for densifying the metallic structure of the tubular bearings composed of antifriction metal in combination, a female die adapted to support the end and side wall of a tubular bearing, a swaging punch adapted to enter the bore of the bearing and to compress the metal of the bearing radially against the side wall of the said

female die, and a compression die adapted to engage an end of the bearing and to compress the bearing against the end wall of the female die.

9. In an apparatus for swaging tubular articles in combination, a body member carrying a work holding die, a plate mounted on the body member for limited movement relative thereto, having an opening therethrough, a swaging punch having a portion adapted to pass through the said opening and into the work holding die and a portion adapted to actuate the said plate to cause movement thereof in one direction and pneumatic means for causing movement of the said plate in the opposite direction.

10. In an apparatus for swaging tubular articles in combination, a body member carrying a work holding die, a perforated plate mounted on the body member for limited movement relative thereto, a swaging punch having a portion adapted to pass through an opening in the said plate and into the work holding die and a portion adapted to engage with the said plate to cause movement thereof in one direction, and fluid pressed plungers in the body member for causing movement of the said plate in the opposite direction.

11. In an apparatus for swaging tubular articles in combination, a body member carrying a work holding die adapted to receive a tubular article, a perforated plate mounted for limited movement relative to the body member, a swaging punch having a portion adapted to pass through an opening in the said plate and into the said tubular article and a second portion adapted to engage with the said plate to cause movement thereof in one direction, means in the said body member and secured to the said plate for limiting movement of the latter relative to the body member, cylinders in the body member, plungers slidably mounted in the said cylinders and secured to the said plate, and fluid means for actuating the plungers to move the said plate away from the body member.

12. In an apparatus for swaging tubular articles in combination, a body member carrying a die, fluid pressed plungers mounted in the body member, a plate secured to the said plungers, rods slidably mounted in the body member and secured to the said plate and adapted to limit the movement of the plate, a swaging punch adapted to enter the said die and to move the said plate toward the body member, the said plungers being adapted to move the said plate away from the said body.

13. In an apparatus for swaging tubular articles in combination, a body member carrying a die, the die being adapted to receive a tubular article, fluid pressed plungers slidably mounted in the body member, rods mounted for limited movement in the body member, a perforated plate secured to the said plungers and rods, a swaging punch having a portion adapted to pass through an opening in the said plate and to engage a tubular article in the said die, the plate serving to remove the article from the punch when the latter is being retracted from the said die and plate.

14. In an apparatus for swaging tubular articles in combination, a body member carrying a die, the die being adapted to receive a tubular article, fluid pressed plungers slidably mounted in the said body member, rods mounted for limited movement in the body member, a perforated plate secured to the said plungers and rods and adapted to engage the tubular article, a swaging punch having a portion adapted to pass through an opening to enter the bore of an article in the die and having also an enlarged portion adapted to engage the said plate and to bring it into engagement with the said tubular article subsequent to the entry thereinto of the swaging punch.

15. A punch for swaging tubular articles, comprising a concave end surface, a conical surface adjacent thereto, a cutting edge formed at the intersection of the said surfaces, a cylindrical surface adjoining the said conical surface and a second cylindrical surface adjoining and of only slightly smaller diameter than the first said cylindrical surface.

In testimony whereof, I hereunto affix my signature.

HENRY C. HOOK.