May 4, 1943. R. C. JOHNSTON 2,318,315

POLISH ROD ROTATOR

Filed Dec. 12, 1941 2 Sheets-Sheet 1

Fig. 1

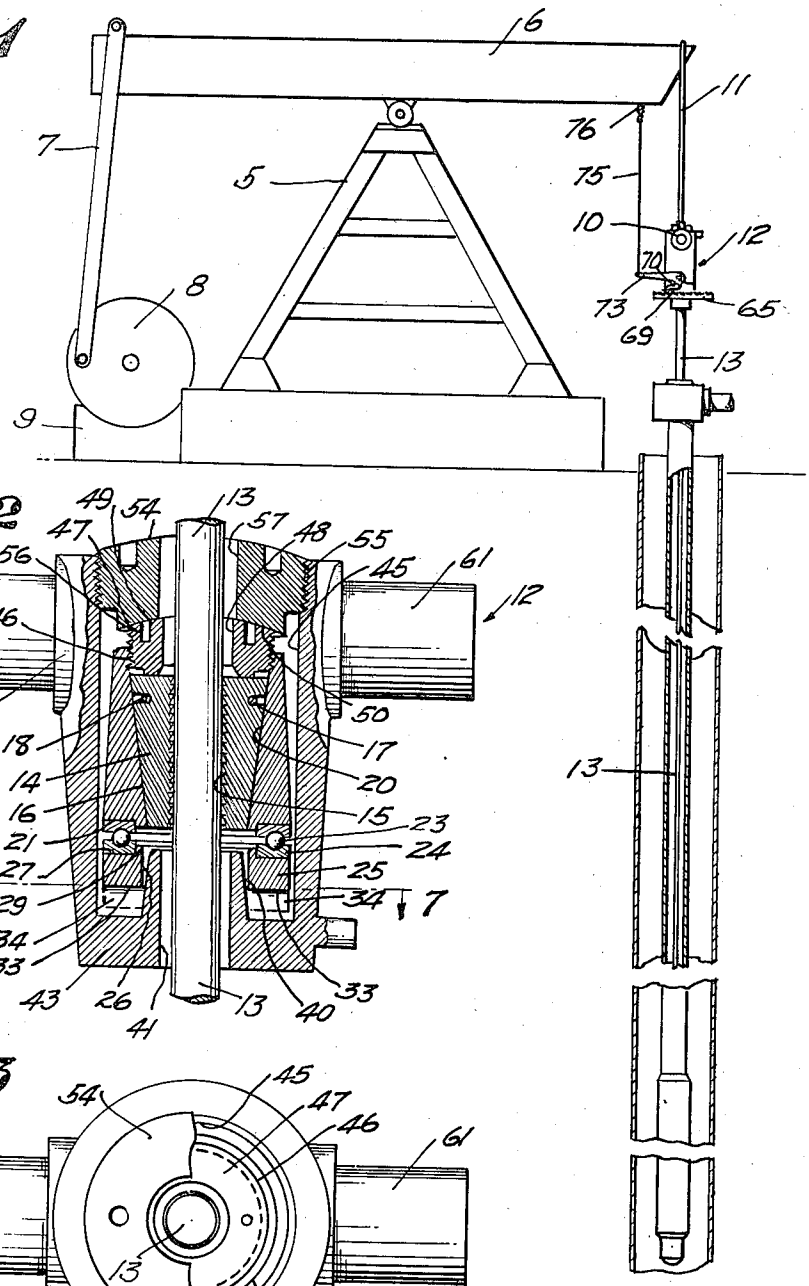


Fig. 2




Fig. 3

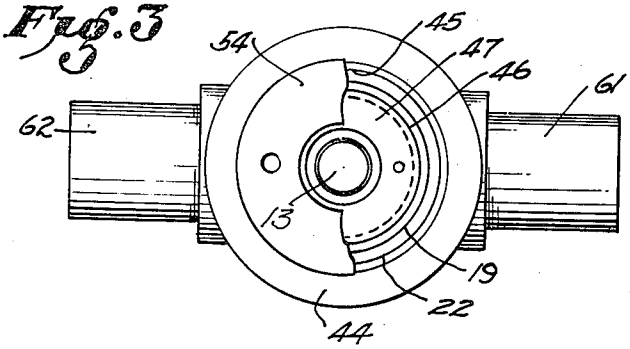


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Fig. 4

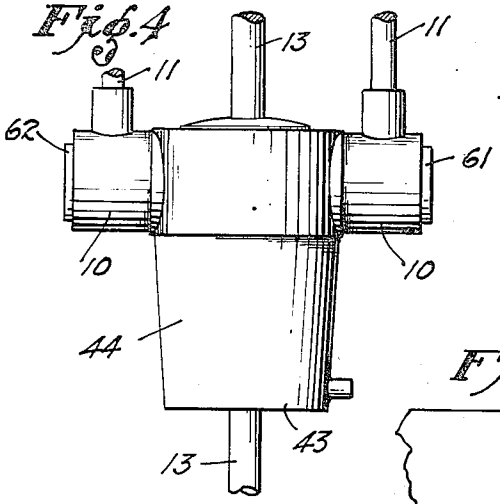



Fig. 7

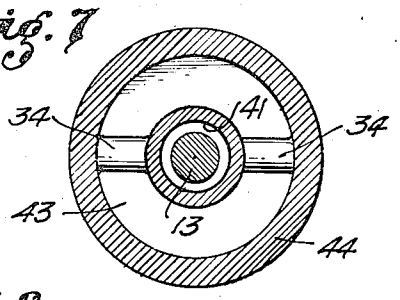



Fig. 8

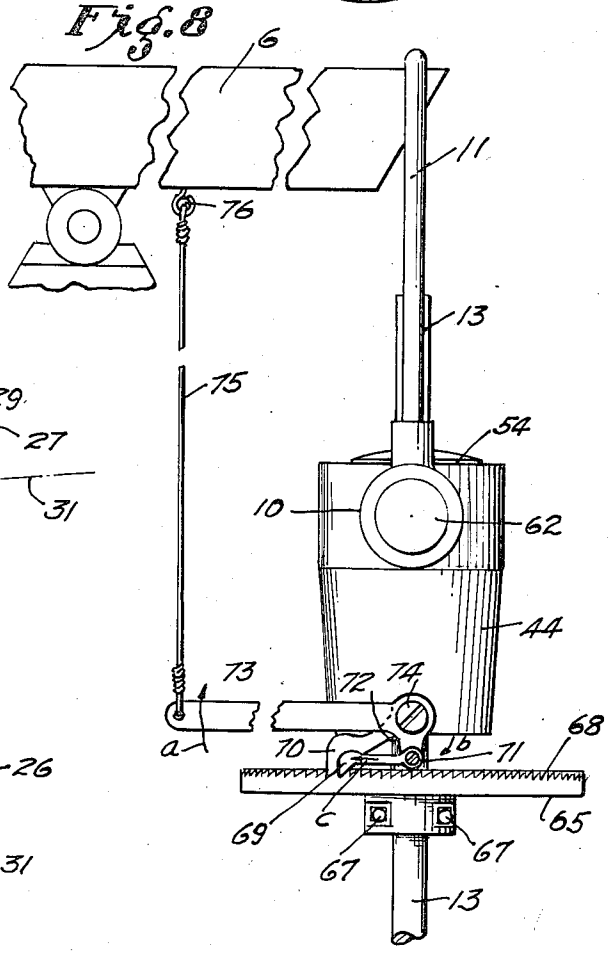



Fig. 5

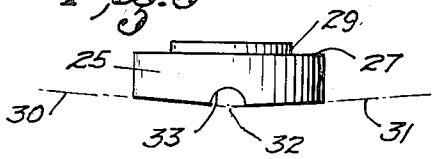
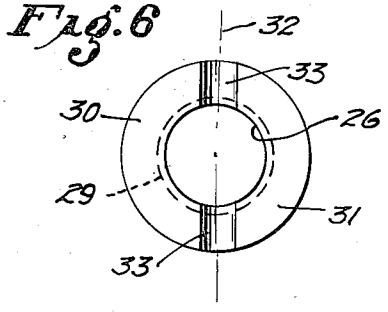



Fig. 6

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Patented May 4, 1943

2,318,315

# UNITED STATES PATENT OFFICE

2,318,315

## POLISH ROD ROTATOR

Robert C. Johnston, Tyler, Tex.

Original application February 6, 1940, Serial No. 317,548. Divided and this application December 12, 1941, Serial No. 422,731

3 Claims. (Cl. 255—14)

This invention relates to oil well production equipment, and particularly pertains to polish rod rotators, and is a division of my co-pending application entitled "Polish rod hanger and rotator," Serial No. 317,548, filed by me February 6, 1940, patented April 21, 1942, No. 2,280,408.

In the operation of well pumping equipment it is common practice to provide a walking beam, at one end of which is attached reins supporting a polish rod hanger. In my co-pending application, of which this is a division, a polish rod hanger structure is claimed in which gripping means are provided for the polish rod. This structure is illustrated and described in the present case in order to disclose one embodiment of the invention. It will be understood, however, that other mountings could be provided which would permit rotation of the polish rod independently of its support on the reins. In connection with the operation of various types of polish rod it is desirable to rotate the rod incident to a reciprocation of the piston rod in the well bore, and thus incident to the reciprocation of the piston within the pumping unit at the production level. It is the principal object of the present invention, therefore, to provide a polish rod hanger which is simple and effective in construction and which acts in direct synchronism with the oscillation of the walking beam to rotate the polish rod an increment of rotation at each reciprocation of the rod.

The present invention contemplates the provision of a polish rod hanger within which a polish rod is gripped in a manner to permit it to have free rotation relative to the hanger, said hanger and polish rod carrying other means connected with the walking beam of a pump mechanism and affected by change in angularity of the walking beam, whereby the polish rod may be rotated an increment of rotation at each reciprocation of the beam and will be held against counter-rotation during the interval between rotation action.

The invention is illustrated by way of example in the accompanying drawings, in which:

Figure 1 is a view indicating a pump jack, the rod hanger structure and a pumping device in a well casing and discloses the application of the present invention.

Fig. 2 is a view in central vertical section showing the details of construction of the rod hanger.

Fig. 3 is a view in plan showing the rod structure and indicating the arrangement of the lock nut for holding the slips.

Fig. 4 is a view in side elevation showing the assembled hanger and the elements of the reins supporting the same.

Fig. 5 is a view in side elevation showing the rock plate disposed beneath the slips.

Fig. 6 is a view in plan showing the under face of the rock plate and the rocker seats therein.

Fig. 7 is a view in plan showing the rocker bars for the rocker plate seats.

Fig. 8 is a view in side elevation showing the rotating element assembly for rotating the polish rod.

Referring more particularly to the drawings, 5 indicates a Samson post of a pump jack, which supports a walking beam 6. The walking beam is oscillated by a pitman rod 7 connected with the driving disc 8 of a pump unit 9. The numeral 10 indicates the bearing portions of the reins 11 by which the pump jack is operatively connected with the structure with which the present invention is concerned. Supported between the bearing members 10 and suspended therefrom is a rod hanger 12 with which the present invention is particularly concerned. Extending through the rod hanger, as indicated in solid lines in Fig. 3 and dotted lines in Fig. 1, is a polish rod 13. It is understood that the polish rod 13 is connected to the upper end of a string of pump rods 13'. The lower end of the string of pump rods connects with a reciprocating piston moving in a pump working barrel, the details of construction of which are of common knowledge in the oil industry.

In the operation of reciprocating pump mechanism used in oil wells it often occurs that an accumulation of sand and silt takes place in the bottom of the working barrel which would prevent the piston from moving to the lower end of its stroke. In usual pumping structures the polish rod is rigidly connected at its upper end to a crosshead or rein structure so that in the event of accumulation of material in the lower end, which would shorten the effective stroke of the pump rod, there would be a tendency for the rod to buckle. In my U. S. Letters Patent No. 2,122,944 slip means were provided to make it possible for the rod hanger to automatically adapt itself to rod conditions and to compensate for differences between the pumping stroke of the rod hanger and the actual pumping movement of the pump rod. Such a structure is embodied in the present invention with additional improvements, including means for rotating the pump and polish rods automatically.

The slips are here indicated at 14 in Fig. 1 of the drawings. These slips may be of any desired

number and have inner serrated faces 15 and outer tapered back portions 16, a cross-section of which slips is arcuate. The slips are yieldably urged toward their innermost position by an annular spring clip 17 which is in the form of a split spring ring fitting within an arcuate groove 18 formed in the outer face 16 of each of the slips. The slips are mounted within a slip bowl 19 which has a frustoconical inner face 20 against which the outer arcuate faces 16 of the slips rest and along which they may move toward a gripping position. The bowl is formed with an annular seat 21 around its lower end to receive a ball or roller race 22. A set of ball or roller bearings 23 are interposed between the race 22 and a lower race 24, thus providing an antifriction thrust bearing for the lower end of the bowl. The lower race in turn rests upon a rock plate 25. This rock plate is an annular member having a central opening 26 through it and being formed with a shoulder 27 to receive the lower race 24. The inner diameters of the bearing races 22 and 24 are such as to insure that tubular centering extensions 28 and 29 will occur upon the contiguous ends of the bowl 19 and the rock plate 25. As indicated in Fig. 5 of the drawings, the lower face of the rock plate is formed in two converging planes 30 and 31. These planes converge along the equatorial center line of the plate, as indicated at 32. Thus, the plate is free to rock laterally of the center line. In order to facilitate in this rocking motion rocker seats 33 are formed as semi-cylindrical indentations in the lower face of the rock plate and with their centers in register with the center line 32. The rocker plate seats 33 rest upon the rocker bars 34. As shown in Fig. 7, these bars are an integral part of end wall 43 of a cylindrical rod hanger housing 44. The central axes of rocker bars 34 are in the same vertical plane with the axes of trunnions 61 and 62. The housing 44 has a cylindrical center bore 45 within which the rod slip assembly previously described is housed. The end wall of the housing has a central bore 41. The bore 41 is through a tubular part of the housing 44 extending upward to make a channel face 40 to hold lubricants for rocker seats 33 and rocker bars 34. The upper end of the slip bowl 19 is internally threaded at 46 and receives a slip lock nut 47 which prevents the retraction of the slips 14 from the bowl. This lock nut has a central opening 48 therein to accommodate the polish rod 13 and has an annular spheroidal face 49 against which annular spheroidal face 50 of a housing cover 54 rests. The housing cover 54 is threaded into the top of the housing 44 with threads 55 and has a downwardly projecting cylindrical length 56 which is longitudinally adjustable by the threads 55. This will provide clearance between the annular spheroidal faces 49 and 50. This will permit rocking of the slip unit on rockers 34 and also rotation of the slip bowl 19.

As shown in Fig. 2 of the drawings, an enlarged bore 57 extends through the length of the cap 54 and thus provides sufficient clearance for the polish rod 13, which is of smaller diameter. This also makes it possible for the housing cover 54 to be conveniently screwed into position. The housing cover 54 may be held in a locked position by a screw 60 which extends through the wall of the housing and engages the threaded portion 55 of the cover. In order to facilitate in rotating the retaining nut 47 and housing cover 54, these members are provided with cored holes to receive a spanner wrench.

The housing 44 is provided at a point near its upper end with a pair of trunnions 61 and 62 which are embraced by the bearings on elements 10. By this arrangement the housing is free to rock around a horizontal axis as supported by the reins and the moving parts of the pump jack.

It has been found desirable in the operation of the invention to rotate the polish rod and the pump rods suspended thereon incident to the pumping operation. This insures that any wear imposed upon the pump rods will be uniformly distributed around the circumference of the structure and that there will not be the probability of binding or wear at any one point. This prevents flat spots from being worn on the rods and also keeps the rod joints screwed tight. The means for accomplishing this result is indicated in Figs. 1 and 8. Here it will be seen that a ratchet plate 65 is fastened upon the polish rod 13 directly beneath the housing structure 44. The ratchet plate is made in two halves and is formed with hub sections 66 which may be placed in an embracing position around the polish rod and there gripped by bolts 67. Radially disposed ratchet teeth 68 are cut in the upper face of the ratchet disc 65 and are engaged by a rotator pawl 69 and a lock dog 70. The rotating pawl is mounted on a horizontally extending pin 71 carried upon a lug 72. The lug 72 is in the form of a short lever arm formed integral with a cantilever bar 73 with which it is disposed at right angles. The cantilever bar is mounted upon a horizontally disposed pivot pin 74 extending radially from the side of the housing 44 of the hanger and adjacent the lower end thereof. The cantilever bar 73 extends horizontally and at its outer free end is connected with an operating cable 75 which leads vertically to a connection 76 on the walking beam 6 and on the end of the walking beam adjacent to the reins 11. The lock dog 70 is a pawl-shaped member free to rotate on the pivot 74 and held in its lowermost position by gravity. This pawl prevents reverse rotation of the ratchet disc 65 while the locking dog 69 is moving ahead and rotating the ratchet disc 65 and the polish rod 13.

In operation of the present invention the rod hanger is assembled as shown in Fig. 1 of the drawings and is suspended upon the reins 10. The polish rod 13 extends through the rod hanger but is in nowise permanently fastened to the hanger housing. When the pumping mechanism is on its up-stroke the teeth 15 of the slips 14 will engage the outer surface of the polish rod and cause the polish rod to be lifted with the hanger as though it were fastened thereto. During this lifting operation the slips 14 will tend to wedge downwardly along the faces of the bowl 19 and will be yieldably held against the rod by the spring ring 17. The weight of the rods will thus be imposed upon the slips and they in turn will be supported by the bowl. The bowl rests upon the antifriction thrust bearing comprising the bearing races 22 and 24 and the rollers 23. Thus, the bowl with the slips gripped therein is free to rotate around the longitudinal axis of the polish rod, thus eliminating any possibility for holding the rod against rotation which would set up torsional strains in the rod and might cause a fracture of the pump rod at some point in its length or the unscrewing of a rod joint. By the arrangement here disclosed there will be no resistance to rotation, thus permitting the

entire pump rod structure to freely rotate if desired. In the event that the rod hanger moves out of alignment with the rectilinear path of travel of the rod there is a tendency for the rod to be placed under bending strain. In the present case this is obviated to a desired extent by the rocking plate 25 resting upon the rocker bars 34.

In assembling the device the rocker plate 25 has been set in the bottom of the housing 44 with seats 33 resting on the rocker bars 34. Thus, as the hanger moves up and down and tends to swing around the axis of the trunnions 61 and 62 any misalignment between the polish rod 13 and the hanger would cause relative movement of these members in a plane at right angles to that of the pivotal axis of the trunnions and the equatorial plane of the rocker bars 34. This equatorial plane, as previously described, is also occupied by the equatorial line 32 dividing the two plane faces 30 and 31 of the rock plate 25. As a result the rock plate 25 may rock on the rocker bars 34 to permit the bowl 19 and the slips to swing in accord with the relative swinging movement occurring between the rod 13 and the hanger structure. This swinging will cause the slip bowl assembly to move its arcuate face 49 in the plane with the arcuate face 50 of the housing cover retaining member 54, it being understood that this arcuate face is struck from a point represented by the intersection of the longitudinal center line of the rocker bars 34 and the plane in which the centers of the rockers 34 lie.

It will be evident that a lubricant may be placed in or on the surfaces 49 and 50 so that the moving faces of the members may be lubricated. It is also to be understood that the channel 40 formed in the upper face of the bottom plate of housing 44 can be filled with lubricant so that the rocker bars 34 may be sufficiently lubricated.

On the down stroke of the pump mechanism it may occur that the pump rod and the polish rod 13 may not be free to move downwardly a distance represented by the downward movement of the hanger, in which event the hanger will move downwardly over the polish rod 13 since the slips 14 will tend to move upwardly as yieldably resisted by the spring 17. When the polish rod hanger changes the direction of its travel and begins to move upwardly the slips will grip the polish rod 13 again and lift the rod.

As previously explained, it is desirable to cause the polish rod to rotate as it reciprocates. This is done automatically. The walking beam oscillates vertically and in doing so reciprocates the polish rod. The reins 11 are connected to the upper forward edge of the walking beam 6 and the cable 71 is connected beneath the walking beam and at a point materially removed from the end of the beam and toward the Samson post. Thus, as the end of the walking beam connected to the polish rod swings downwardly it describes a larger arc than the arc described by the cable support, with the result that the member 73 will be drawn upwardly at its outer end and will swing in the direction of the arrow *a* indicated in Fig. 8. This will cause the lug 72 to swing in the direction of the arrow *b* and move the rotator pawl 69 in the direction of the arrow *c*, with the result that the end point of the pawl 69 will engage the teeth 68 on the ratchet disc 65 and force this disc to rotate. During this movement the point of the lock dog 70 will ride over the ratchet teeth and will remain in engagement with one of the ratchet teeth when the pawl 69 has reached the end of its stroke. This takes place when the polish rod hanger is at the lower end of its stroke. It will be recognized that the polish rod hanger is free to rotate in view of the fact that the polish rod is mounted within the slip unit and that the slip unit is free to rotate. When the polish rod hanger moves toward its uppermost position the reins 11 and the cable 75 will readjust themselves, as shown in Fig. 1 of the drawings. During such readjustment the member 73 will swing downwardly by gravity in a direction opposite to the direction of the arrow *a*. This will swing the lug 72 to its original position and will draw the pawl 69 in the opposite direction to the arrow *c* and cause the free end of the pawl to ride over the ratchet teeth preparatory to taking another position of engagement with the ratchet teeth so that upon the next down-stroke of the polish rod the pawl will be set for a new rotational movement. It will be seen that the length of the bar 73 and the length of the lug 72 as well as the spacing of the reins 11 from the cable 75 will determine the length of stroke of the pawl so that as the pawl moves to a new position upon each reciprocation of the polish rod it will ride over a predetermined number of ratchet teeth. This will insure that the pawl will cause the ratchet disc 65 to be rotated a predetermined degree at each reciprocation of the polish rod and on the down-stroke thereof. By reason of the pawl arrangement with the ratchet disc the polish rod will always be free to rotate in the feeding direction of the pawl 69.

It will thus be seen that by the use of the polish rod hanger here disclosed, simple and effective means are provided for rotating the polish rod progressively as the polish rod reciprocates, said means being rugged in its construction and not liable to get out of order.

While I have shown the preferred form of my invention as now known to me, it will be understood that various changes may be made in combination, construction, and arrangement of parts by those skilled in the art, without departing from the spirit of my invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. In combination with the walking beam of a pump jack and the rod reins thereof, a polish rod hanger pivotally supported upon said reins and through which a polish rod extends, a housing for said hanger, a slip unit within said housing through which the polish rod extends and by which it is gripped, a seat structure within the hanger capable of oscillating at right angles to the plane of the pivotal axis of the hanger and upon which seat structure the slip unit rests, a ratchet plate secured to the polish rod at a point beneath the hanger and disposed in a plane at right angles to that of the polish rod, a ratchet structure carried by the hanger and engaging the ratchet plate, and operative means between the walking beam and the ratchet structure, whereby as the polish rod moves downwardly on its down-stroke the ratchet structure will engage the ratchet plate and rotate the polish rod a predetermined degree of rotation.

2. In combination with the walking beam of a pump jack and the rod reins thereof, a polish rod hanger pivotally supported upon said reins and through which a polish rod extends, a housing for said hanger, a slip unit within said housing through which the polish rod extends and by which it is gripped, a seat structure within the

hanger capable of oscillating at right angles to the plane of the pivotal axis of the hanger and upon which seat structure the slip unit rests, a ratchet plate secured to the polish rod at a point beneath the hanger and disposed in a plane at right angles to that of the polish rod, a ratchet structure carried by the hanger and engaging the ratchet plate, and operative means between the walking beam and the ratchet structure whereby as the polish rod moves downwardly on its down-stroke the ratchet structure will engage the ratchet plate and rotate the polish rod a predetermined degree of rotation, said direction of rotation being counter to the pitch of the threads on the joints of pump rods attached to the polish rods.

3. In combination with the walking beam of a pump jack and the rod reins thereof, a polish rod hanger pivotally supported upon said reins and through which a polish rod extends, a housing for said hanger, a slip unit within said housing through which the polish rod extends and by which it is gripped, a seat structure within the hanger capable of oscillating at right angles to the plane of the pivotal axis of the hanger and upon which seat structure the slip unit rests, a ratchet plate secured to the polish rod at a point beneath the hanger and disposed in a plane at right angles to that of the polish rod, a ratchet structure carried by the hanger and engaging the ratchet plate, and operative means between the walking beam and the ratchet structure, whereby as the polish rod moves downwardly on its down-stroke the ratchet structure will engage the ratchet plate and rotate the polish rod a predetermined degree of rotation, the ratchet structure preventing counter rotation of the polish rod to the direction of its positive feed and permitting free rotation of the polish rod in the direction of positive feed.

ROBERT C. JOHNSTON.