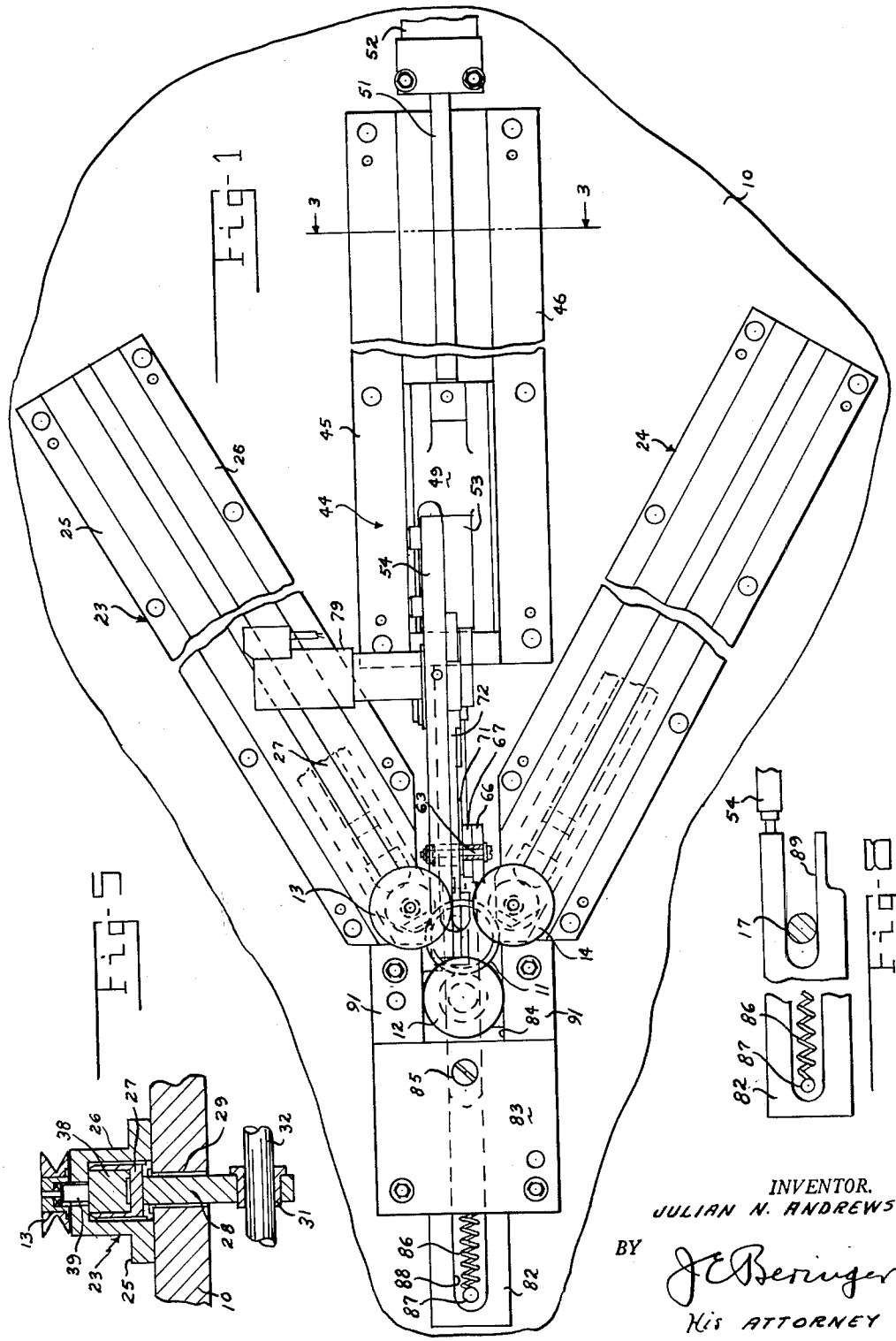
July 7, 1964 J. N. ANDREWS 3,139,707

METALLIC O-RING POLISHING MACHINE

Filed Oct. 17, 1962 2 Sheets-Sheet 1

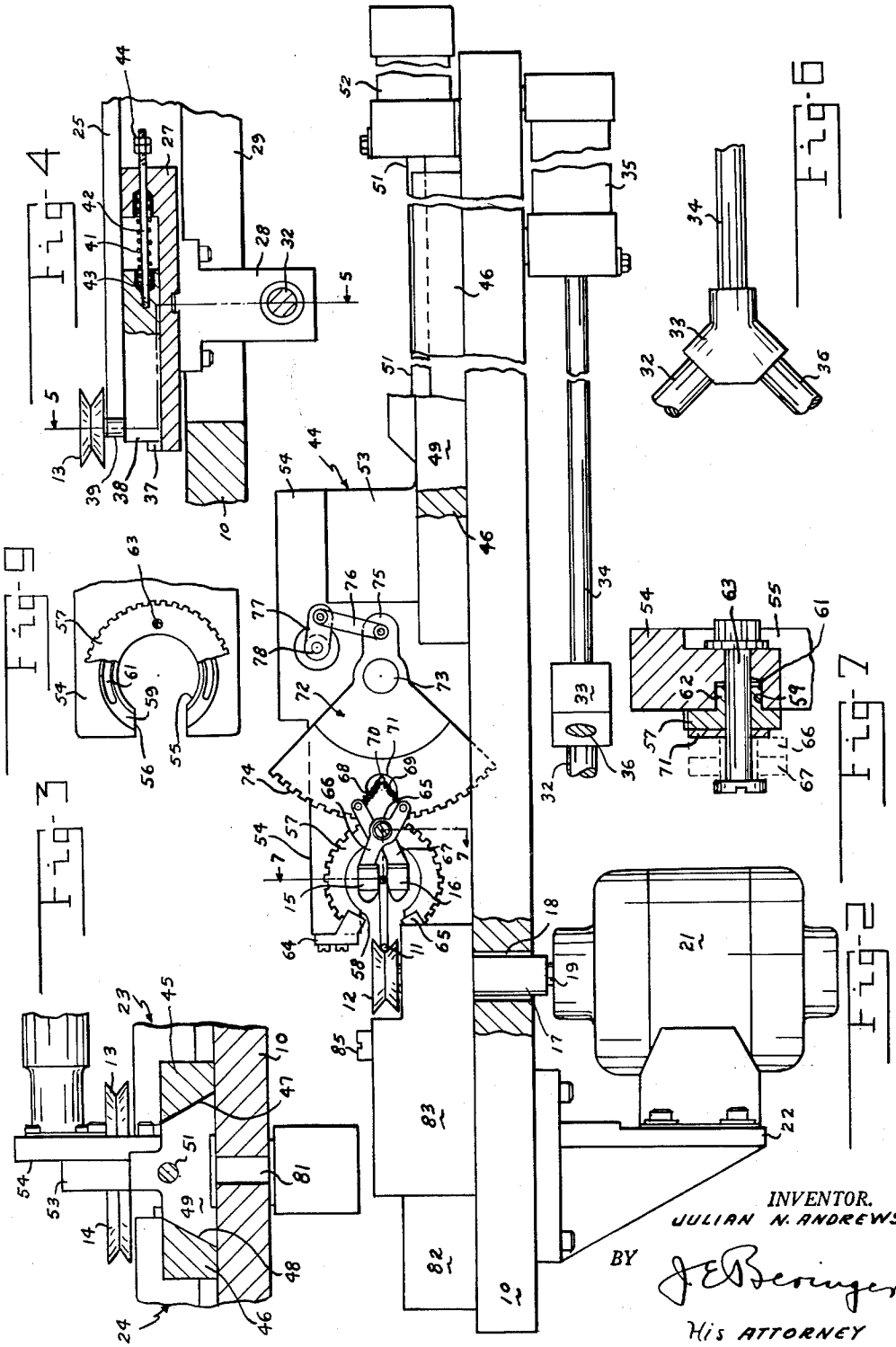


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METALLIC O-RING POLISHING MACHINE

Filed Oct. 17, 1962 2 Sheets-Sheet 2



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United States Patent Office 3,139,707 Patented July 7, 1964

3,139,707

METALLIC O-RING POLISHING MACHINE

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Filed Oct. 17, 1962, Ser. No. 231,243
12 Claims. (Cl. 51—58)

This invention relates to process tools and particularly to a tool adapted to polish the entire outer surface of a metal O-ring or the like, as a part of a machine operation.

Metal O-rings, used as sealing gaskets, have a requirement for a smooth exterior relatively free of superficial grooving and the like. It is proposed by the instant invention that, after forming, the ring shall be subjected to a buffing and polishing operation in a machine suitably constructed and arranged for the purpose.

Another object of the invention is to provide a machine of the class described utilizing motion in different senses of a ring and of polishing means to finish expeditiously the entire ring surface.

A further object of the invention is to provide a machine accepting rings of different diameter and operable thereon without adjustment through automatic compensation of ring holding and working devices.

Still another object of the invention is to provide a machine facilitating the mounting and processing of a ring as described, the machine components lending themselves to automatic actuation and control.

Other objects and structural details of the invention will appear from the following description, when read in connection with the accompanying drawings, wherein:

FIG. 1 is a plan view of a machine in accordance with the illustrated embodiment of the invention;

FIG. 2 is a view in side elevation, partly broken away, of the machine of FIG. 1, certain angularly disposed ring ring engaging slide mechanisms being omitted;

FIG. 3 is a fragmentary view in cross-section, taken substantially along the line 3—3 of FIG. 1;

FIG. 4 is a fragmentary view in longitudinal section, taken through one of the angular slide members;

FIG. 5 is a detail view in cross-section, taken substantially along the irregular line 5—5 of FIG. 4;

FIG. 6 is a detail plan view of a Y-joint comprised in the angular slide mechanism;

FIG. 7 is a detail fragmentary view taken through the polishing head with the polishing arms being indicated in dotted outline, the view being taken generally along the irregular line 7—7 of FIG. 2;

FIG. 8 is a detail plan view of resilient means associated with the polishing head carriage; and

FIG. 9 is a fragmentary view of the front end of the polishing head carriage, partly broken away.

Referring to the drawings, the invention is disclosed as embodied in a machine tool for polishing metal O-rings. The machine comprises a stationary table or base plate **10** providing chief support for ring mounting and polishing devices. In carrying out the polishing operation, a metal O-ring **11** is gripped at spaced points on its periphery by a plurality of angularly disposed relatively movable rollers **12**, **13** and **14** held thereby in an elevated position above the base plate **10**. A pair of wheels **15** and **16**, made of a fine abrasive or buffing material, are adapted to engage upper and lower or opposite faces of the ring **11** and are supported for a relative oscillating motion transversely of the plane of the ring. Simultaneously with this motion the ring is rotated about its axis and the result of the combined motions is to effect a buffing and polishing of the entire ring surface.

Considering the involved structure and mode of operation in greater detail, the rollers **12–14** have the configuration of sheaves for engaging O-rings of varying cross-sectional area. The roller or sheave **12** is secured to one end of a shaft **17** which is vertically disposed in an opening **18** in the base plate **10** with the said one end thereof in upwardly projecting relation to the base plate. The other or lower end of the shaft **17** is in driven relation to a shaft **19** forming a part of a rotary electric motor **21** mounted on the underside of base **10** through bracket means **22**. The roller **12** is thus arranged for and capable of powered rotation but is fixed relative to the base **10** insofar as bodily shifting motion is concerned. The rollers **13** and **14**, on the other hand, while being rotatable are bodily shiftable relative to base **10** in a manner to be advanced on and retracted from the roller **12**.

The rollers **13** and **14** are movable on respective slideways **23** and **24** angularly disposed in a manner to cause the rollers **13** and **14** to move in respectively converging and diverging paths as they advance on and retract from roller **12**. The slideways **23** and **24** are identical so that a description of one will suffice for both. Thus, slideway **23** is comprised of like angle rails **25** and **26** fastened to the plate **10** in a facing or opposing relation to one another. Having a sliding mounting between the opposing rails **25** and **26** is a block **27**. A tongue **28** is secured to the underside of block **27** and is received in an elongated slot **29** in the base plate **10**. Projecting downwardly through and beyond plate **10**, the tongue **28** has a bearing **31** installed in its lower projecting portion slidingly receiving a rod **32**. The latter projects from an end mount in a Y-fitting **33** mounted on the projecting end of a piston rod **34** extensible and retractable from a hydraulic cylinder **35**. Fitting **33** mounts another and like rod **36**, the rods **32** and **36** being in a divergent relation and extending into like cooperative engagement with tongue elements **28** of respective slideway devices **23** and **24**. Extension and retraction of piston rod **34** as described accordingly results in sliding movements of respective block members **27** in their slideways **23** and **24**.

Each block **27**, and again referring to the example of slideway **23**, is formed with an upwardly opening channel configuration **37** in which is slidingly received an extension member **38**. Installed in this member is an upwardly projecting stub shaft **39** on which the roller **13** has a rotary bearing. A compression spring **41** is interposed between recesses in the rear of mounting block **27** and extension member **38**. A rod **42** is surrounded by spring **41** and has an end portion **43** anchored in member **38**. The rod **42** passes through and beyond mounting block **27** and has abutment means **44** on the other or outer end to limit forward thrust of the rod. The arrangement, as may be seen, is one to provide a yield in the mounting of the roller sheaves **13** and **14** whereby these members may resiliently engage the O-ring **11** and accommodate variations in the movement of the mounting blocks in the slideways **23** and **24**. Upon extension of piston rod **34**, therefore, the mounting blocks **27** advance in their respective slideways **23** and **24** until the roller sheaves **13** and **14** engage the O-ring, with slight permitted additional extending motion of the mounting blocks **27** compressing the springs **41** and causing the roller-sheaves **13** and **14** to seat the O-ring with a yielding pressure on roller-sheave **12**. The roller-sheaves are, as noted rotatable so that rotation of the positively driven roller-sheave **12** may effectively turn the O-ring about its axis. The arrangement is one to accommodate O-rings of different diameters with extending motion of the piston rod **34** being selectively interrupted when the roller sheaves **13** and **14** shall engage and apply a holding pressure to an encountered O-ring.

The aforementioned polishing wheels **15** and **16** are located intermediate the roller-sheaves **13** and **14** and are movable as a part of a carriage means **44** disposed longitudinally between the slideways **23** and **24**. Laterally

spaced apart rails 45 and 46 have opposing inclined faces 47 and 48 respectively complementarily engaging corresponding side surfaces on a slide member 49, the latter being thus confined between the rails 45 and 46 with freedom only of longitudinal sliding motion. A piston rod 51 is extensible and retractable from a hydraulic cylinder 52 and is connected to slide member 49 to effect longitudinal motion thereof as described. At what may be considered its forward or inner end the slide member 49 is formed with an upstanding wall portion 53 to which is fastened a forwardly projecting plate extension 54. Near the front extremity of plate extension 54 a transverse circular opening 55 is formed opening by way of a slotted formation 56 through such forward extremity. The arrangement is one to give the plate extension 54 a bifurcated configuration by which it may extend into embracing relation to the O-ring 11 which is thus received within the lateral circular opening 55. A spur gear 57 overlies opening 55, having a ring-like configuration and a slotted side opening 58 corresponding to circular opening 55 with its slotted portion 56. In surrounding relation to opening 55, in member 54, is a circular groove 59. In groove 59, and terminating short of the ends thereof, is an arcuate slot 61. On the underside of gear 57 is a flange 62 complementary to groove 59 and received therein. A bolt 63 extends transversely through member 54 and mounted gear 57 passing through slot 61 and cooperating therewith to limit rotary motion of gear 57 in either direction. Retainer devices 64 and 65 on the respective projecting extremities of plate extension 54 have turned over portions to hold the spur gear 57 seated on the plate 54.

The polishing wheels 15 and 16 are rotatable on the ends of respective lever arms 66 and 67. These cross one another to define a scissors-like device. At the point of intersection the levers are pivotally mounted on an outer projecting end of bolt 63. The ends of levers 66 and 67, opposite wheels 15 and 16 have tension springs 68 and 69 attached thereto having a common connection to an intermediate stud 70 projecting from an anchor plate 71. The latter is mounted on a bolt 63 between the levers 66–67 and gear 57. A sector gear 72 lies between plate 71 and member 54 in the plane of gear 57.

The member 72 is rotatably mounted on a stud 73 on the extension plate 54 and to one side of such pivot point has a toothed surface 74 meshing with spur gear 57. On the other side of pivot point 73, the member 72 is formed with an arm 75 connected by a link 76 to a crank arm 77 on a shaft 78. The shaft 78 is rotatable, as for example by an electric motor 79 mounted on one side of the plate extension 54. In response to rotation of the shaft 78, crank arm 77 turns, and, through link 76, rocks sector gear 72 in an oscillatory motion about pivot point 73. Spur gear 57 accordingly is correspondingly moved in an oscillating sense, carrying with it the pair of crossed levers 65 and 66. The wheels 15 and 16, which are biased in an approaching direction by the springs 68 and 69 accordingly make a wiping contact with the surface of O-ring 11 in to and fro circular motions which tend to overlap. By virtue of such wiping motion, accomplished in conjunction with the rotary turning movement of the ring 11 the entire outer surface of the O-ring is buffed and polished. The travel of the sector gear 72 into and beneath the plane of base plate 10 is accommodated by a longitudinally extending slot 81 in the base plate.

The carriage means 44, with mounted polishing mechanism, is selectively advanced in correspondence with the roller sheaves 13 and 14 to conform to the diameter of the O-ring to be polished. Resilient means displaceable by forward travel of the carriage means 44 is defined by a slide-like member 82 having a slidable mounting on the base plate 10. The member 82 is confined and guided in its movement by stationary reactant means 83 fastened to the base plate and having on its under side a through longitudinal groove 84. One end of the member 83 is broken away to define spaced arms allowing for passage of the spindle 17 upward through groove 84 to accommodate roller sheave 12. A stud member 85 is set in the member 83 and projects downward into the groove 84. A spring 86 is tensioned between screw stud 85 and an anchor stud 87 in slide member 82. The spring 86 is partly received in a recess 88 in member 82. The member 82 is generally aligned with the carriage means 44 and has an elongated slot 89 for passage of the spindle 17 therethrough. The inner end thereof is specifically aligned with and adapted to be engaged by the lower projecting bifurcation of plate extension 54. Spring 86 is relatively weak and normally projects member 82 forwardly of stationary means 83 where its upper surface may act as an extension of a table-like surface 91 on the said spaced arms on means 83. These surfaces may be used to support the O-ring while the machine is being closed thereon, the arrangement being one to enable sheaves 12–14 to grip and position the work automatically.

In the latter regard it will be understood that starting and stopping of the motors 21 and 79, as well as extension and retraction of the piston rods 34 and 51 may be suitably effected in a timed relation under automatic control—also that these operations might be performed manually or by power devices other than those shown.

What is claimed is:

1. Apparatus for the polishing of metal O-rings, including a support, a plurality of rollers mounted on said support in angularly disposed relation to one another and in a common plane, said rollers being rotatable and capable of relative movement in said common plane, an O-ring if disposed in said plane being adapted to be gripped at spaced points on its periphery by said rollers, means for rotating at least one of said rollers to rotate a gripped O-ring, a carriage on said support adapted to be advanced on a gripped ring, and dual polishing means on said carriage engageable with opposite faces of a gripped O-ring.

2. Apparatus for the polishing of metal O-rings, including a support, relatively rotatable and slidable means on said support for peripherally gripping and turning an O-ring, carriage means slidable on said support and adapted to be advanced on and retracted from a gripped ring, polishing means on said carriage means for simultaneously engaging opposite faces of the O-ring, said polishing means including opposed devices biased in a relative approaching direction, and oscillatory means on said carriage means carrying said devices.

3. Apparatus for the polishing of metal O-rings, including a support, relatively rotatable and slidable means on said support for peripheral gripping and turning an O-ring, carriage means slidable on said support and adapted to be advanced on and retracted from a gripped ring, polishing means on said carriage means for simultaneously engaging opposite faces of the O-ring, said polishing means including opposed devices biased in a relative approaching direction, oscillatory means on said carriage means carrying said devices, and independently operable means on said carriage means for oscillating said oscillatory means.

4. Apparatus for the polishing of metal O-rings, including a support, relatively rotatable and slidable means on said support for peripherally gripping and turning an O-ring, polishing means adapted to engage opposite faces of the O-ring including opposed biased devices, an oscillatory mount for said devices, a slidable carriage on said support mounting said devices and said mount therefor, and means on said carriage for rocking said oscillatory mount, including a pivotally movable member, a crank and independent motor means for turning said crank.

5. Apparatus acording to claim 4, characterized by peripheral teeth on said mount and said pivotally movable member interengaged to establish a driving relation between said member and said mount.

6. Apparatus for polishing the surface of metal O-rings, including means for holding a ring while rotating it about its axis, a pair of finger-like polishing devices adapted to grip opposing faces of the ring in a common plane transversely intersecting a held ring, and means for oscillating said devices in said plane to accomplish in conjunction with rotation of the ring a polishing of the entire outer surface thereof.

7. Apparatus for polishing the surface of metal O-rings, including a support, a plurality of rollers angularly disposed to one another in a common plane and mounted on said support for circumferentially spaced peripheral gripping engagement with a ring disposed in said plane, certain of said rollers being bodily displaceable relative to said support to accommodate rings of differing diameter to the grip of said rollers, means for rotating said ring, and dual polishing means engageable with opposite surfaces of the ring, said polishing means being disposed in a plane transverse to said common plane and mounted on said support for relative oscillatory motion to accomplish in conjunction with rotation of the ring a polishing of the entire outer surface thereof.

8. Apparatus according to claim 7, characterized by a spur gear rotatably mounted on said support and carrying said polishing means, and means meshed therewith for oscillating said spur gear.

9. Apparatus for polishing the surface of metal O-rings, including a support, roller means mounted on said support and relatively adjustable to make circumferentially spaced peripheral contact with an O-ring, a carriage slidable on said support, polishing means on said carriage brought to cooperative relation with said O-ring by advance of said carriage, and slide means supporting said O-ring for gripping by said roller means, said slide means being biased in one direction and displaced in the opposite direction by advance of said carriage.

10. Apparatus for the polishing of metal O-rings, including a support, means for mounting an O-ring including a roller projected from and rotatable in said support and other rollers projected from and slidable in said support in paths converging toward said rotatable roller, means for rotating such rotatable roller, and polishing means intermediate the paths of motion of said slidable rollers simultaneously engageable with opposing faces of a mounted O-ring, said last named means being supported for oscillatory motion in a plane transverse to the plane in which said O-ring is held, said polishing means acting in conjunction with rotation of the ring to polish the entire outer surface thereof.

11. Apparatus for polishing the surface of metal O-rings, including a support having an elongated central portion and relatively divergent side portions, carriage means reciprocable in said central portion, a mounting block reciprocable in each of said side portions, means for mounting an O-ring in said support, a rotatable roller on each of said blocks, said blocks being advanceable on an O-ring to engage said rollers therewith, relatively stationary roller means on said support upon which an O-ring seats under engagement by said rotatable rollers, means for rotating an O-ring in the grip of said rollers and rollers means, and polishing fingers mounted on said carriage means to engage underlying and overlying surfaces of an O-ring, said carriage means being advanced in conjunction with the advance of said blocks to engage an encountered O-ring as described.

12. Apparatus according to claim 11, characterized by means on said carriage means to oscillate said polishing fingers to accomplish in conjunction with rotation of a ring a polishing of the entire outer surface thereof.

References Cited in the file of this patent

UNITED STATES PATENTS

476,248	Case	June 7, 1892
960,447	Tyden	June 7, 1910
2,039,223	Hutchinson	Apr. 28, 1936
2,398,022	Marren	Apr. 9, 1946