Aug. 9, 1949.

T. A. BOWERS

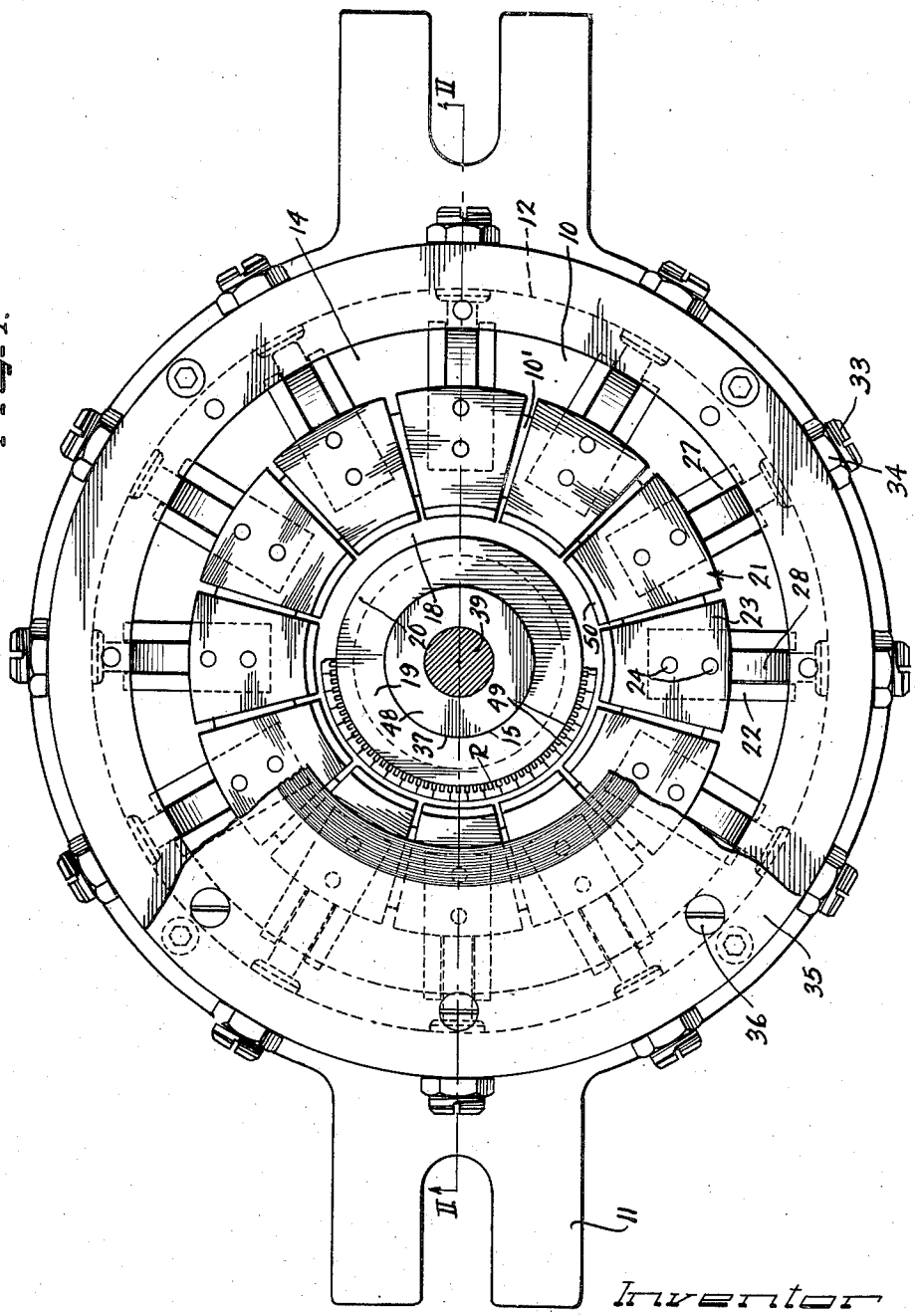
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APPARATUS FOR SIZING AND SETTING ARTICLES SUCH AS PISTON RINGS

Filed Nov. 7, 1945

2 Sheets-Sheet 1

Fig. 1.




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2 Sheets-Sheet 2

Fig. 2.

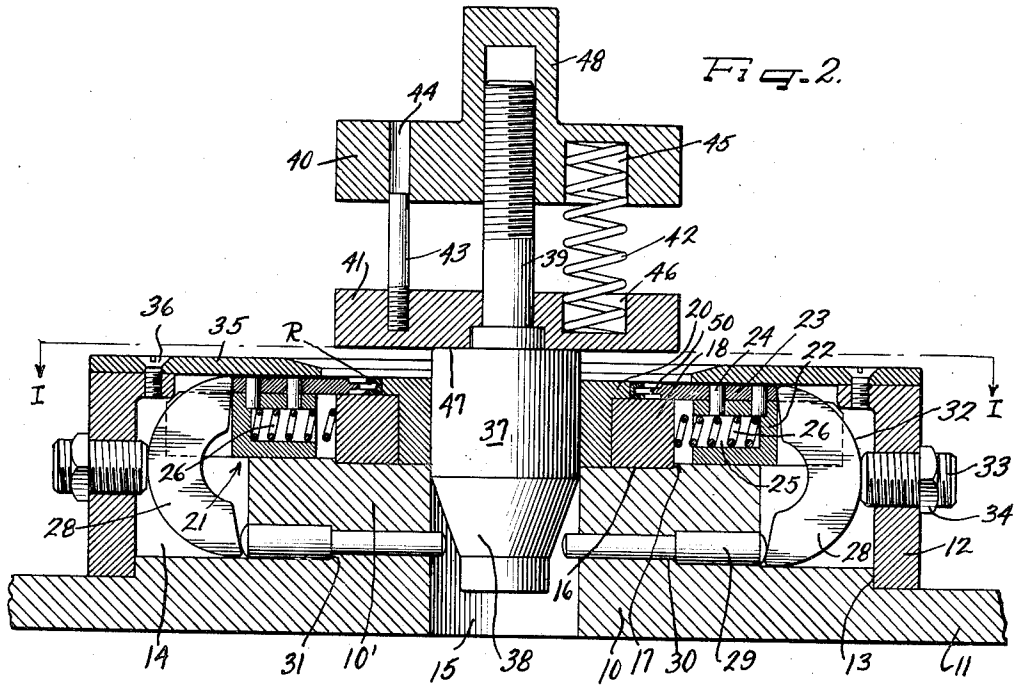
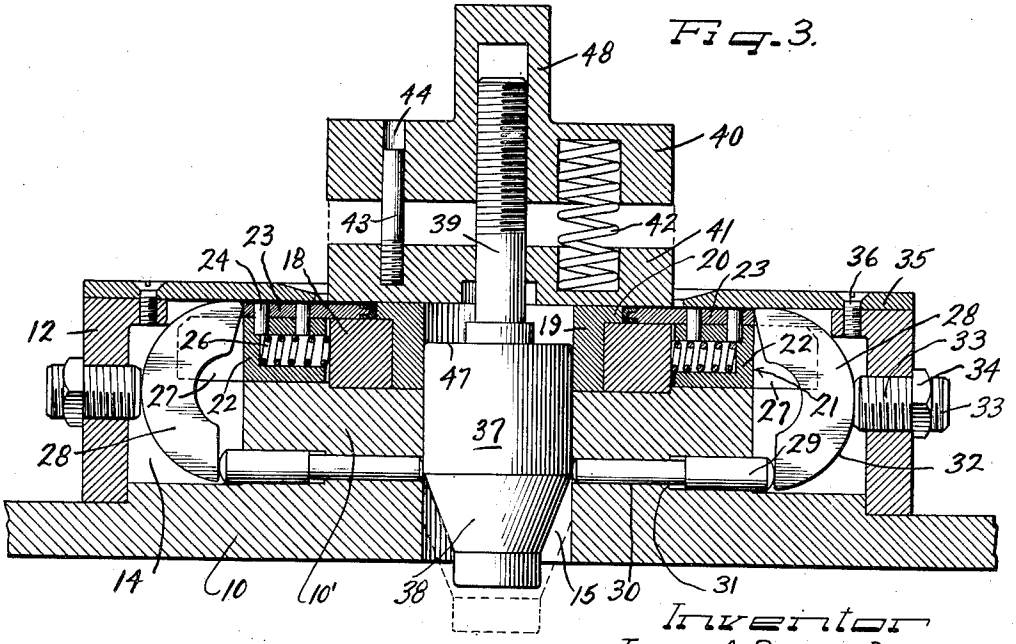



Fig. 3.




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## APPARATUS FOR SIZING AND SETTING ARTICLES SUCH AS PISTON RINGS

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7 Claims. (Cl. 78—15)

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This invention relates to a die structure adapted particularly for shaping, sizing and setting ring shaped articles, and more especially oil type piston rings or the like.

An important object of the invention is to produce an improved die structure of the collet type in which collet jaws of different sizes may be interchangeably assembled for the treatment of rings of different diameters.

Another object is to provide improved means for effecting the radial shifting of the collet jaws for radial compression of rings against and around a sizing bushing for sizing of the rings to the desired diameter, together with improved setting means for axial holding and setting of the rings during the sizing operation, as a result of which operations the rings will be given their final shape and dimensions.

A further object of the present invention is to provide an improved die structure for finishing ring shaped articles of U-shaped cross section.

The above referred to and other objects, features and advantages of my invention will be apparent from the following detailed description and are embodied in the structure shown on the accompanying two sheets of drawings in which:

Figure 1 is a top plan view from plane I—I in Figure 2, and with a part of the cover plate broken away;

Figure 2 is a section on plane II—II in Figure 1 showing the die structure in open position; and

Figure 3 is a section like Figure 2 but showing the die structure in closing position for shaping, sizing and setting a ring.

The structure shown comprises a circular base 10 having ears 11 extending therefrom by means of which the structure may be mounted on a support, as the work table of a power press. Mounted on the base is an annular cylindrical wall member 12 held concentric therewith by engagement with a circular shoulder 13 on the base. An integral axially upwardly projecting, central portion 10' of reduced diameter on the base cooperates concentrically with the wall member 12 to provide an annular channel space 14 therebetween. Extending coaxially through the base is a cylindrical bore or passageway 15. In its upper side, the base is countersunk to provide a flat annular surface 16 surrounded by a shoulder 17 concentric with the bore or passageway 15. Mounted concentrically on the surface 16 is an annular anvil 18 which is of somewhat smaller diameter than the passageway 15. The anvil 18 is preferably of rectangular cross-section and is held in

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centered relation by abutting the shoulder 17. Extending through the anvil 18 is a sizing bushing 19 whose inner diameter coincides with the diameter of the passageway 15. The bushing has an outwardly directed flange 20 which projects over and engages with the top of the anvil along the inner margin thereof, the outer cylindrical face or shoulder of the flange being of a diameter corresponding with the inner diameter to which rings R are to be shaped and correspond. The rings R to be treated are placed on the anvil 18 in encircling relation with the sizing bushing flange 20.

Arranged in a circular row concentric with the passageway 15 and mounted on the base part 10' outside of the anvil 18 for sliding radial movement on the base part, are jaw elements 21. Each of these jaw elements comprises a rectangular body 22 the upper face of which is coplanar with the upper face of the anvil 18. On top of each body 22 is mounted a jaw plate 23 which projects over slidably onto the top face of the anvil 18 and is formed as a ring segment cooperative with all of the other jaw plates 23 to form a sizing ring to drive against and sizingly clamp the interposed ring element R against the sizing perimeter of the sizing bushing flange 20. The jaw plates are held on the respective bodies 22 as by pins 24. The bodies 22 have axially inwardly opening bores 25 for supporting respective coiled compression springs 26 which abut the outer side or periphery of the anvil 18 and normally tend to shift the jaw elements radially outwardly to hold the radially inner edges of the jaw plates 23 clear of the ring R to be treated. In its outer end each jaw body 22 has a vertical slot 27 therein for receiving the upper end of a rocker lever or cam 28. These levers or cams 28 extend down in the annular space 14 for engagement at their lower ends with plungers 29 which are shifted radially in bores 30 through the lower part of the base portion 10'.

At their inner ends the plungers are adapted to project radially into the vertical passageway 15 through the base. The outer portions of the plungers 29 are of somewhat greater diameter than the inner portions thereof and the respective bores 30 are correspondingly dimensioned so as to provide shoulders 31 against which the complementary shoulders provided by the enlarged diameter outer portions of the plungers abut to limit their inward movement, as shown on Figure 2. At their outer or back edges 32, the rocking cams or levers 28 are shown as of substantially semi-circular extent. These edges

32 have fulcrum engagement with the inner ends of means such as fulcrum studs 33 which have adjustable threaded engagement in the annular wall 12 and are provided with lock nuts 34. The jaw elements 21 and the cam elements 28 are held in service position by an annular cover plate 35 detachably secured to the wall 12 as by screws 36.

Means for driving the actuating plungers 29 comprises a cylindrical driving plunger 37, reciprocably shiftable axially in the passageway 15 and the sizing ring 19 and having a conical lower portion 38 for engagement with the inner ends of the plungers 29. The driving plunger 37 has a stem 39 extending upward therefrom and threaded along its outer end for threaded engagement by a setting punch member 40. A pressure member or pad 41 is concentric with and slidably receives the stem 39. Between the setting punch member 40 and the pressure pad 41 is disposed a uniformly circularly spaced plurality of compression springs 42 and alternate pilot pins 43. The pilot pins 43 thread into the pressure pad for slidable reception in pilot bores 44 in the setting punch 40, while the springs 42 are seated at their ends in aligned pockets 45 and 46 in the punch and pad members respectively. The springs 42 are of such length and compression characteristics as normally to force the punch and pad members axially apart to the extent limited by engagement of the pressure pad 41 by an opposing shoulder 47 on the upper end of the driving plunger 37. The setting punch 40 is shown as having a stud 48 extending therefrom by which it may readily be attached to the ram of a power press (not shown).

The assembly including the driving plunger 37 and the setting punch 40 and the pressure pad 41 is normally raised by the ram to be clear of the passageway 15 in order that rings R to be treated may be applied to the anvil 18 around the flange 20 of the sizing bushing 19. When the punch assembly is thus raised, the springs 42 will hold the pressure pad member 41 against the shoulder 47 at the upper end of the punch member 37, as shown on Figure 2.

The particular ring R shown on the drawings is of radially outwardly opening U cross-section and may be formed of segments 49, as shown on Figure 1. The jaw plates 23 are therefore provided with tongues 50 for engaging in the ring channel.

When the punch driving plunger and setting punch structure is withdrawn from the base assembly, the springs 26 in the jaw bodies 22 will shift the bodies radially outwardly to hold the jaw plates 23 in outer position, as shown on Figures 1 and 2, and such outward shift of the jaw bodies rocks the cam members 28 on their fulcrum studs 33 for radially inward shift by the lower ends of the cams of the plungers 29 to cause the inner ends of the latter to project into the passageway 15 into the path of the conical end portion 38 of the driving plunger 37 when the driving plunger is moved downwardly through the passageway 15. Figure 2 shows the punch and driving plunger assembly being moved downwardly with the driving plunger 37 engaging in the sizing bushing 19 and the passageway 15. As the punch and plunger assembly continues its downward movement the conical plunger end portion 38 will engage with the inner ends of the actuating plungers 29 to shift them radially outwardly for rocking of the cam members 28 on their fulcrum studs 33. This results in radial inward shift of the jaw members 21 by the upper ends of the cam members 28.

As the conical driving plunger end portion 38 comes into engagement with the plungers 29, the pressure pad 41 comes down into engagement with the top of the sizing bushing 19 and then, as the driving plunger 37 continues its downward movement and the actuating plungers 29 gradually advance radially outwardly and continue rocking of the cam members 28 for driving thereby of the jaw members 21 inwardly for engagement of the jaw plates 23 with the ring R to be sized, the springs 42 will be compressed to urge the pressure pad with increasing pressure against the sizing bushing 19 and the ring R to be treated and toward the jaw plates 23, thus holding the ring R in proper radial alignment while the jaw plate tongues 50 exert radial pressure into and against the ring for contraction thereof to the diameter of the flange 20 of the sizing bushing, this operation being shown in full outline on Figure 3. Thereafter, the ram of the power press may be moved down far enough for striking of the pressure pad 41 by the setting punch member 40 as shown in dot-dash outline on Figure 3 for the final shaping and setting of the ring R. After this final operation, the punch and plunger assembly will be raised clear of the jaw assembly and the sizing jaw springs 26 operate to spread the jaws 21 open, thereby permiting removal of the finished ring R and insertion of the next ring to be treated.

Rings of different diameters may readily be treated in my improved die structure. For any size of ring, a sizing bushing 19 will be applied which has a flange 20 of the diameter to which the ring is to be sized, and jaw plates 23 of proper radial length will be applied to the jaw bodies 22. By adjusting the fulcrum studs 33, the desired radial pressure of the cam members 28 against the jaw members may readily be obtained. As the plungers 29 are being shifted outwardly by the conical drawing plunger end portion 38, the cylindrical body of the driving plunger 37 operates to a certain extent to hold the sizing bushing 19 concentric with the jaw element circle so that the sizing pressure will be equally distributed against the ring to be treated.

There has been shown a practical and efficient embodiment of the features of the invention but it is not desired to be limited to the exact construction, arrangement and operation shown and described as changes and modifications may be made without departure from the scope of the invention as defined in the claims.

The invention claimed is:

1. In combination in a die structure for the purpose described, a base member having a bore therethrough, a sizing bushing on said base structure forming a continuation of said bore and having an outer surface of a diameter for receiving a ring to be sized, a circular row of cooperative jaw elements mounted on said base structure for radial inward movement for sizing engagement with the ring to be sized, actuating plungers radially shiftable in said base and having their inner ends projectable into said bore, and lever members having fulcrum connections intermediate their ends and engaging at their upper and lower ends respectively with said jaw elements and said actuating plungers, and a driving plunger member axially shiftable in said sizing bushing and said bore for engagement with the inner ends of said actuating plungers to shift them radially outwardly for thereby rocking said

lever members on their fulcrums for inward radial shifting of the jaw elements against the ring to be sized.

2. In combination in a die structure for the purpose described, a base member having a bore therethrough, a sizing bushing on said base structure forming a continuation of said bore and having an outer surface of a diameter for receiving a ring to be sized, a circular row of cooperative jaw elements mounted on said base structure for radial inward movement for sizing engagement with the ring to be sized, actuating plungers radially shiftable in said base and having their inner ends projectable into said bore, and lever members having fulcrum connections intermediate their ends and engaging at their upper and lower ends respectively with said jaw elements and said actuating plungers, a driving plunger member axially shiftable in said sizing bushing and said bore for engagement with the inner ends of said actuating plungers to shift them radially outwardly for thereby rocking said lever members on their fulcrums for radial inward shifting of the jaw elements against the ring to be sized, and a pressure member for pressure engagement with the sizing bushing for holding the ring to be sized and said jaw members in radial alignment while said jaw members are being shifted inwardly into sizing engagement with the ring.

3. In combination in a die structure for the purpose described, a bushing having an outer cylindrical surface for receiving a ring which is to be sized to the diameter of said surface, a circular row of jaw elements surrounding said bushing and movable radially, fulcrum means disposed annularly about said jaw elements, rocking levers fulcrumed intermediate their ends on said fulcrum means and engaging at one of their ends with said jaw elements, a member movable axially in said sizing bushing, and means movable by said member during axial movement thereof in a plane normal to the axis of said member for rocking said levers on their fulcrums for inward radial shift thereby of said jaw members into engagement with the rig to be sized.

4. In combination in a die structure for the purpose described, a base having a central aperture, a bushing having an outer cylindrical surface for receiving a ring which is to be sized to the diameter of said surface, a circular row of jaw elements surrounding said bushing and movable radially, fulcrum means disposed annularly about said jaw elements, rocking levers fulcrumed intermediate their ends on said fulcrum means and engaging at one of their ends with said jaw elements, a member movable axially in said sizing bushing, means disposed in said base for sliding movement normal to said axis by said member during axial movement thereof for rocking said levers on their fulcrums for inward radial shift thereby of said jaw members into engagement with the ring to be sized, and means movable with said member for engagement with the ring to be sized and the jaw members to maintain radial alignment thereof during inward shift of the jaw members.

5. In combination in a die structure for the purpose described, a sizing bushing having an outer cylindrical surface for receiving a ring to be sized thereto, a circular row of jaw elements surrounding said bushing and movable radially theretoward, a housing wall surrounding said jaw elements, adjustable fulcrum members on said housing wall, rocking levers fulcrumed intermediate their ends on said fulcrum members and engaging at one of their ends with said jaw elements, a member movable axially in said sizing bushing, and means operated by said member during axial movement thereof for acting on the other ends of the rocking levers for rocking the levers to effect inward radial shift thereby of said jaw members into engagement with the ring to be sized.



6. In a die structure for the purpose described, a supporting base, a sizing bushing supported on said base and having an outer cylindrical surface for receiving a ring which is to be sized to said surface, a circular row of jaw elements surrounding said bushing and movable radially theretoward, rocking levers fulcrumed intermediate their ends and engaging at one of their ends with said jaw elements, a member movable axially in said sizing bushing and having a camming surface, and plungers movable in said supporting base for engagement by said cam surface to be shifted into engagement with the other ends of said levers for rocking thereof for inward shift thereby of the jaw members into engagement with the ring of said bushing to be sized.

7. A die structure for the purpose described comprising a base having an axial passageway therethrough, a sizing bushing mounted on said base and forming a continuation of said passageway, said bushing having an outer cylindrical surface of a diameter to which a ring received thereby is to be sized, a circular row of jaw elements mounted on said base concentric with said bushing for radial movement theretoward, actuating plungers radially shiftable in said base below said jaw elements, rocking levers engageable at their upper ends with said jaw elements and at their lower ends with said actuating plungers, adjustable fulcrum members engageable by said levers intermediate their ends, and a driving plunger shiftable axially in said bushing and said passageway and having a cam surface for engagement with said actuating plungers for radial outward shifting thereof and rocking of said levers for inward shift thereby of said jaw elements into engagements with the ring on said sizing bushing for sizing of the ring to the bushing surface diameter.

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*Administratrix of the Estate of Thomas A. Bowers, Deceased.*


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