Sept. 10, 1968 E. S. PIERCE 3,400,451

WIRE WORKING APPARATUS

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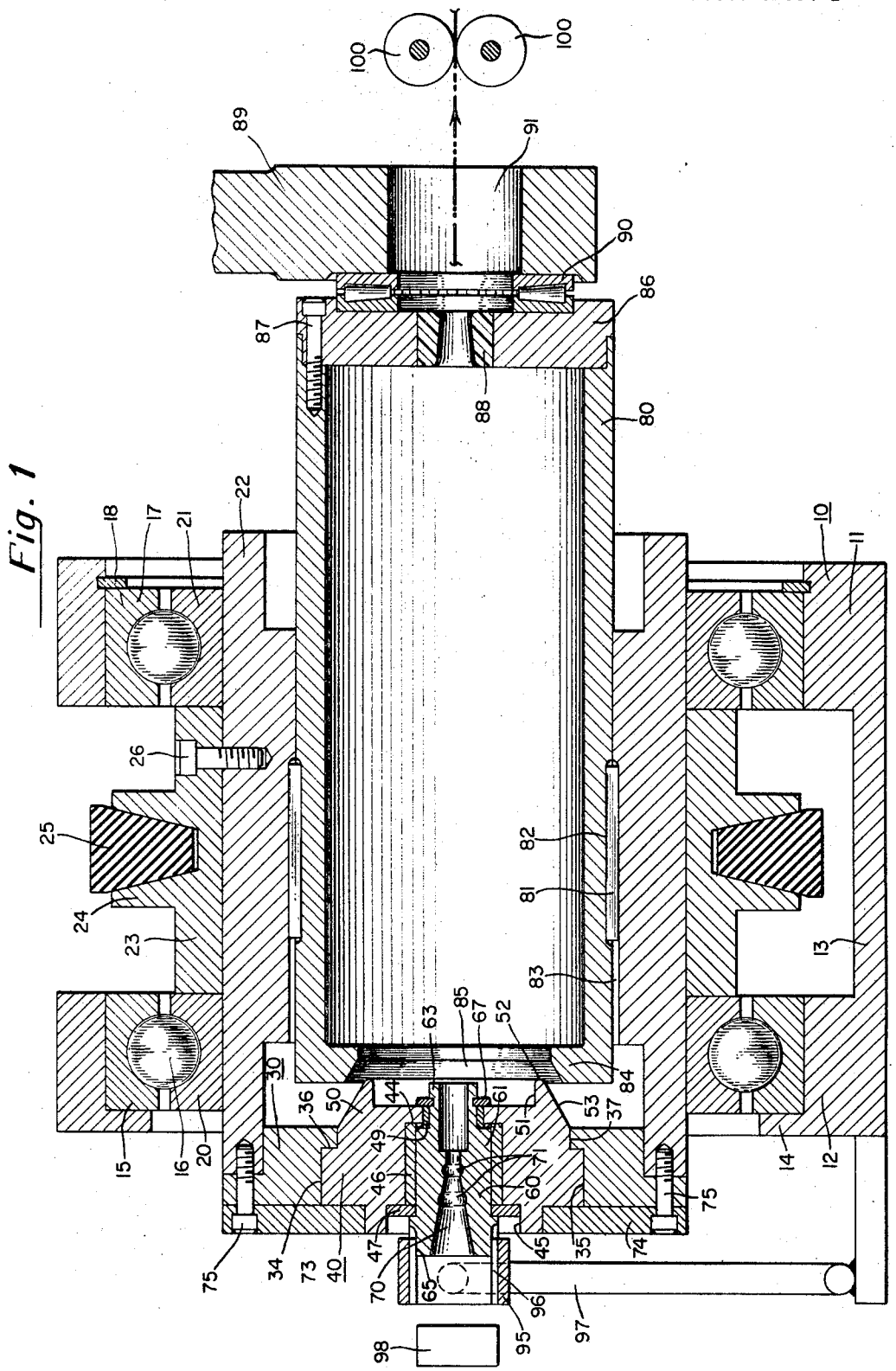
Fig. 1



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WIRE WORKING APPARATUS

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Fig. 3

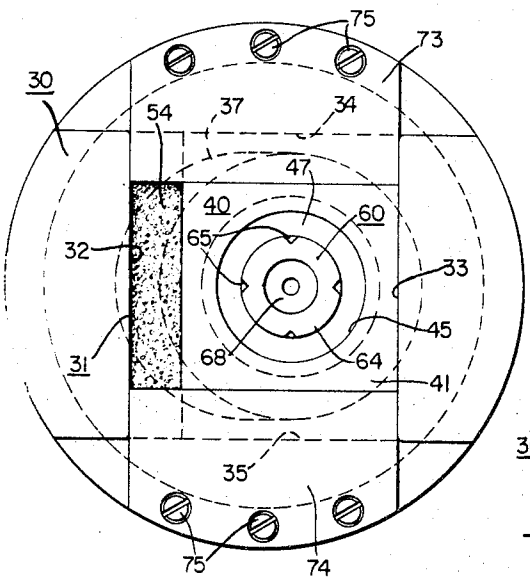


Fig. 2

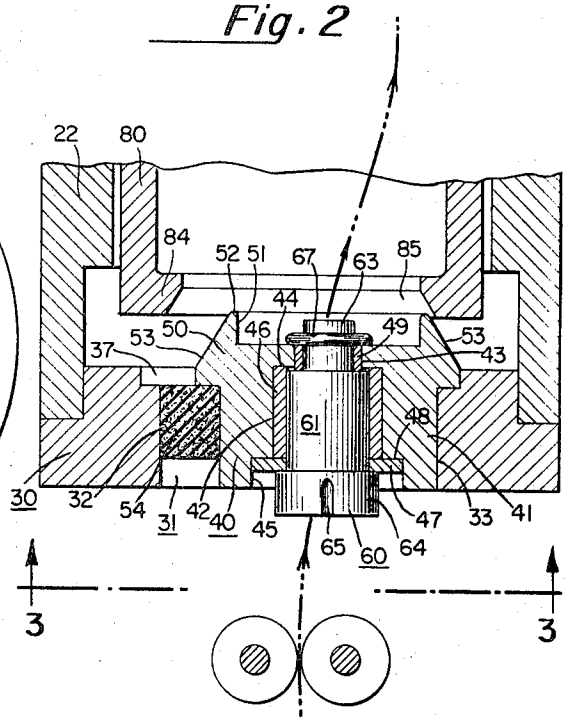
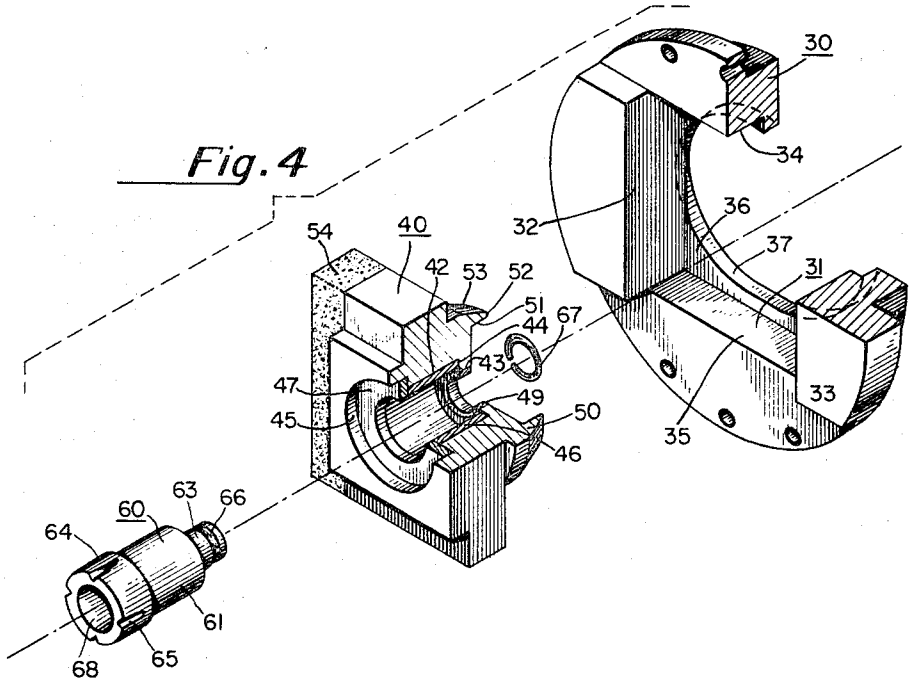


Fig. 4



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WIRE WORKING APPARATUS

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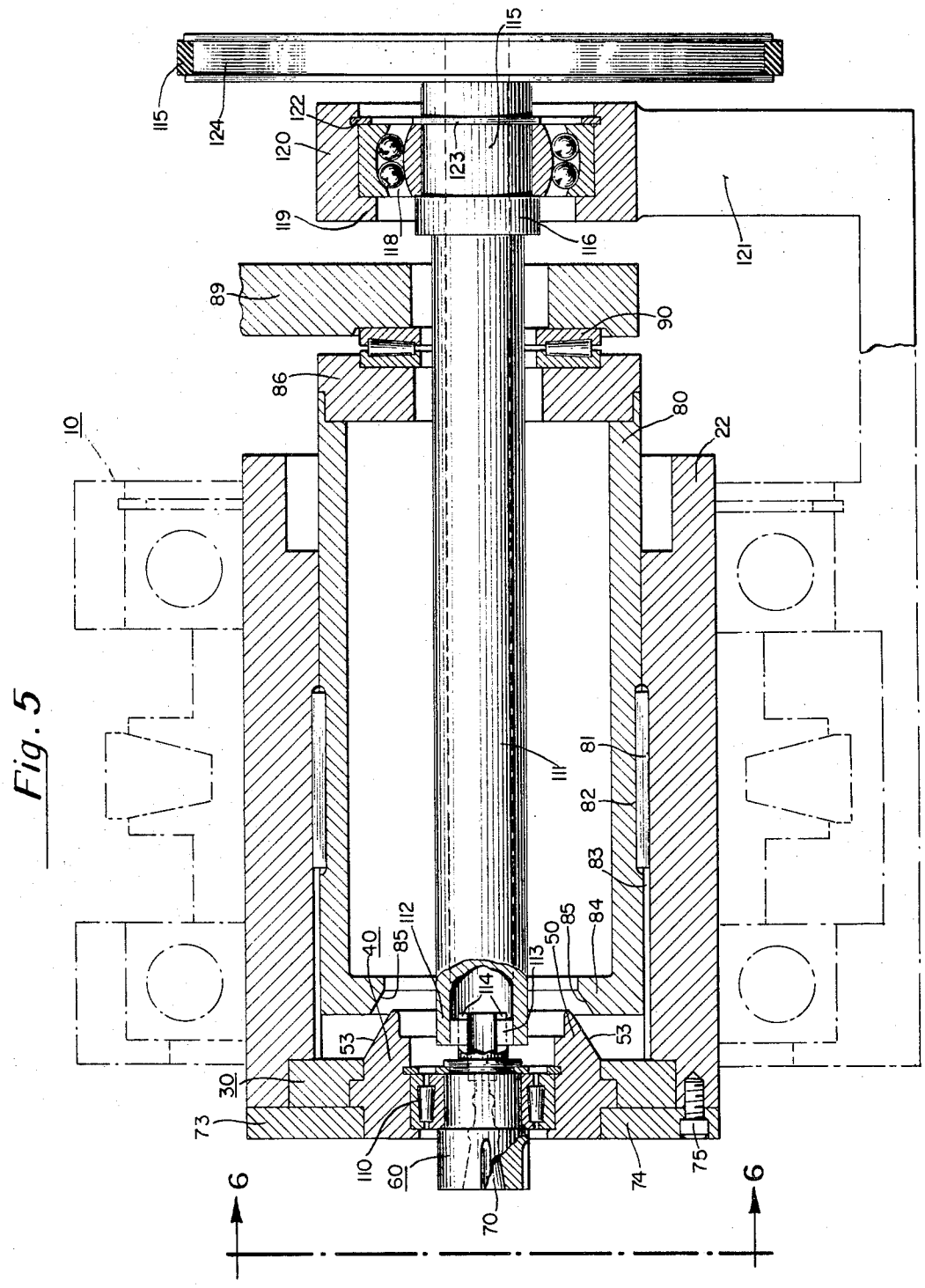

Fig. 5

Fig. 6

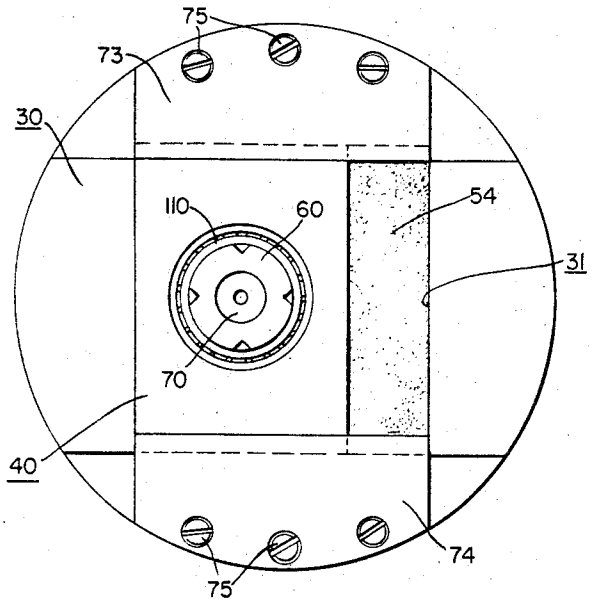

Fig. 9

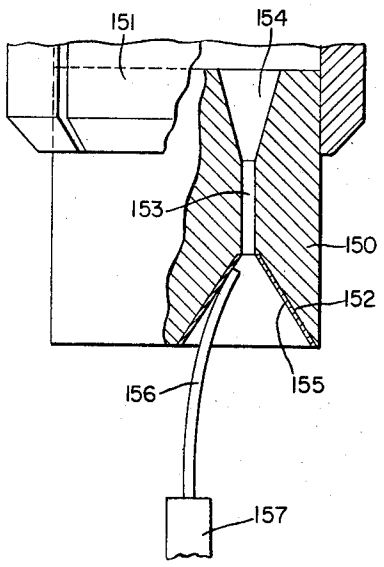

Fig. 10

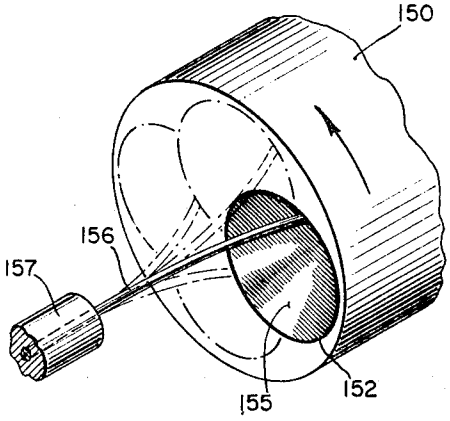

Fig. 11

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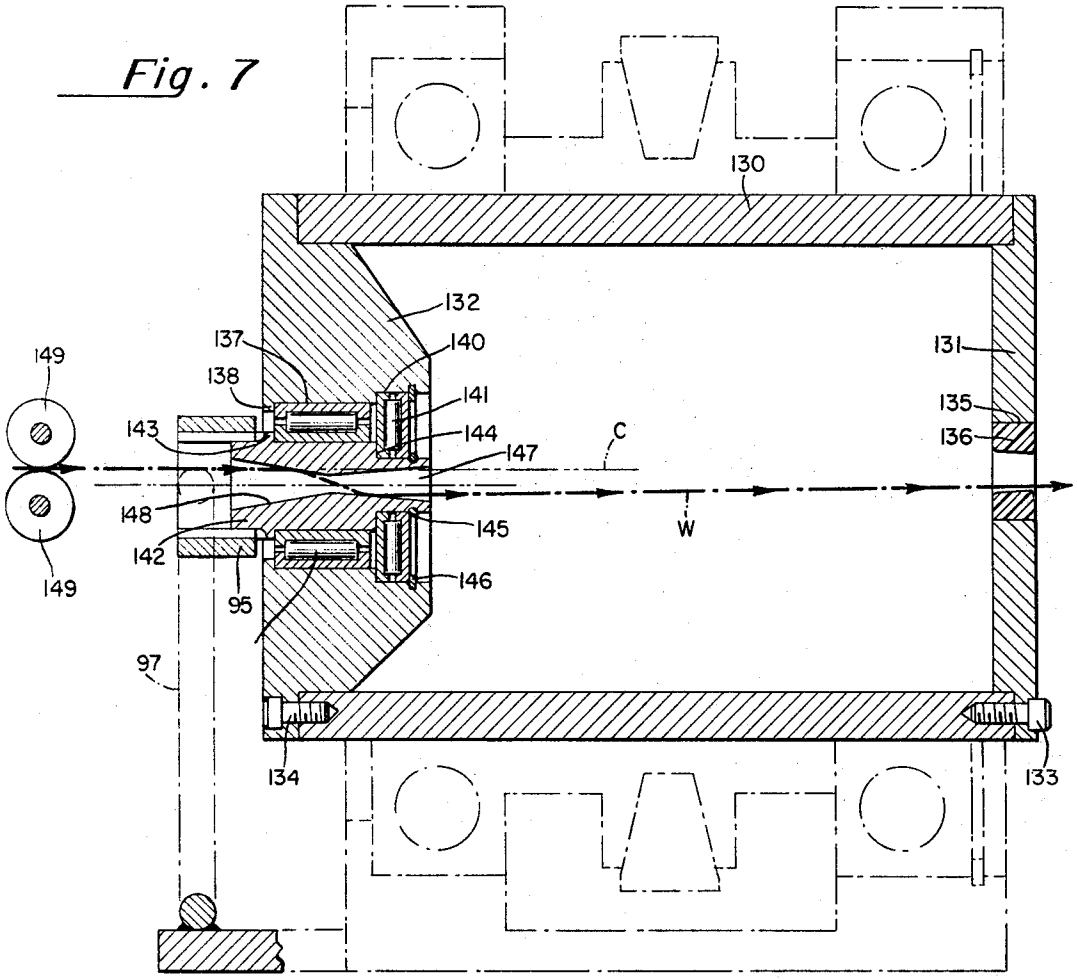
Fig. 7



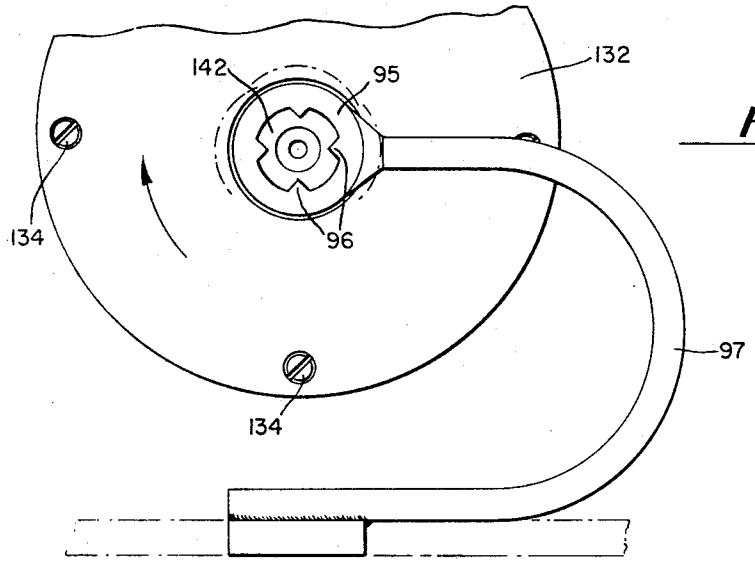


Fig. 8

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3,400,451

WIRE WORKING APPARATUS

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Filed Jan. 23, 1967, Ser. No. 611,062
19 Claims. (Cl. 29—561)

ABSTRACT OF THE DISCLOSURE

The instant disclosure is of machines for grinding, burnishing and/or straightening either continuous or short lengths of tempered or resilient metal wire or rods.

BACKGROUND OF THE INVENTION

The invention relates to the field of grinding, burnishing or shaping continuous or short lengths of tempered or resilient metal wire or rod to remove surface imperfections common to drawn wire and rods such as draw marks, pits and the like and to provide other surface effects as well as to straighten the wire or rod.

Heretofore apparatus has been proposed as illustrated for example by patents to Green 2,497,407, issued Feb. 14, 1950; Stewart 2,293,923, issued Aug. 25, 1942; and Matteson 1,797,174, issued Mar. 17, 1931, to perform one or more of the functions noted above. Such prior mechanisms have not however provided the desired versatility and efficiency in operation and it is the principal object of the instant invention to overcome such disadvantages of the prior art.

SUMMARY OF THE INVENTION

Briefly summarized the invention resides in an apparatus comprising an internal conical annular grinding surface against which the wire or rod is fed. The annular grinding surface may, in one form of the invention, be itself held against rotation but subject to oscillation. In another form of the invention the annular grinding surface may be also rotated either in the same but suitably in the opposite direction from the oscillatory movement. The annular grinding surface may be so formed, as when applied to a wire fed at intervals, to provide special surface effects on the wire as for example successive portions of larger and smaller diameters.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a sectional view taken longitudinally through one form of an apparatus embodying the instant invention;

FIG. 2 is a sectional view similar to the lower part of FIG. 1 but taken at right angles to the showing of FIG. 1;

FIG. 3 is a sectional view taken on the line 3—3 of FIG. 2;

FIG. 4 is an exploded perspective view of certain elements of the apparatus of FIGS. 1 to 3;

FIG. 5 is a view similar to FIG. 1 of a modified form of the apparatus embodying the instant invention;

FIG. 6 is a sectional view taken on the line 6—6 of FIG. 5;

FIG. 7 is a sectional view illustrating a further embodiment of the invention;

FIG. 8 is an end view of the embodiment of FIG. 7;

FIG. 9 is a view partially in elevation and partially in section of a further embodiment of the invention;

FIG. 10 is a perspective view on an enlarged scale illustrating a portion of the embodiment of FIG. 9 and its operation; and

FIG. 11 is a sectional view on an enlarged scale of a wire or rod following its processing by certain embodiments of the apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring now to the drawings and more particularly to FIGS. 1 to 4 there is shown a mounting **10** comprising spaced rings **11** and **12**, respectively, connected by a web **13** which may be rigidly attached to any desired support such as a wall, floor or other suitable member. Ring **12** includes an inner flange **14** forming a stop for the outer race **15** of a suitable bearing such as ball bearing **16**. A similar ball bearing **17** has its outer race confined against outward movement by a snap ring **18** fitting in a groove **19** in ring **11**. The inner races **20** and **21** of the bearings **16** and **17** respectively are secured in any suitable way to an outer sleeve **22** for rotation therewith. Also secured to the outer sleeve as by stud **26** is a ring **23** defining a pulley **24** for a driving belt such as the V belt **25** illustrated.

The lower end of the outer sleeve, as viewed in FIGS. 1 and 2, supports a circular plate **30** having a rectangular recess **31** (see FIGS. 3 and 4). Recess **31** (see particularly FIG. 4) is defined by a first pair of opposed walls **32** and **33** and a second pair of opposed walls **34** and **35**, walls **34** and **35** being spaced apart a greater distance than the first pair of walls. A bottom wall **36** of the recess includes a concentric opening **37** generally ovaloid in shape and having its major diameter perpendicular to and of a length somewhat greater than the spacing of walls **32** and **33** and its minor diameter of a length somewhat lesser than the spacing of walls **34** and **35**. Mounted within recess **31** is a unit **40** comprising a rectangular block **41** centrally bored to form a bore **42** extending part way through the block and terminating at a shoulder **44** and a smaller coaxial bore **43** extending the remainder of the thickness of the block. Bore **42** is countersunk as shown at **45**. A suitable bearing such as a brass bushing **46** is inserted within bore **42** and a thrust bearing **47** such as a brass washer or the like is seated on shoulder **48** and surrounds bore **42**. A bushing **49** similar to bushing **46** is inserted within bore **43**.

Block **41** includes an integral extension **50** of circular cross-section coaxial with bore **42**. Extension **50** has a central recess **51** defined by circular lip **52** having an outer frusto-conical wall **53**. The diameter of extension **50** at the base thereof is substantially equal to but slightly less than the minor diameter of opening **37**. A block **54** of rubber or other readily compressible but resilient material is secured by any suitable means to a lateral sidewall of block **41**, blocks **41** and **54** together being so dimensioned as to be readily received within but to fill recess **31**, when the resilient block **54** is in its relaxed state.

A cylindrical tool **60** has an intermediate portion **61** of a diameter to be rotatably received within bushing **46** a forward extension **63** of a diameter to be rotatably received in bushing **49** and a rear portion **64** of enlarged diameter to be received in countersunk portion **45**. Portion **64** is provided with a plurality of locking slots **65** for a purpose hereinafter described and forward portion **63** is grooved as at **66** to receive a locking ring **67**. The internal surface **68** of tool **60** includes (see FIG. 1) a grinding annulus **70** of generally conical configuration but suitably including, for a purpose hereinafter to be explained, annular grooves **71**. The grinding annulus **70** terminates in a cylindrical portion **72** of an enlarged diameter relative to the inner end of the grinding annulus. Grinding annulus **70** is coated with carborundum, diamond grit, carbide or ceramic grits or other suitable abrasive material.

Tool **60** is assembled in unit **40** by inserting the portions **61** and **63** in bushings **46** and **49** respectively and securing it therein by placing snap ring **67** in groove **66**. Unit **40** is mounted in plate **30** by compressing block **54** sufficiently that the projecting portion of extension **50** can pass wall **33** the unit then being inserted in recess **31** until extension **50** reaches opening **37** the compression force on block **54**

then being released to allow the unit to assume the position shown in FIGS. 1 and 2. Unit **40** is retained in this position in plate **30** and plate **30** in turn is secured to outer sleeve **22** by segmented plates **73** and **74** which are received in recesses formed in unit **40** and plate **30**. Plates **73** and **74** are secured to outer sleeve **22** as by screws **75**. As will be observed particularly from FIGS. 2 and 3 when the parts are assembled as described above block **41** and tool **60** supported therein will be off center or eccentric with respect to sleeve **22**.

Interfitting within outer sleeve **22** is an inner sleeve **80** the sleeves being connected for conjoint rotation but relative endwise sliding movement by keys **81** confined in slots **82** of the inner sleeve and seated for sliding movement in elongated slots **83** of the outer sleeve. The lower end, as viewed in FIGS. 1 and 2, of the inner sleeve **80** is partially closed by a circular flange **84** defining a funnel shaped opening **85** having a diameter at its mouth slightly less than the diameter of extension **50** at its base. The wall of the funnel shaped opening slopes at substantially the same angle as the angle of slope of wall **53** of extension **50**.

The upper end of inner sleeve **80** is closed by a cap plate **86** secured thereto as by screws **87**. Cap plate **86** has a central opening in which a bushing or sleeve **88** is secured the bushing being of nylon or other similar material to avoid excessive abrasion of the wire as it travels therethrough in the manner hereinafter explained. One end of a pressure arm **89** overlies cap plate **86** and is separated therefrom by an annular thrust bearing **90**. The end of pressure arm **89** overlying inner sleeve **80** has a central bore of larger diameter but coaxial with the central opening in sleeve **88**. Pressure arm **89** is adapted to be moved between the raised position shown in FIG. 1 and a lowered position in which it forces inner sleeve **88**, through the interaction of the walls of funnel shaped wall **85** and the outer wall of extension **50**, to shift the rectangular block **41** to position tool **60** concentrically to the sleeve, block **54** of rubber or the like being compressed during such shifting movement. The means for causing the lowering or downward movement of the pressure arm has not been shown but may be any suitable manually or mechanically operated means or electrically operated means such as a solenoid operated device.

In the form of the invention shown in FIGS. 1 to 4 tool **60** is held against rotation with the sleeves by any suitable means. For example such means can comprise a collar **95** having ribs **96** interfitting in slots **65** in tool **60**. Collar **95** is held against rotation but permitted to move with the tool as the latter moves in its eccentric path and between its eccentric and concentric positions by a U-shaped spring bracket **97** having one end secured to the collar and its other end secured to a fixed frame member.

Where the mechanism described above is to be employed for the form grinding of a continuous length of wire or the like a wire supply reel (not shown) is supported by any suitable means (not shown) below the device. A manually or mechanically operated gripping device, illustrated only diagrammatically at **98** and which may be of any suitable type, is employed the gripping device being located to guide the wire concentrically of the sleeves and being so constructed or operated as to intermittently release the wire to the grinding tool **60** at the required intervals as to form grind the wire through the intermediary of the grooves **71** of the tool to a desired shape such as that shown for example in FIG. 6. Opposed rolls **100** adapted to be constantly driven by any suitable means (not shown) are supported above the sleeves in position to receive between them a wire passing through bushing **88** the rolls being adapted to exert a slipping drawing action on the wire to maintain tension thereon during the grinding operation and to pull the wire through the device when the gripping action of device **98** is released.

In preparation for the grinding operation pressure arm **89** is moved downwardly to shift the tool into concentric relationship with the sleeve, and the wire is then drawn from the reel, threaded through the gripping device, through tool **60**, bushing **88** and between rolls **100**. The outer sleeve is then driven through the medium of pulley **25** at a speed of say 8,000 to 15,000 r.p.m. and rolls **100** are driven to exert constant tension on the wire. Pressure arm **89** is then raised whereby the block **41** and the tool **60** carried thereby are shifted into eccentric relationship with respect to the outer sleeve, the tool then exerting a grinding action on the wire held stationary at this point. After a predetermined interval during which the wire is ground to provide a section having adjacent portions of different diameters as determined by the characteristics of the tool, pressure arm **89** is again lowered to bring the tool into concentric relationship to the sleeve and the wire is then advanced, gripping device **98** being opened or released for this purpose, to position a second section of the wire within the grinding tool. Pressure arm **89** is then again raised and the second grinding operation performed. These operations are continued until the desired length of the wire has been ground to produce an effect such as shown in FIG. 11. It will be understood of course the ground areas need not be contiguous as shown in FIG. 11 but can be of any desired spacing and character.

When the device of FIGS. 1 to 4 is to be employed for the centerless grinding or burnishing of a continuous length of wire to a uniform diameter the gripping device **98** is omitted and the wire is drawn directly from the reel preferably through a tension means of any suitable type (not shown) and to the opposed rolls **100**. In this case the pressure arm is lowered to shift the tool concentrically to the sleeves only for the initial threading operation the pressure arm then being raised and the wire thereafter being continuously drawn through the tool to obtain a uniform surface grinding or burnishing effect. While the grinding surface shown in FIGS. 1 to 4 may be employed it is preferable in this instance to employ a tool having the grinding surface illustrated in FIG. 7.

The device of FIGS. 1 to 4 may also be employed for the form grinding of the end portions of individual pieces of wire such as the grinding of the points of needles or the like. For this purpose the pieces of wire are successively inserted in a chuck such as that shown at **156** in the form of the invention shown in FIG. 9. Pressure arm **89** is lowered as before to force the inner sleeve downwardly to adjust the tool to its concentric relationship to the sleeves and the chuck is supported by suitable means (not shown) to locate the end of the wire within and in concentric relationship to the grinding surface of the tool. Upon rotation of the sleeves and the raising of pressure arm **89** the end of the wire is ground by what is in effect centerless grinding. The tool may have some special configuration to provide a desired end shape for the needle or other wire element. On the other hand if a pointing or sharpening of the wire is the desired effect a tool having a plain grinding surface such as that of FIG. 7 may be used.

Referring now to FIGS. 5 and 6 a second embodiment of the invention is illustrated employing for the most part the construction features of the embodiment of FIGS. 1 to 4, such common features being given the same reference characters. Thus in the embodiment of FIGS. 5 and 6 the inner and outer sleeves **22** and **80**, respectively, are keyed together for joint rotation but relative endwise sliding movement as in the first embodiment. The tool **60** and the mounting means therefor may be identical to those of the first embodiment except that due to certain features which will be described hereafter, suitably a roller bearing **110**, the beaing being of the type which also serves a thrust bearing function, is substituted for the bushings **46**, **47** and **49**.

The distinguishing feature of the second embodiment lies in the ability of the tool to rotate independently of the sleeve structure and in either direction. The means for this purpose comprises a hollow tube **111** the lower

end of which is joined to a tubular washer **112** in any suitable manner. The tubular washer is provided with two diametrically opposed projections **113**, although a greater number may be employed if desired, the projections interfitting in slots **114** in the upper end of tool **60**. Tube **111** extends through sleeve **80** and beyond the end thereof and beyond pressure arm **89**. The projecting outer end carries a collar **115** fixed thereto in any suitable manner the collar including an enlarged portion **116** defining an annular flange supporting the inner race of a ball bearing unit **118**. The outer race of the ball bearing unit **118** is supported on an interior annular flange **119** formed in ring **120** preferably integral with an arm **121** which is supported in fixed position from the framework of the machine. Split washers **122** and **123** interfit in grooves in the inner surface of the ring **120** and in collar **115**, respectively, to retain the inner and outer races against their respective shoulders. A pulley **124** is affixed to the upper ends of the tube **111** the pulley being adapted to be driven from any suitable source (not shown) by a belt **115**. Tube **111** is composed of a material such as a rubberized fabric or the like of the type employed for pressure tubing or hose or may be a hollow wound shafting material or is otherwise of such construction that it has the ability to flex laterally during the travel of the tool in its eccentric path but at the same time transmit torque to the tool.

The embodiment of FIGS. 5 and 6 operates, when employed for either the centerless grinding of continuously moving lengths of wire or for wire shaping, in the same manner as described for the embodiment of FIGS. 1 to 4 except that in this second embodiment the tool is also rotated through the medium of the flexible tube **111** and its driving mechanism. Thus the tool may be rotated in the opposite direction to the rotation of the inner and outer sleeves **22** and **80** to increase the grinding speed over that afforded by the rotation of the sleeves alone. On the other hand the tool may be rotated in the same direction as the sleeves to reduce the grinding speed. A particular advantage of this feature is that the effective r.p.m. may be readily varied to provide the different desired grinding effects while the rate of feed and hence the delivery of the wire remains constant as may be required for subsequent operations thereon. Also very high grinding speeds may be obtained without injury to the device. For example by rotating the sleeve structure at the acceptable rate of 15,000 r.p.m. previously mentioned while rotating the tool in the opposite direction at up to 15,000 r.p.m. an effective grinding speed of up to 30,000 r.p.m. results.

The embodiment of the invention illustrated in FIGS. 7 and 8 is of a simplified construction primarily adapted for operation on a continuously moving wire for the centerless grinding or burnishing thereof. However it may serve the function of pointing short lengths of wire similarly as the embodiment of FIGS. 1 to 4. In this form of the invention a single sleeve **130** is employed the sleeve being mounted for rotation in the same manner as the outer sleeve of the previously described embodiments. The sleeve has end members **131** and **132** secured thereto as by a series of screws **133** and **134** only one of each series being shown. End member **131** has a central aperture **135** in which a bushing or sleeve **136** of the same type as bushing **88** of the first embodiment is secured. End member **132** has an eccentrically located cylindrical aperture **137** the annular wall of which is defined in part by a flange **138** providing a shoulder supporting the outer race of a roller bearing unit **139**. The annular wall of aperture **137** is also defined in part by a recessed wall **140** defining a shoulder for the partial support of the inner race of a roller thrust bearing **141**. A hollow grinding or polishing tool **142** which is of generally cylindrical shape includes a flange **143** supporting the inner race of roller bearing **139** and an end portion of reduced diameter defining a shoulder **144** in part supporting the inner race of thrust bearing **141**. The bearings are maintained in position and the tool is held against endwise movement relative to end member **132** by a snap ring **145** interfitting a groove in the tool and a snap ring **146** interfitting a groove in the end member. The tool is held against rotation in the bearings by any suitable means but suitably, as illustrated, by the same means as employed in the first embodiment. The hollow interior of tool **142** comprises a frusto-conical mouth **147** terminating approximately midway of the length of the tool, the wall of the mouth portion defining, when coated with a suitable abrasive, an annular grinding or burnishing surface depending upon the particular abrasive employed. The remainder of the hollow interior of the tool comprises a second frusto-conical portion **148** reversed with respect to the mouth and in communication therewith. The outer enlarged end of the mouth portion is of a diameter to extend beyond the centerline C of sleeve **130**.

In the embodiment of FIGS. 7 and 8 rolls **149** driven by any suitable means (not shown) are employed to positively feed or push the wire, indicated by dot-and-dash line W, concentrically of the sleeve **130**. In operation the wire W supplied from a suitable source or reel (not shown), and after being originally threaded through the tool **142**, the hollow interior of sleeve **130** and bushing **136** and to any suitable wire take-up device (not shown), is positively fed or pushed forwardly by the feed rolls **149** into contact with the wall of the conical mouth of tool **142** the wire thereafter taking the path indicated. The wire take-up device may be of any suitable type as previously mentioned but in any event it is of such character that very little if any tension is applied to the wire at the location of the tool.

Referring now to FIGS. 9 and 10 a further simplified form of the invention is illustrated this embodiment being adapted primarily for the pointing and/or straightening of short lengths of wire. The unit which in this instance comprises a cylindrical block **150** is adapted to be mounted for rotation in any suitable way such as in a conventional chuck **151** of a lathe, drill press or the like. Block **150** has an eccentrically positioned conical recess **152** having its apex suitably in communication with a cylindrical channel **153** which in turn is in communication with a conical opening **154** leading from the upper end of the cylindrical block **150**, channel **153** and opening **154** serving to permit the movement of air and particles carried thereby through the block. The annular wall of recess **152** is surfaced with a suitable abrasive **155** of any of the types previously mentioned. A short wire length **156** to be pointed is supported in fixed position in a holder or chuck **157** of any suitable type the chuck being located concentrically of the block and in such position that the end of the wire length to be worked contacts the abrasively coated wall of conical recess **152** intermediate its height.

In operation upon rotation of the block **150** with chuck **151** the end of the wire length is subjected to a grinding action to reduce it to the extent desired as, for example, to a point. At the same time the whipping action to which the wire length is subjected performs a wire straightening function. In this connection, and as will be understood, in each of several embodiments the straightening is inherently achieved by the whipping action to which the wire is subjected.

As will be appreciated from the foregoing description the embodiments of FIGS. 1 to 6 may be employed for either centerless grinding or form grinding of continuous lengths of wire. On the other hand the simplified embodiment of FIGS. 7 and 8 does not permit form grinding but is highly effective for centerless grinding and burnishing. Each of the above mentioned embodiments may, of course, in addition to their other functions be used, as previously pointed out for the embodiment of FIGS. 1 to 4, for pointing short lengths of wire similarly as embodiment of FIGS. 9 and 10. It should be noted that a further

function inherently performed particularly by the embodiments of FIGS. 1 to 4 and 7 and 8 is the burnishing of the ground wire as it necessarily contacts the walls of the nylon bushing or sleeve such as bushing **88** of the embodiment of FIGS. 1 to 4 during its passage therethrough. This burnishing effect is enhanced by particles of the abrasive substance which are released during the grinding action and which settle on the bushing.

It will also be understood that in the use of any of the several embodiments of the invention it is possible to maintain the wire or rod at the desired finished dimensions or character notwithstanding wear or other deterioration of the grinding surfaces by varying the speed of rotation of the tool or of the tool holder or of both, depending upon the embodiment involved, or by varying the rate of feed of the wire and hence the pressure of the wire against the tool. The checking of the wire dimensions may be performed by conventional measuring devices such as diodic inspecting equipment, or an air measurement means. Such devices may, if desired, be employed in connection with suitable mechanisms not herein illustrated to directly modify the factors mentioned above whereby the dimensional characteristics of the wire or rod are automatically maintained. On the other hand continuous manual inspection may be employed and adjustments made manually.

Having thus described the invention in rather complete detail it will be understood that these details need not be strictly adhered to and that various changes and modifications may be made all falling within the scope of the invention as defined by the following claims.

What is claimed is:

1. In an apparatus for working wire, a cylindrical body structure having an axis and including an end structure transverse to said axis with a portion thereof including a conical recess at least normally eccentric to said axis and having an annular wireworking wall, means for rotating said body structure and at least a part of said end structure, and means to advance wire on the line of said axis and into contact with said annular wall.

2. An apparatus as defined in claim **1** wherein said annular wall has an abrasive surface.

3. An apparatus as defined in claim **1** wherein said body structure comprises a sleeve and said part of said end structure is secured to said sleeve, and said portion of said end structure comprises a tool element and there is means mounting said tool element in said part.

4. An apparatus as defined in claim **3** wherein said mounting for said tool element includes means to permit relative rotation between said tool element and said part of said end structure.

5. An apparatus as defined in claim **4** wherein there is means for holding said tool element against rotation with said sleeve.

6. An apparatus as defined in claim **4** wherein there is means for rotating said tool element relatively to said sleeve.

7. An apparatus as defined in claim **3** wherein said part comprises a block containing the mounting for said tool element, said block including resilient means adapted to bias said mounting to an eccentric position with respect to said axis, and there is means to shift said mounting against said bias into concentric relationship to said axis.

8. An apparatus as defined in claim **7** wherein said means to shift said mounting comprises an extension on said block projecting into said sleeve, a second sleeve, means mounting said second sleeve within said first mentioned sleeve for rotation therewith and endwise movement relatively thereto, said second sleeve including means for, upon endwise movement thereof toward said block, cooperation with said extension to shift said block and mounting, and there is means for moving said second sleeve toward and away from said block.

9. An apparatus as defined in claim **8** wherein said extension is of annular configuration and has an inclined surface and said means included in said second sleeve for cooperation with said flange comprises means defining a similarly inclined annular surface.

10. An apparatus as defined in claim **7** wherein said block comprises a rectangular member and said resilient means comprises strip of compressible material secured to said member at one side thereof.

11. An apparatus as defined in claim **7** wherein there is means for holding said tool element against rotation with said sleeve.

12. An apparatus as defined in claim **11** wherein said last named means comprises a fixed support and a resilient U-shaped member having one end secured to said tool and a second end secured to said fixed support.

13. An apparatus as defined in claim **7** wherein there is means for rotating said tool relatively to said sleeve.

14. An apparatus as defined in claim **13** wherein said means for rotating said tool relatively to said sleeve comprises a hollow flexible shaft extending within said sleeve connected at one end to said tool and there is means for rotating said shaft.

15. An apparatus as defined in claim **3** wherein there is a second sleeve within said first sleeve, there is means defining a wire passageway between said conical recess and the interior of said sleeve and wherein said second sleeve includes an end member remote from said recess and there is a bushed opening for the egress of wire from the interior of said second sleeve whereby the wall of said bushed opening performs a burnishing function on wire passing through said opening in contact with said wall.

16. An apparatus as defined in claim **1** wherein there is means defining a wire passageway between said conical recess and the interior of said sleeve and wherein said sleeve includes an end member remote from said recess and there is a bushed opening in said end member for the egress of wire from the interior of said sleeve whereby the wall of said opening performs a burnishing function on wire passing through said opening in contact with said wall.

17. An apparatus as defined in claim **1** wherein said portion of said end structure includes a tool element fixed in an eccentric position relatively to said axis said tool element containing said conical recess, there is means defining a wire passageway between said conical recess and the interior of said sleeve and wherein said means to advance wire on the line of said axis comprises means for pushing said wire against said annular wall through said passageway and into the interior of said sleeve.

18. An apparatus as defined in claim **1** wherein said cylindrical structure comprises a sleeve, there is means defining a wire passageway between said recess and the interior of said sleeve, and said means to advance wire on the line of said axis comprises means to advance a length of wire at spaced intervals.

19. In an apparatus as defined in claim **1** wherein said cylindrical body structure and said end structure comprise a single unit.

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