Nov. 26, 1935. E. B. ROTHWEILER 2,022,154

MACHINE AND METHOD FOR MAKING PISTON RINGS

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Fig. 1.

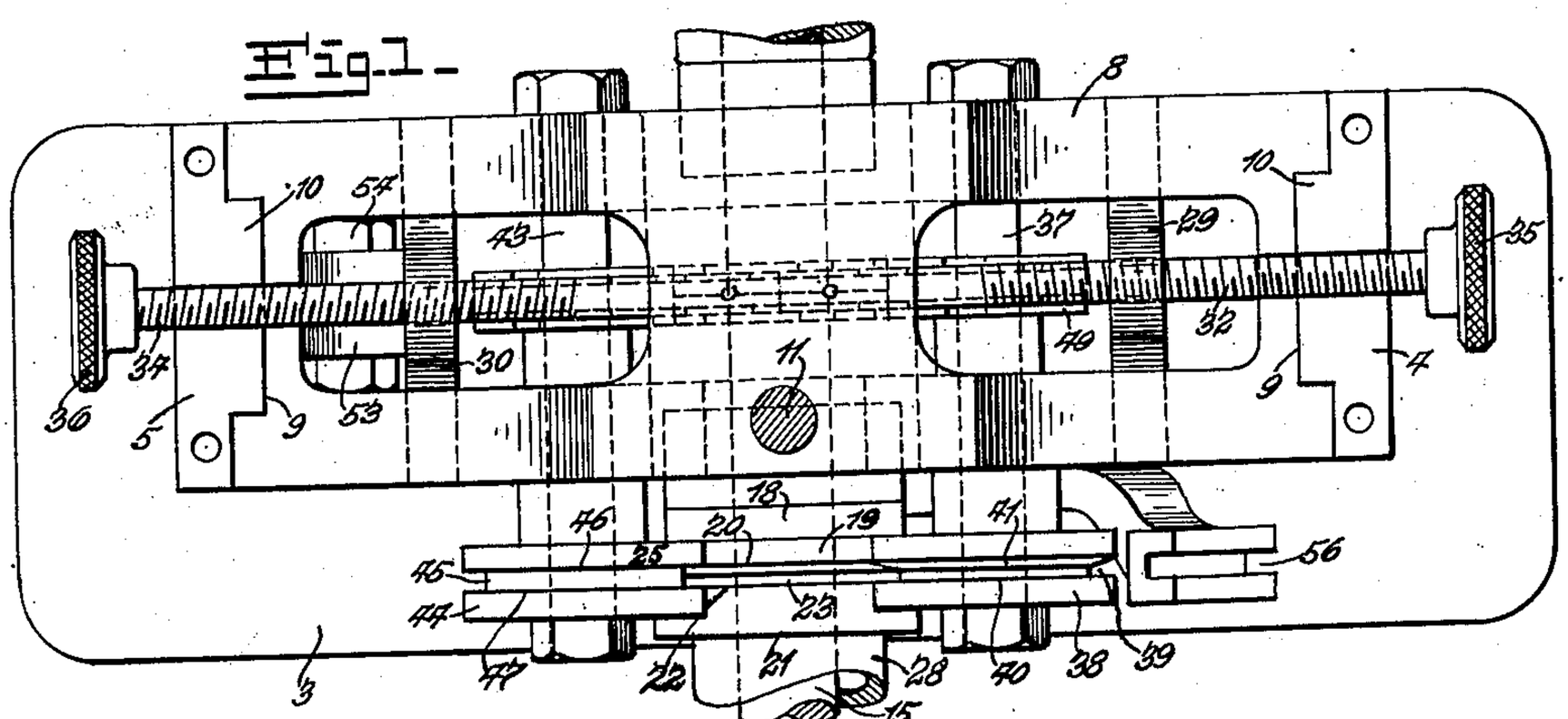

Fig. 2.

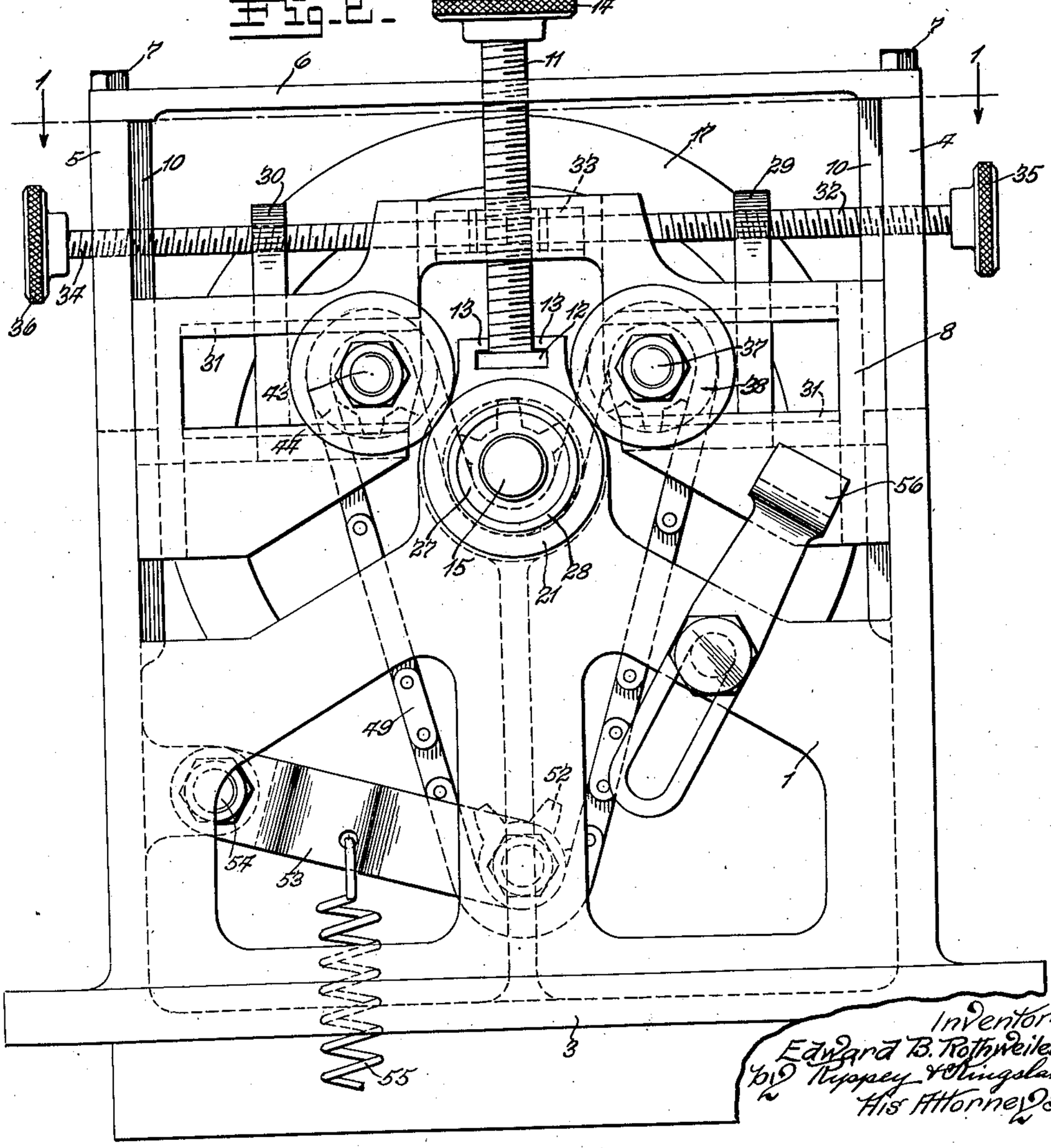

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Fig. 4.

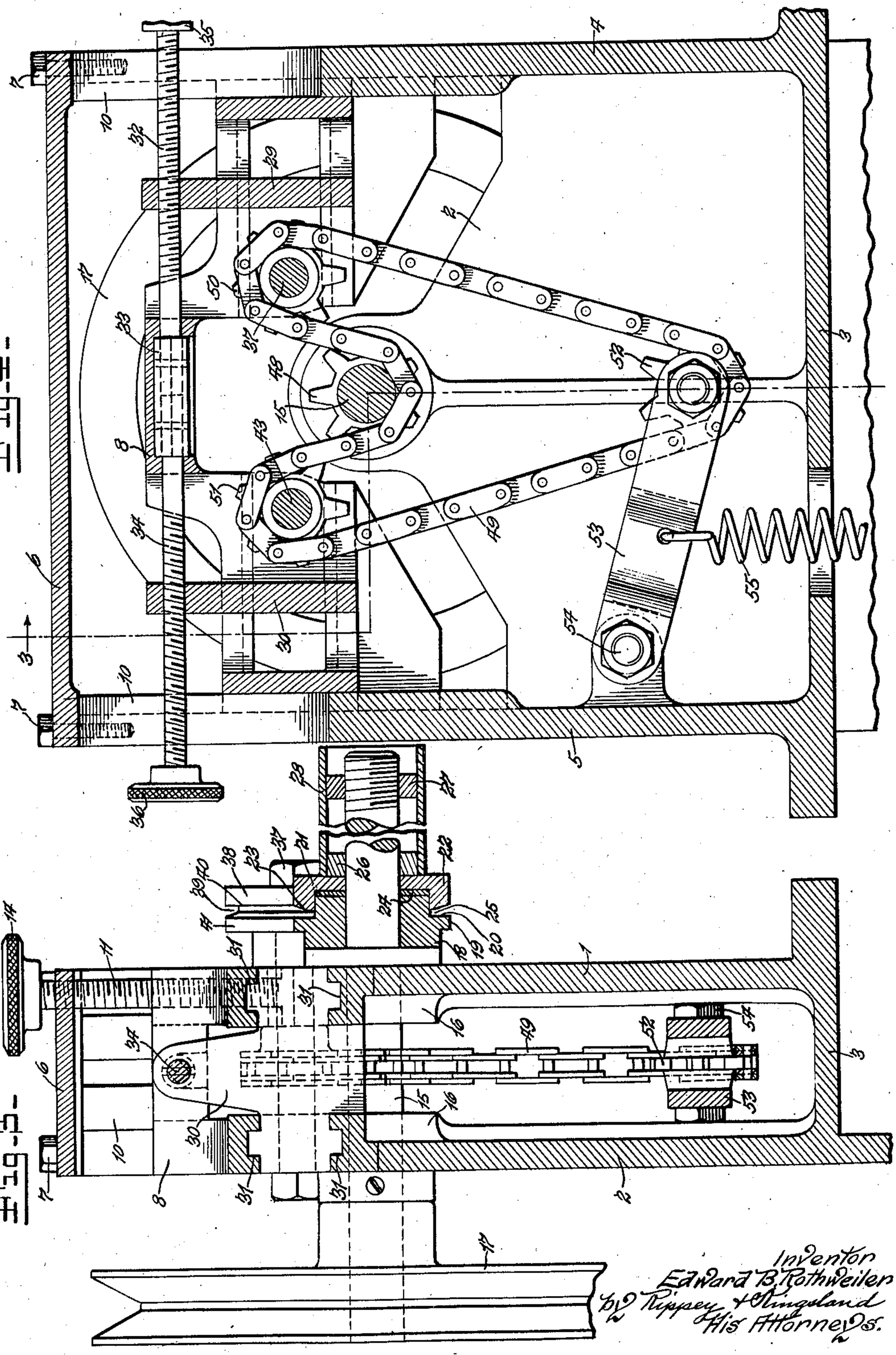

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Fig. 5.

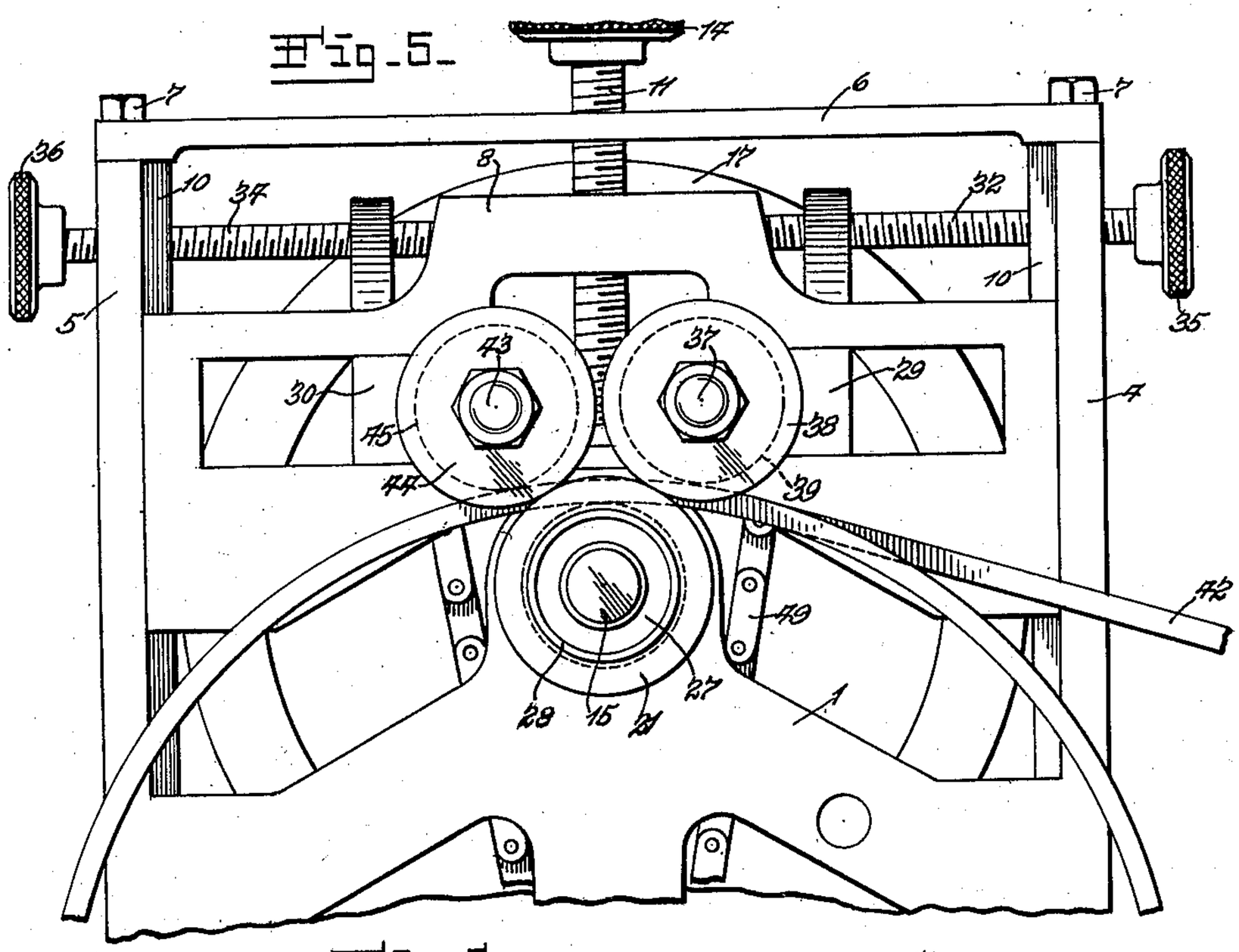


Fig. 6.

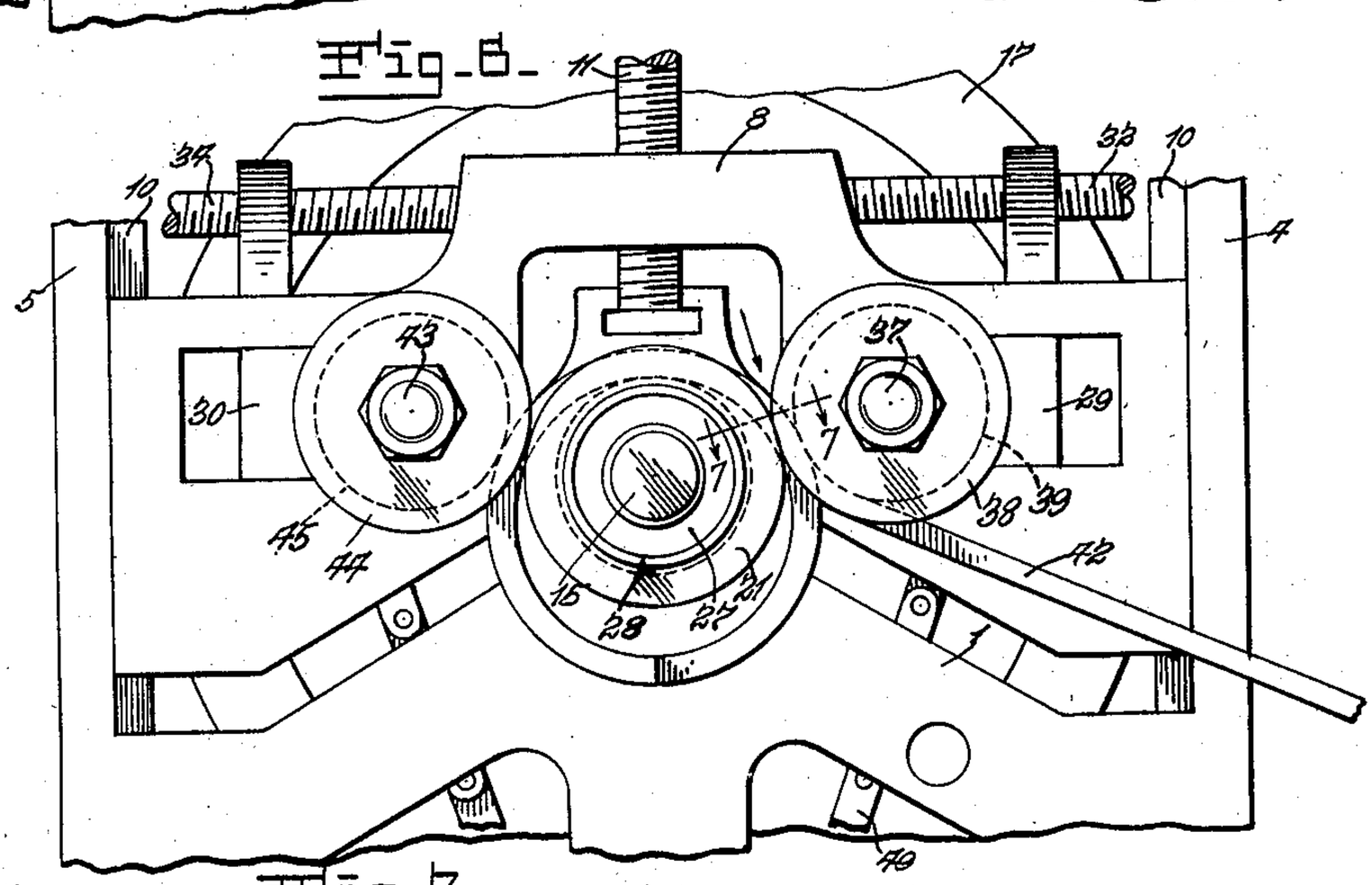
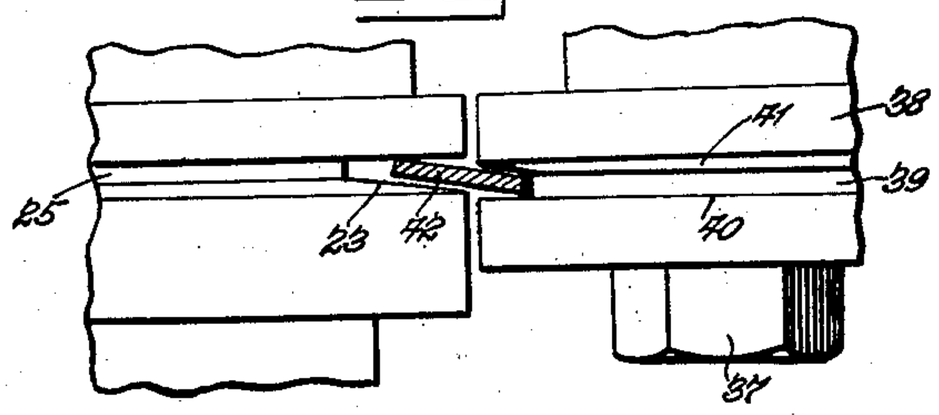


Fig. 7.



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UNITED STATES PATENT OFFICE

2,022,154

MACHINE AND METHOD FOR MAKING PISTON RINGS

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Application November 21, 1934, Serial No. 754,008

7 Claims. (Cl. 153—64.5)

This invention relates to a machine and method for making piston rings.

An object of the invention is to provide a machine for rolling a strip of metal into annular form and at the same time applying pressure to the opposite sides of the inner and outer margins by cooperating rollers which also apply pressure to the inner and outer edges of the strip and to utilize the combined effects of these pressures to bend the strip into annular form and to dish the resulting annular strip or ring.

Another object of the invention is to provide a machine having novel conveniently operative means for varying the positions of the rollers relatively in order that the machine may be satisfactorily used to form rings of different sizes or diameters.

Various other objects and advantages of the machine will be apparent from the following description, reference being made to the annexed drawings, in which—

Fig. 1 is a top plan view of the machine having the top frame member removed and one of the adjusting shafts in section on the line 1—1 of Fig. 2.

Fig. 2 is a side elevation of the machine showing the rollers that change the straight form into annular form.

Fig. 3 is a vertical sectional view along the irregular line 3—3 of Fig. 4.

Fig. 4 is a vertical sectional view of the machine at right angles to the section of Fig. 3.

Fig. 5 is a side elevation of a portion of the machine showing the rollers adjusted to form rings of relatively large diameter.

Fig. 6 is a view showing the rollers in adjustment to form rings of relatively small diameter.

Fig. 7 is an enlarged fragmentary elevational view of portions of the rollers that produce the dished formation of the rings, the ring strip being shown in section on the line 7—7 of Fig. 6 and out of engagement with the walls which press against opposite sides of the opposite marginal portions of the strip in actual operation.

The machine comprises a frame including two upright spaced side portions 1 and 2 having rigid or integral connection 3 at their lower ends and having their vertical ends in rigid or integral connection with end members 4 and 5. A top member 6 may be attached to the upper end of the frame by screws 7. A frame 8 is mounted for vertical sliding movements to different vertical adjusted positions in the machine frame above described. The frame 8 has vertical grooves 9 in its ends receiving ribs 10 formed on the frame members 4 and 5. A rod 11 extends through the plate 6 and is screwed through the central portion of the frame 8, having a head 12 on its lower end engaging under inwardly extended portions 13 in the frame 1 (Fig. 2). A handle 14 may be attached to the upper end of the rod 11 for rotating the same. The structure comprising the parts 12 and 13 prevent the rod 11 from moving endwise or longitudinally when said rod is rotated; and the threaded engagement of the rod 11 with the frame 8 will move said frame 8 vertically along the rod 11.

A shaft 15 is journalled for rotation in bearings 16 formed in connection with the frames 1 and may be rotated by any appropriate driving device, such as a pulley or wheel 17 attached to said shaft for engagement with an operating device (not shown). A roller element 18 is attached to the shaft 15 at the opposite side of the machine frame from the pulley 17 and is formed with a circumferential flange 19 having a radial wall 20 along its outer side. A cooperating roller element 21 is mounted on the shaft 15 and is provided with an annular flange 22 that encircles the outer end of the roller element 18 and is formed with an end wall 23 that flares outwardly away from the wall 20. The roller element 21 may be held in any desired relationship with respect to the roller element 18 by suitable spacing means 24, such as shims or washers located between the roller elements 18 and 21. Thus, the width of the slot groove 25 formed by the radial wall 20 and the outwardly flaring wall 23 may be varied, as desired, by varying the number or thickness of the spacers 24.

A collar 26 is attached to the shaft 15 adjacent to the roller element 21. The outer end of the shaft 15 is threaded (Fig. 3) and a nut 27 is screwed on said threaded end. A tube 28 is rigid with the nut 27 and telescopes on the collar 26, which should be round in order to permit the tube 28 to turn with the nut 27 in mounting and removing the tube 28. The inner end of the tube 28 presses against the roller element 21 and holds said roller element 21 in rigid relationship to the roller element 18.

Two frames 29 and 30, which may be of duplicate construction, are mounted for horizontal sliding movements in guides 31 in the frame 8. These frames 29 and 30 may be moved horizontally toward and from each other. A shaft 32 is screwed through the frame 29 and has its inner end engaged in a sleeve 33 mounted and held from endwise movement in the frame 8 (Fig. 4). A similar shaft 34 is screwed through the frame

30 and has its inner end engaged with the sleeve 33. The inner ends of the shafts 32 and 34 may be engaged with the sleeve 33, so that either of said shafts will rotate said sleeve 33, or not, as desired. As shown, the inner ends of the shafts 32 and 34 are rigidly attached to the sleeve 33, so that either of said shafts will rotate said sleeves and thereby rotate the other shaft. The threads on the shaft 32 run oppositely from the threads on the shaft 34, as a consequence of which rotation of said shafts in one direction will move the frames 29 and 30 inwardly toward each other and rotation of said shafts in the opposite direction will move said frames outwardly from each other. The outer end of the shaft 32, which is beyond the end member 4 of the frame, is equipped with a handle 35, whereby said shaft may be conveniently rotated and the outer end of the shaft 34, which is beyond the end member 5 of the frame, is equipped with a handle 36 for the same purpose.

A shaft 37 is rotatively supported by the frame 29 parallel with the shaft 15 and has attached thereto a roller 38 having a circumferential groove 39 provided with a radial wall 40 at the outer side of said groove and with a wall 41 at the inner side of said groove flaring away from the wall 40 in a plane approximately parallel with the wall 23. The radial wall 40 is outwardly slidable beyond the inner section of the wall 23 with the periphery of the roller element 21, so that the bottom of the groove 39 is outwardly beyond the bottom of the groove 25 (Fig. 7). A satisfactory adjustment of the parts is that shown in which the intersection of the inclined wall 41 with the bottom of the groove 39 is approximately in the same plane as the intersection of the inclined wall 23 with the bottom of the groove 25. The bottoms of these grooves 25 and 39 are slightly wider than the thickness of the strip 42 that is to be formed into a ring or rings by operation of the machine.

The frame 30 supports a rotary shaft 43 parallel with the shafts 15 and 37. A roller 44 is attached to the shaft 43 adjacent to the roller comprising the roller elements 18 and 21. The roller 44 is formed with a circumferential groove 45, which, as shown, is defined by two radial walls 46 and 47 the same distance apart as the peripheral portions of the walls 20 and 23.

The shaft 15 operates devices for rotating the shafts 37 and 43. As shown, a sprocket wheel 48 (Fig. 4) is attached to the shaft 15 and is engaged by a sprocket chain 49. The sprocket chain 49 engages a sprocket wheel 50 on the shaft 37 and a sprocket wheel 51 on the shaft 43. The sprocket chain 49 also engages a sprocket wheel 52 supported by a lever 53. The lever 53 is mounted on a pivot 54 supported by the frame of the machine and is actuated downwardly by a spring 55, so that the wheel 52 functions as a tensioning device for the chain 49.

A guide 56 for the metallic strip 42 may be mounted on the frame 1 at an appropriate distance from the feeding and forming devices, including the roller 38, which may be designated as a combined feeding and forming roller, since it cooperates with the two-part roller 18 and 21 to feed the metallic strip and to apply pressures against opposite sides of the opposite marginal portions and against the edges of said strip, so that when said strip passes between the roller 44 and the composite roller 18—21, the strip is coiled into annular form of a diameter determined by the positions of the rollers 38 and 44 with respect to each other and to the composite roller 18—21. When a long strip is coiled into annular form, the coils pass from between the rollers onto the tube 28 and are supported by said tube until the strip is severed or until all of the strip is coiled and the strip disengaged from the rollers.

To form rings or coils of relatively large diameter, the adjusting and supporting device 11 is operated to move the frame 8 upwardly and support said frame in its upwardly adjusted position. Then one or the other of the rods 32 or 34 is rotated to move the frames 29 and 30 inwardly toward each other until the peripheries of the rollers 38 and 44 are in contact with or adjacent to the periphery of the composite roller 18—21. Then the end of the strip is passed between the roller 38 and the composite roller 18—21 in the grooves 39 and 25 and is subjected to lateral pressure along opposite sides of its opposite marginal portions by the inclined walls 23 and 41 and is subjected to edgewise pressure by the bottom walls of the grooves 25 and 39. The strip then passes between the composite roller 18—21 and the roller 44 and tilts or inclines from the wall 46 to the wall 47, the outer edge of the strip or coil engaging in the corner formed by intersection of the inner wall 46 with the bottom wall of the groove and the inner marginal portion of the coil engaging against the outer portion of the wall 47.

The rollers 38 and 44 may be moved to different selected adjustments to make coils or rings of any desired diameters by operating the devices 11, 32 and 34 to locate the rollers 38 and 44 in proper relationship to the composite roller 18—21. This machine has been used with a high degree of satisfaction in the manufacture of piston rings and large numbers of such rings may be manufactured in a comparatively short time by a single operator using this machine. A long strip 42 may be shaped into a continuous coil and thereafter cut at appropriate points to form the separate split piston rings with the ends of the respective rings spaced apart properly, so that the rings may be mounted on pistons and compressed within cylinders for which they are intended.

The construction of this machine may be varied within the scope of equivalent limits without departure from the nature and principle of the invention.

I claim:

1. A machine for forming a strip of metal into a piston ring comprising a pair of rollers having grooves to receive the strip and each of said grooves having an inclined wall at one side thereof applying pressure laterally against opposite sides of opposite marginal portions of the strip passing through said grooves and having its edges engaging the bottoms of said grooves, and an additional roller having a peripheral groove receiving said strip and cooperating with said first named rollers to bend said strip into annular form.

2. A machine for forming a strip of metal into a piston ring comprising a pair of rollers having grooves receiving opposite marginal portions of the strip and having walls applying lateral pressure against opposite sides of said opposite marginal portions of the strip passing through said grooves and having its edges engaging the bottoms of said grooves, and an additional roller having a peripheral groove receiving said strip

and cooperating with said first named rollers to bend said strip into annular spiral form.

3. A machine for forming a strip of metal into continuous spiral annular form comprising rollers having grooves receiving and applying pressure laterally against opposite sides of opposite marginal portions of said strip, and an additional roller cooperating with said first rollers to bend said strip into continuous spiral annular form in which the inner marginal portion is dished from the radii of the outer margin.

4. A machine for forming a strip of metal into a piston ring comprising a pair of rollers having grooves to receive the strip and each of said grooves having an inclined wall applying pressure laterally against opposite sides of opposite marginal portions of the strip passing through said grooves and having its edges engaging the bottoms of said grooves, an additional roller having a peripheral groove receiving said strip and cooperating with said first named rollers to bend said strip into annular form, and means for adjusting and securing said rollers in different relative positions to bend strips into annular form of selected diameters.

5. A machine for forming a strip of metal into a piston ring comprising a pair of rollers having grooves receiving opposite marginal portions of the strip and having walls applying lateral pressure against opposite sides of said opposite marginal portions of the strip passing through said grooves and having its edges engaging the bottoms of said groves, an additional roller having a peripheral groove receiving said strip and cooperating with said first named rollers to bend said strip into annular spiral form, and means for adjusting and securing said rollers in different relative positions to bend strips into annular form of selected diameters.

6. A machine for forming a strip of metal into continuous spiral annular form comprising rollers having grooves receiving and applying pressure laterally against opposite sides of opposite marginal portions of said strip, an additional roller cooperating with said first rollers to bend said strip into continuous spiral annular form in which the inner marginal portion is dished from the radii of the outer margin, and means for adjusting and securing said rollers in different relative positions to bend strips into annular form of selected diameters.

7. The method of forming a strip of metal into a continuous dished spiral annulus which consists in applying lateral pressure to opposite sides of the opposite marginal portions of said strip and simultaneously applying pressure to the opposite edges of said strip and bending said strip into continuous spiral annular form while said strip is under said pressures.

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