April 7, 1959 J. L. PETTIT ET AL 2,880,433

MACHINERY FOR CLEANING HOLLOW CYLINDRICAL OBJECTS

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Fig. 1

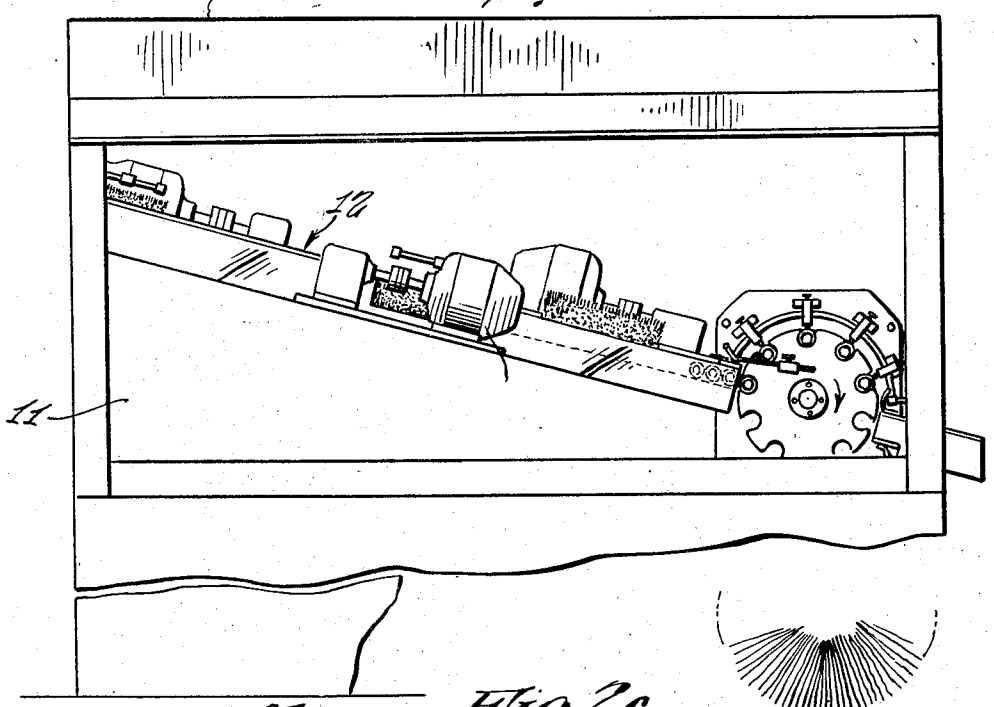



Fig. 5

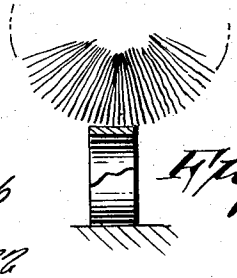


Fig. 2c




Fig. 6

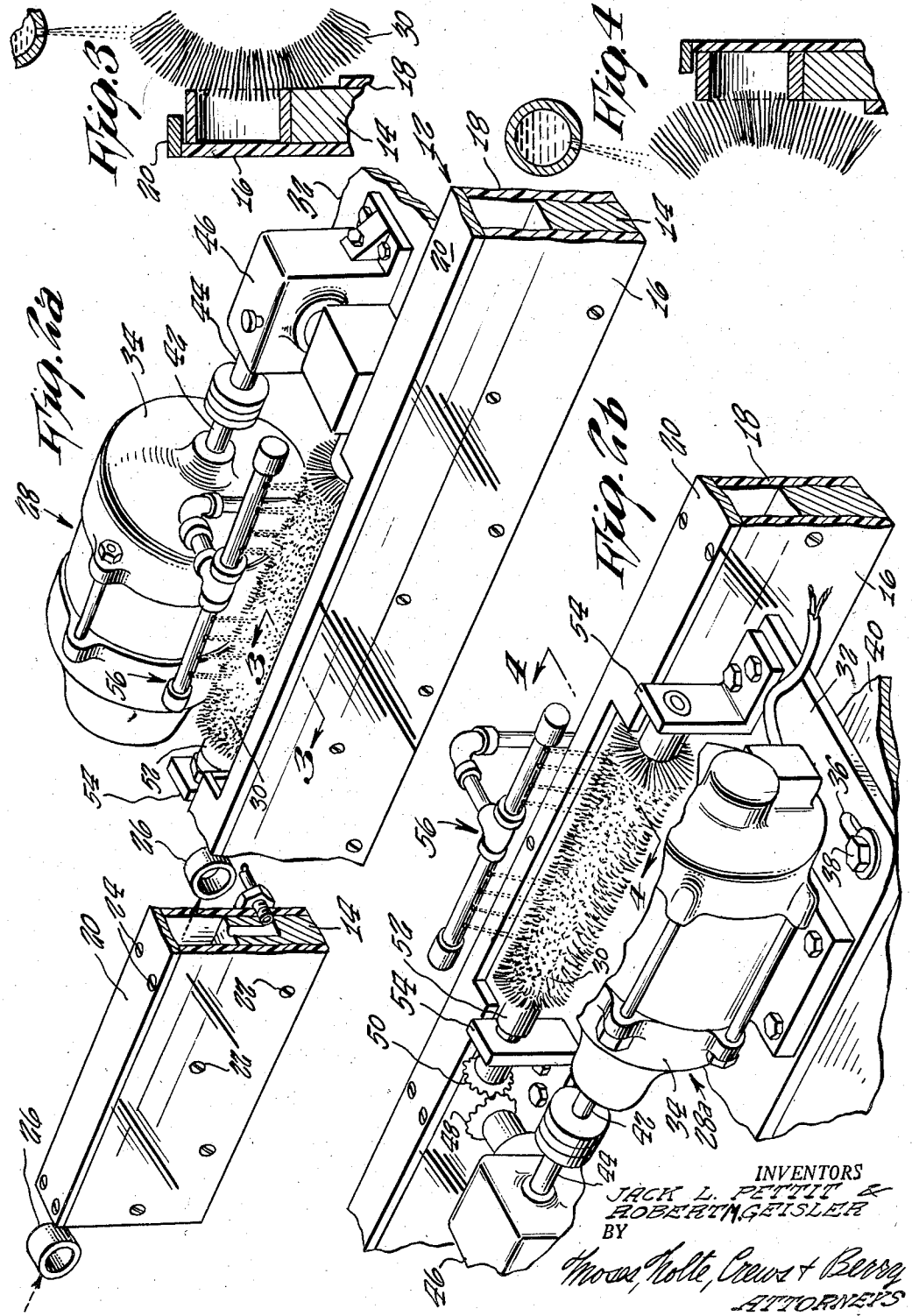



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MACHINERY FOR CLEANING HOLLOW CYLINDRICAL OBJECTS

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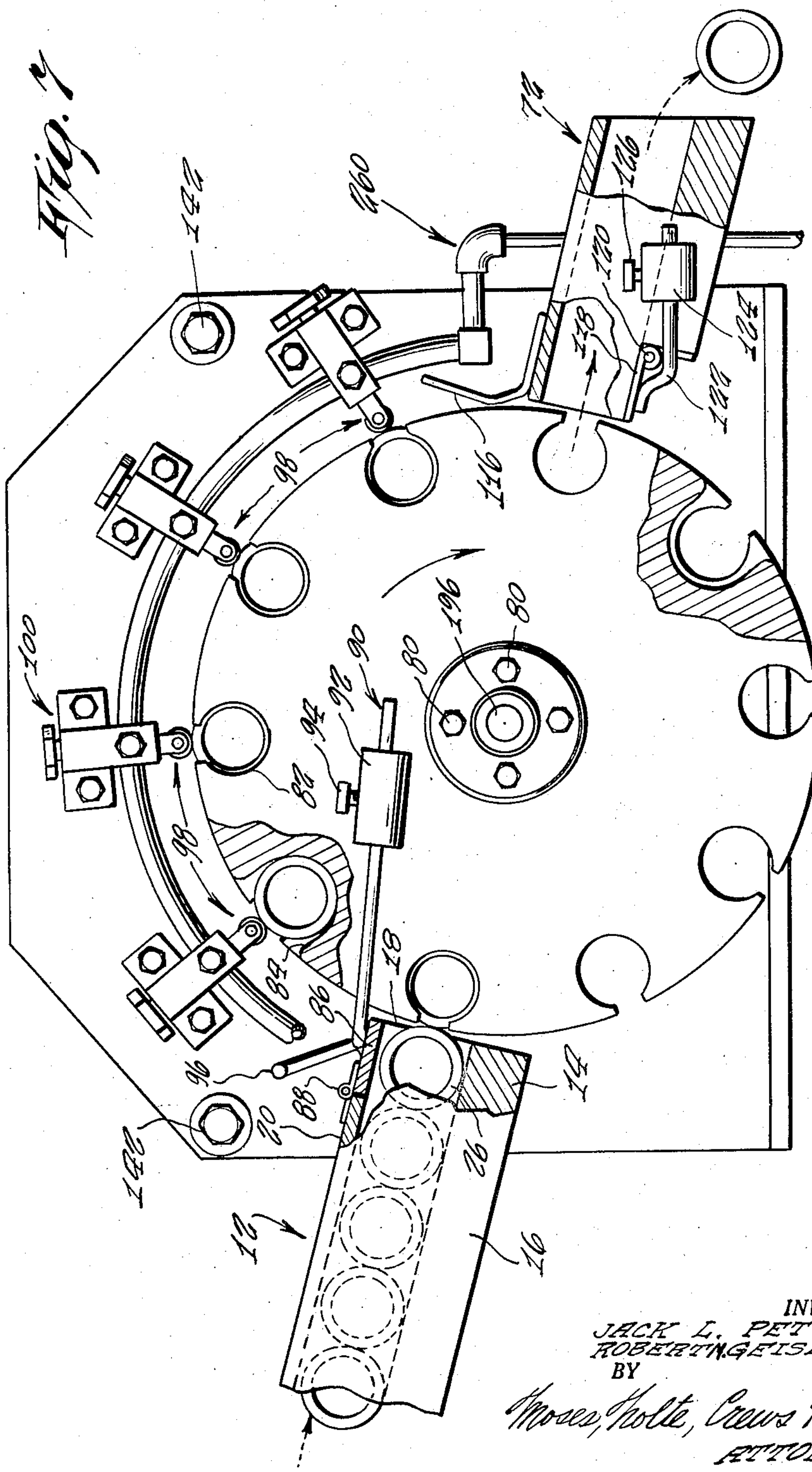



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MACHINERY FOR CLEANING HOLLOW CYLINDRICAL OBJECTS

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Fig. 7



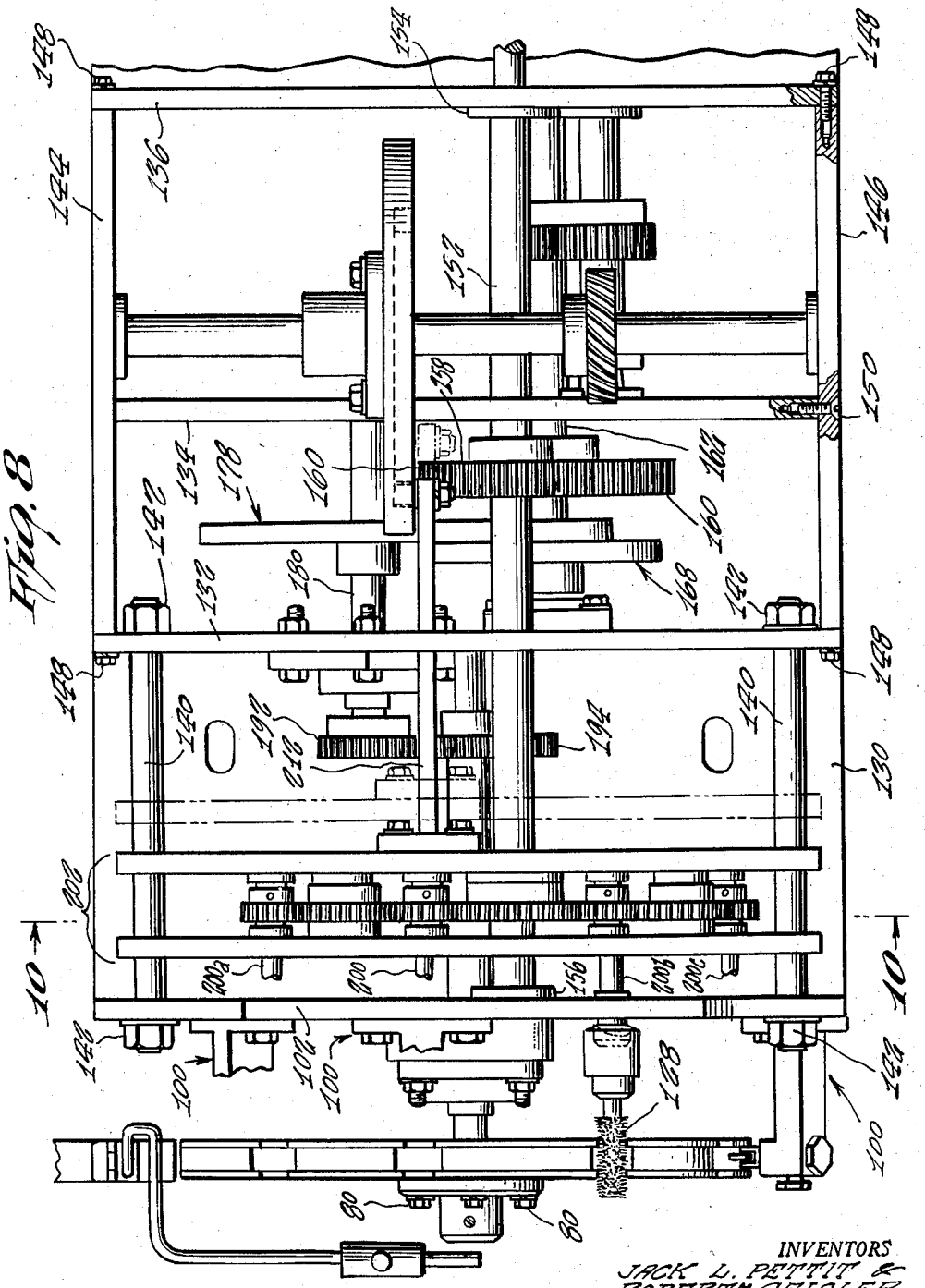
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MACHINERY FOR CLEANING HOLLOW CYLINDRICAL OBJECTS

Filed Feb. 21, 1955 8 Sheets-Sheet 4

Fig. 8



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MACHINERY FOR CLEANING HOLLOW CYLINDRICAL OBJECTS

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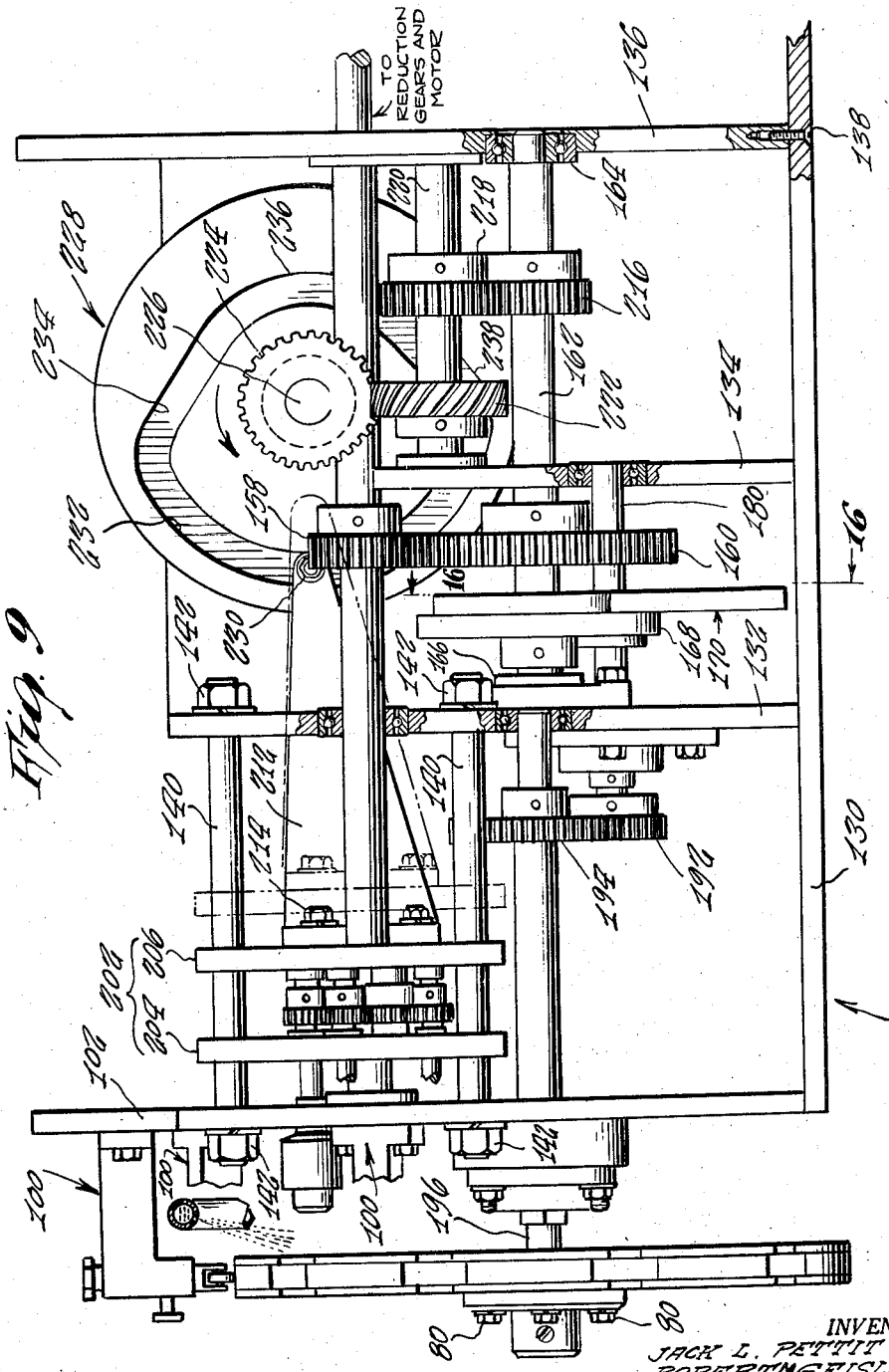



Fig. 9

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MACHINERY FOR CLEANING HOLLOW CYLINDRICAL OBJECTS

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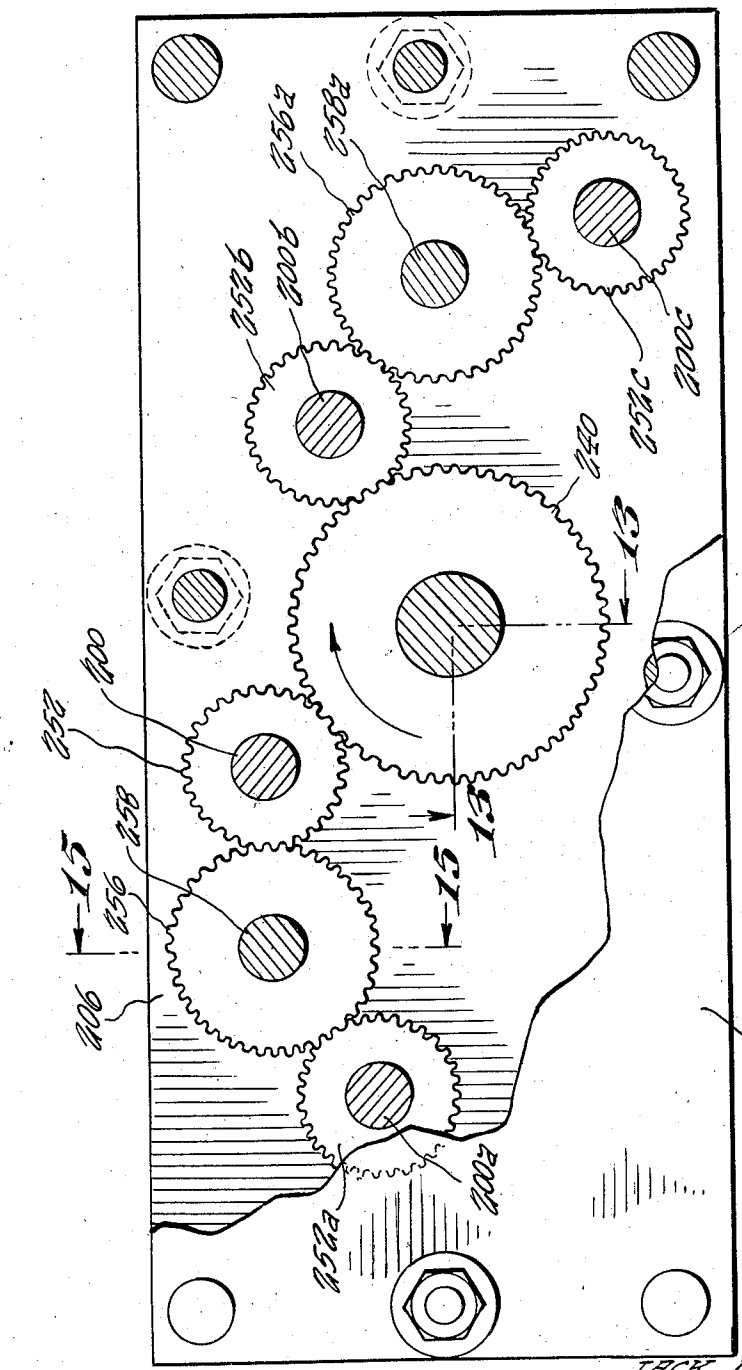



Fig. 10

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MACHINERY FOR CLEANING HOLLOW CYLINDRICAL OBJECTS

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Fig. 11

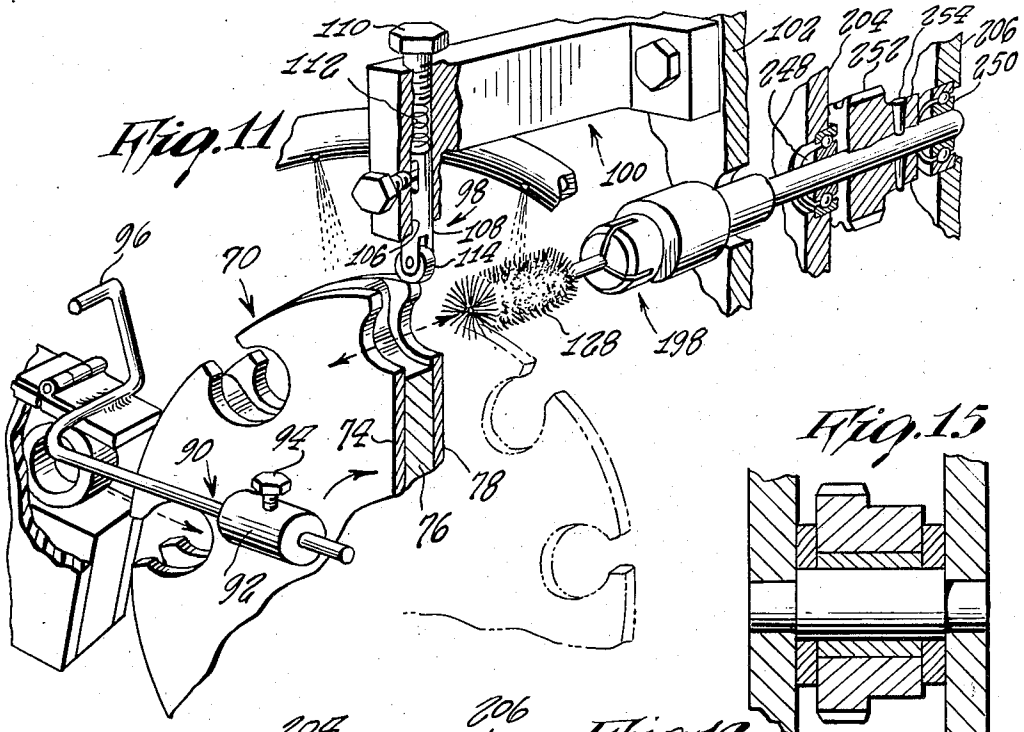



Fig. 15



Fig. 12

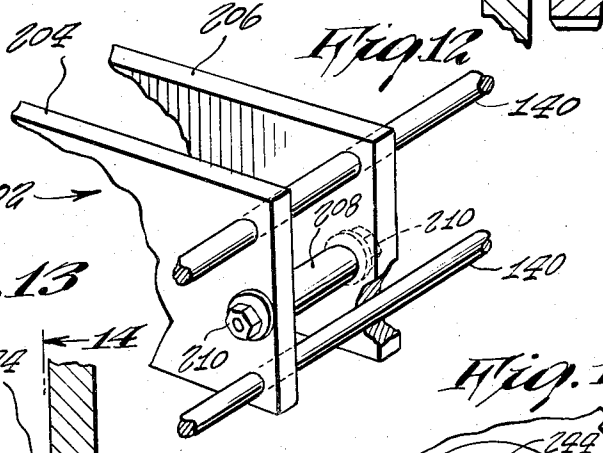



Fig. 13

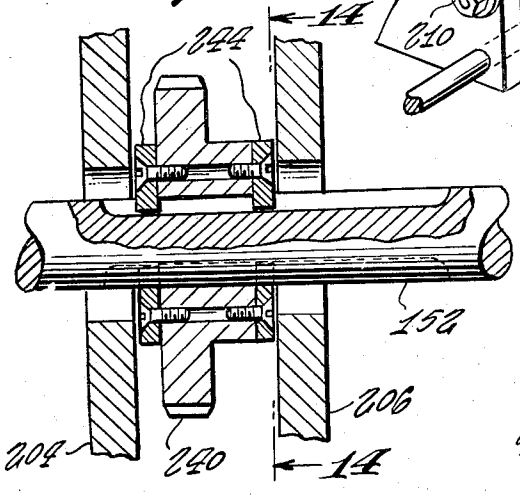
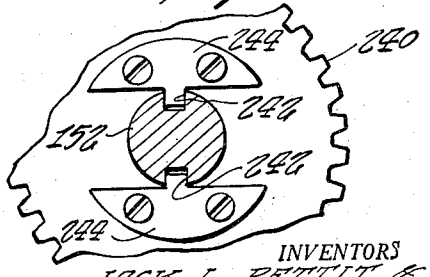



Fig. 14




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MACHINERY FOR CLEANING HOLLOW CYLINDRICAL OBJECTS

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Fig. 16

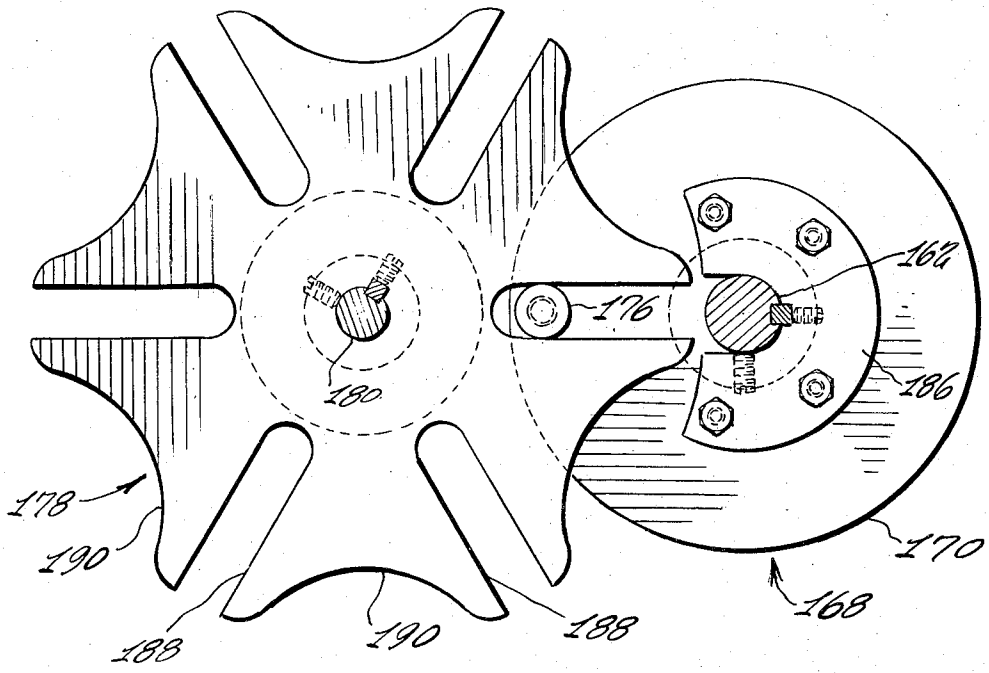
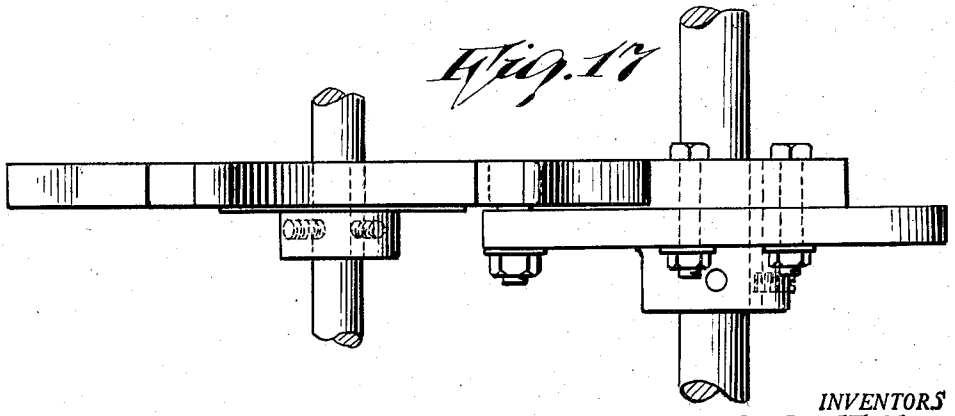



Fig. 17



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United States Patent Office 2,880,433 Patented Apr. 7, 1959



2,880,433

# MACHINERY FOR CLEANING HOLLOW CYLINDRICAL OBJECTS

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Application February 21, 1955, Serial No. 489,364

8 Claims. (Cl. 15—21)

This invention relates to machinery for cleaning hollow cylindrical objects such as bearing sleeves.

It has been common practice in the art to provide a machine having an inclined guideway along which cylindrical work pieces such as bearing sleeves, impelled by gravity, are caused to roll slowly past successive rotary scrubbing brushes, which brushes act respectively to brush one end, the opposite end, and the circumferential surface of each work piece.

It is a primary object of the present invention to supplement such a machine with practical and efficient mechanism for automatically conducting the sleeves to and through a series of brushing stations, at each of which the interior surface is brushed by a separate rotary brush which is continuously supplied with a treating agent such as a soap or detergent solution.

It is a feature of the invention that provision is made of a rotary feed wheel having pockets at uniform intervals, for automatically picking up the work pieces one by one from the guideway and carrying them forward step by step to advance them through successive brushing stations, at each of which they are caused to dwell while a rotary brush advances to enter the work piece and then recedes. The brushes are all advanced and withdrawn in unison by common operating mechanisms in timed relation with the step by step advance of the carrying wheel.

It is a further feature of the invention that a workpiece supplying station is provided above the horizontal axial plane of the feed wheel, that a discharge station is provided below the horizontal axial plane of the feed wheel, and that the brushing stations, all located above the horizontal axial plane of the feed wheel divide the angular interval between the supply and discharge station into equal parts.

It is still another feature of the invention that means are provided for automatically engaging the work pieces as they are carried by the feed wheel into positions for brushing, and for automatically clamping them against rotation by and with the rotary brushes.

Other objects and advantages will hereinafter appear.

In the drawing forming part of this specification:

Fig. 1 is a fragmentary view in side elevation comprehensively showing an illustrative machine which embodies features of the present invention;

Figs. 2*a*, 2*b* and 2*c* are fragmentary perspective views showing respectively the first and second side brushing units and the brushing units which act upon the circumferential surfaces of the work pieces;

Fig. 3 is a fragmentary view in sectional elevation showing the action of the first side brush upon the work pieces, the section being taken upon the line **3—3** of Fig. 2*a*, looking in the direction of the arrows;

Fig. 4 is a fragmentary view in sectional elevation showing the action of the second side brush upon the work pieces, the section being taken upon the line **4—4** of Fig. 2*b*, looking in the direction of the arrows;

Fig. 5 is a fragmentary view in sectional elevation showing the action of the circumferential brush upon the work pieces, the section being taken upon the line **5—5** of Fig. 2*c*, looking in the direction of the arrows;

Fig. 6 is a fragmentary sectional view taken upon the line **6—6** of Fig. 2*c*, looking in the direction of the arrows;

Fig. 7 is a fragmentary view in side elevation and partly broken away, the view being on a larger scale than Fig. 1, and showing particularly the feed wheel which holds the work pieces for interior brushing, together with supply and discharge means associated with the wheel;

Fig. 8 is a fragmentary plan view, partly broken away, showing the interior brushing mechanism, but with all but one of the brushes, themselves, omitted;

Fig. 9 is a fragmentary view in side elevation of the mechanism illustrated in Fig. 8, but with the brushes and all but one of the brush spindles omitted;

Fig. 10 is a view in sectional elevation, the section being taken upon the line **10—10** of Fig. 8, looking in the direction of the arrows;

Fig. 11 is a fragmentary, perspective view showing the feed wheel and various associated mechanisms;

Fig. 12 is a fragmentary, perspective view showing details of a reciprocating frame assembly and supporting means therefor;

Fig. 13 is a fragmentary sectional view, the section being taken on the line **13—13** of Fig. 10, looking in the direction of the arrows;

Fig. 14 is a fragmentary sectional view, the section being taken on the line **14—14** of Fig. 13, looking in the direction of the arrows;

Fig. 15 is a fragmentary sectional view, the section being taken on the line **15—15** of Fig. 10, looking in the direction of the arrows;

Fig. 16 is a sectional view taken on the line **16—16** of Fig. 9, looking in the direction of the arrows, the view being upon a considerably larger scale than Fig. 9; and

Fig. 17 is an edge view of the mechanism illustrated in Fig. 16.

As seen in Fig. 1, the cleaning unit comprises a casing or cabinet **10** in which substantially the entire mechanism is housed. The cabinet includes a window having a transparent pane **11** of Lucite through which the mechanism can be seen when the unit is in operation.

An inclined guideway **12** enters the casing at the left and slopes downward toward the right, desirably at an angle of substantially fifteen degrees to the horizontal. The guideway is composed of a bottom bar **14**, side plates **16** and **18**, and a top plate **20**, all secured together by screws **22** and **24**, as shown. The guideway **12** is adapted to be supplied exteriorly of the casing with work pieces in the form of cylindrical sleeves **26**, either manually or by any suitable automatic feeder. It is essential that the work pieces be supplied in the attitudes shown so that they will roll down the guideway. Except at the completion of a job, the work pieces fill the guideway substantially from end to end and stand in contiguous relation with one another.

In traveling along the guideway, the work pieces pass successive brushing units **28**, **28***a* and **28***b*. The units **28** and **28***a* are identical, save that they are set to act upon opposite ends of the work pieces. Features shown in either are common to both. A single description will suffice. The unit **28** comprises a rotary inclined bristle brush **30** which brushes the right end of the work pieces as illustrated in Fig. 3. The plates **18** and **20** are cut away as shown in Fig. 3 in order to afford access of the brush **30** to the work pieces. The brush unit comprises a base plate **32** upon which an electric motor **34** is made fast. The base plate **32** is formed with slots **36** which

extend transversely of the work path. Headed screws 38 have their shanks passed downward through the slots and threaded into an underlying frame member 40. The unit as a whole may be adjusted toward and from the work, and fixed in adjusted position by tightening of the screws 38.

The shaft 42 of motor 34 is flexibly connected to drive the input shaft 44 of a speed reducing gear box unit 46. The output shaft of said unit acts through bevel gears 48 and 50 to drive the shaft 52 of the brush 30. The brush shaft is rotatably supported in angle brackets 54 which are made fast to the base plate 30.

Identical sprinkler heads 56 are provided for the several brush units. Through means (not shown), the used solution is caught, strained, and pumped back to the sprinkler head for re-use in accordance with practice common in the art. In this connection, the bar 14 is formed with drain passages 53 which deliver the solution to drain pipes 55.

The unit 28*a*, as has been noted, is like the unit 28 in all respects, save that it is turned around, and the brush 30 of the unit 28*a* is disposed to clean the opposite ends of the work pieces as illustrated in Fig. 2*b*. In this instance the plates 16 and 20 are cut away to expose the work.

The unit 28*b* is also like the units 28 and 28*a*, but it is mounted in a different manner so that it may be adjustably supported with the brush directly over the work pieces in position to engage them lightly. The base plate 32*b* is provided with lag screws 56, by which it can be adjusted to a desired height in relation to the supporting frame 40. Supporting blocks 58 are secured to the lower end margins of the base plate 32*b*. The plate 32*b* is supported on angle brackets 60. Each bracket 60 includes a vertical web through which vertically extending slots 62 are formed. Headed screws 64 have their shanks passed through the slots 62 and threaded into the blocks 58. When the screws 56 have been satisfactorily adjusted to locate the brush 30 at a desired level, the screws 64 may be tightened to fix the adjustment.

Each bracket 60 includes a horizontal web which is formed with a slot 66 that extends toward and from the guideway 12. In each instance a headed screw 68 has its shank passed downward through the slot 66 and threaded into the frame member 40. When the unit 28*b* has been adjusted transversely to center the brush over the work pieces, the screws 68 are tightened to fix the adjustment. The plates 16 and 18 are partially cut away, and a section of the plate 20 is completely omitted in order to make the work pieces accessible to the brush 30 of the unit 28*b*.

The mechanism thus far described is effective to brush the opposite ends and the circumferential surfaces of the work pieces, but not the interior surfaces of the work pieces. The part of the machine already described in detail is not new per se. The primary novelty of the present invention has to do with mechanism for automatically brushing the interior surfaces of the work pieces.

At the lower end of the guideway 12 there is provided a feed wheel 70, which receives the work pieces from the guideway 12 and carries them upward and forward step by step for internal brushing at successive stations, and for final discharge into a discharge chute 72. The wheel is composed of three discs 74, 76 and 78, the outer discs 74 and 78 being thin discs and the intermediate disc 76 being comparatively thick and having a thickness somewhat greater than the length of a work piece 26. As shown, each disc is formed with ten equally spaced peripheral notches, corresponding notches of the several discs being combined to form work piece pockets. The discs 74, 76 and 78 are united near their centers by headed screws 80 into a unitary sector. The screws 80 have their shanks passed through a disc 81, and through the disc 74 and threaded into the disc 78. A hub portion of the disc 81 is secured by a set screw 83 upon a driven shaft 196.

The notches 82 of the discs 74 and 78 correspond in shape and angular disposition. Each notch 82 has a narrow marginal opening but is generally circular in form, the circular portion having a diameter greater than the internal diameter of a work piece to leave the work piece wall clear for the reception of brushes, but less than the external diameter of a work piece to confine the work piece in a pocket against axial movement. The notches 84 of the disc 76 coincide in angular disposition with the respective notches 82 of the discs 74 and 78 but are differently shaped. Each notch 84 has a substantially semi-circular base portion and a wide mouth which is bounded by outwardly extending, slightly divergent side walls. The width of the mouth of a notch 84 is greater than the diameter of a work piece, but the semi-circular base of the notch is of the same diameter as a work piece. When a work piece is lodged in a pocket, half of the circumference is frictionally engaged by the base of a notch 84, and the free portion of its circumference stands tangent to the circumferential line which bounds the wheel 70.

The guideway 12, as has been noted, extends downward at a slope of 15 degrees. The center of the wheel 70 is desirably directly in line with the center line of feed of the work pieces 26 along the guideway 12 and along the chute 72, as shown in Fig. 7. The work pieces 26 stand in the guideway 12 in a continuous line (see Fig. 7), with each work piece pressing from behind against the work pieces which precedes it.

As the wheel 70 turns clockwise toward the position illustrated in Fig. 7, the lowermost work piece 26 bears against the periphery of the wheel 70 and is restrained by the wheel 70. As the wheel comes to rest in the Fig. 7 position, the lowermost work piece rolls by gravity from the guideway 12 into the adjacent pocket of the wheel. At each step of advance the work piece is carried forward to a brushing station at which a rotary brush enters the work piece until it has been subjected to four such brushings, and at the fifth station the work piece is carried opposite the chute 72 where it is free to roll by gravity into and down the chute. It will be seen that the wheel 70 constitutes an automatic separator and carrier for the work pieces, acting first to separate the work pieces one by one from the line in the guideway 12 and then to carry the work pieces in properly timed relation through successive brushing stations.

In order to avoid possible jamming, and to afford access, the plate 20 is terminated short of the lower end of the guideway 12 by a distance equal substantially to the diameter of a work piece. A movable cover member 86 is secured through a hinge 88 to the plate 20 and normally stands in line with the plate 20. A wire arm 90 is secured to the cover 86 and extends forward from it. A weight 92 is slidable on the arm 90 and may be secured in any desired position of adjustment by a set screw 94, to regulate the resistance of the cover 86 to upward movement. A tail 96 of the arm 90 is disposed to engage the plate 20 as the cover 86 is swung open and to arrest the swinging movement before the arm 90 has reached a vertical position. This avoids the possibility of the cover being inadvertently left open, because it cannot be swung to an open position in which it is stable.

Opposite each brushing station there is provided a pressure plunger 98 for pressing the current work piece inward toward the center of the wheel 70. This causes the circumference of the work piece to bear against the semi-circular base of the notch in the disc 76 with sufficient frictional force to restrain the work piece against rotation by or with the brush. The semi-circular configuration is not essential, so long as a configuration is chosen which affords adequate resistance to rotation of the work pieces during brushing.

The pressure plungers 98 are duplicates of one another and are similarly mounted. Details of the construction and mounting of one of the pressure plungers 98 are illustrated in Fig. 11. A bracket 100 is rigidly affixed to a stationary plate 102 which forms part of a frame 104. At one end the bracket 100 is formed with a bore 106 in which a rod 108 is slidably mounted. The rod 108 forms the principle or body member of the pressure plunger 98. A headed plug 110 is threaded downward into the upper end of the bore 106. A compression coil spring 112 is interposed between the plug 110 and the rod 108 and urges the rod 108 downward. The rod 108 carries a rotary roller 114 at its lower end.

The roller 114 rides normally against the circumference of the wheel 70, but when a pocket held work piece 26 comes opposite a plunger it engages the roller 114 and sustains the plunger against the thrust of the spring 112. As the wheel again moves forward the roller 114 bridges the gap between the work piece and the periphery of the wheel 70 and rides once more upon the wheel. At the end of a run the pockets will come to the brushing station empty. In order to limit downward movement of the pressure plungers 98, each is provided with a headed screw 115 which is threaded through the forward wall of the bracket 100 and has its tip portion disposed in a vertical slot 117 of the associated rod 108.

In traveling from the last brushing station to the discharge station opposite the chute 70, a wheel pocket crosses the horizontal axial plane of the wheel and assumes an attitude which favors the rolling of the work piece out of the pocket. In order to prevent premature discharge or partial discharge of the work piece, a retaining guard 116 is affixed to the top of the chute 72. The chute 72 is generally of rigid construction, but at its introductory end a short floor section is cut away and is replaced by a safety trap door 118 to prevent jamming. The trap door 118 is pivotally supported on a fulcrum pin 120, and is free to yield in the event that a work piece remains partially stuck in one of the wall pockets. A wire rod 122, secured to the lower face of the trap door 118, extends externally of the chute to the right of the pin 120, and carries a counterbalancing weight 124. The weight 124 is secured in any desired position of adjustment along the rod by a set screw 126.

It is essential, of course, for the wheel 70 to be caused to advance and to dwell in alternation, and for the internally acting brushes to be advanced and retracted while the wheel stands at rest. The mechanism for supporting and driving the wheel 70 and the brushes 128 while coordinating the action of the wheel and the brushes with one another is carried on the frame 104.

The frame 104 comprises the vertical plate 102, previously referred to, a horizontal base plate 130, and vertical plates 132, 134 and 136, the vertical plates being all secured to the base plates by screws 138 as illustrated in the case of the plate 136 in Fig. 9. The plates 102 and 132 are rigidly connected to shouldered rods 140 whose reduced threaded ends are passed through the plate and have lock washers and clamping nuts 142 applied. The plates 132 and 136 are joined rigidly to one another through connecting plates 144 and 146, being secured to the latter plates through screws 148. The plate 134 is made rigid with the plates 144 and 146 by screws 150.

The main drive shaft 152 is driven from a motor (not shown). The shaft 152 is supported in ball bearings 154 and 156 which are carried respectively by the plates 136 and 132. The shaft 152 has fast upon it a gear 158 which drives a larger gear 160 at slower speed than itself. The gear 160, through a suitable gear train, drives the wheel 70 intermittently. The gear 160 is fast on a shaft 162. One revolution of the shaft 162 corresponds to one brushing and feeding cycle.

The shaft 162, which is supported in bearings 164 and 166 carried by the plates 136 and 132, also has fast upon it the constantly rotating, movable member 168 of a conventional Geneva gear unit 170. The input member 168 comprises a disc 170 upon which a bearing pin 172 is secured by a nut 174. The pin 172 rotatably supports a drive roller 176 which intermittently drives star wheel 178 fast upon a shaft 180.

The arrangement is such that the shaft 162 acts during one-third of a revolution to advance the shaft 180 through one-sixth of a revolution. The shaft 180 is then caused to be locked against rotation during the remaining two-thirds of a revolution of the shaft 162. The disc 170 has rigidly affixed to it, by bolts 182 and nuts 184, a locking segment 186 whose peripheral angular extent is substantially 240 degrees. The star wheel 178 is formed with six equally spaced radial slots 188, each of a width to slidingly receive the roller 176. Between the slots, the star wheel segments have concave arcuate surfaces 190, each with a radius of curvature equal to the radius of locking segment 186, and each adapted for engagement with the locking segment 186 during one of the six intervals between feeding steps in the rotation of the star wheel.

The radius measured from the center of the shaft 162 to the center of the roller 176 is exactly one-half the length of the line of centers measured from the center of the shaft 162 to the center of the shaft 180. The radius of the star wheel at the mouth of each slot is so chosen that the roller is caused to enter and to leave the slots while traveling radially of the star wheel. In other words, the radius along the center line of the slot is equal to the line of centers times the sine of sixty degrees, so that a thirty degree right triangle is formed by the driving and driven radii and the line of centers at the beginning and at the end of a driving period.

The output shaft 180 of the Geneva gear unit has fast upon it a gear 192 which meshes with, and drives, a larger gear 194 fast on the supporting and driving shaft 196 of the wheel 70. The pitch diameter of the gear 192 is three-fifths the pitch diameter of the gear 194. It follows that while the shaft 162 turns through one-third of a revolution and the shaft 180 turns through one-sixth of a revolution, the wheel 70 is turned through one-tenth of a revolution, and that while the shaft 152 turns through the remaining two-thirds of a revolution the wheel 70 is locked against rotation.

The brushes 128, their holding chucks 198, their spindles 200, and most of the drive gearing for the brush spindles are carried by a reciprocating frame 202 which consists of two parallel vertical plates 204 and 206, rigidly united in spaced relation by shouldered rods 208 on whose reduced threaded ends lock washer and clamping nuts 210 are applied. The plates 204 and 206 are slidingly supported for fore and aft movement on the rods 140. An actuated arm 212 is rigidly affixed to the plate 206 by means of screws 214.

The shaft 162 which, it will be remembered, is the input shaft of the Geneva unit, serves also to drive the frame 202 through the arm 212. The shaft 162 has fast upon it a gear 216 which drives an equal gear 218 fast on a shaft 220. The shaft 220 has fast upon it a spiral gear 222 which drives at its own rotary speed a spiral gear 224, fast on a shaft 226. Thus, the shaft 226 is driven at the same rotary speed as the shaft 162, making one revolution per cycle. The shaft 226 has fast upon it a track cam 228 which, through a follower roller 230, carried by the arm 212, drives the arm 212 and the frame 202 to and fro.

Visual inspection of the track cam reveals that the track comprises a segment 232 of uniform, large radius which extends through substantially 120 degrees, a segment 234 of contracting radius which extends through substantially 60 degrees, a segment 236 of uniform, small radius which extends through substantially 120 degrees, and a segment 238 of increasing radius which extends

through substantially 60 degrees. As the segments **236** act on the follower **230**, the frame **202** and the brushes carried by it are held fully retracted. It is during this period that the wheel **70** is turned one-tenth of a revolution and relocked. As the segment **238** acts on the follower, the frame **202** is thrust forward. As the segment **232** acts on the follower the frame **202** is held forward. As the segment **234** acts on the follower the frame **202** is pulled rearward and the brushes **128** are drawn clear of the wheel **70**.

The main drive shaft **152**, which does not move axially, is arranged to rotate all the brushes and brush gears carried by the frame **202**. As best seen in Figs. 13 and **14**, a gear **240** is mounted upon the shaft **152** between the plates **204** and **206**. Throughout a distance equal to somewhat more than the range of movement of the frame **202** the shaft **152** is formed with diametrically opposed key ways **242**. Key plates **244** are affixed to the front and rear faces of the gear **240** by screws **246**, each plate having a key finger which is received in the associated key-way of the shaft **152**. The combined thickness of the gear **240** and the plates **244** substantially fills the space between the plates **204** and **206** so that the gear assembly is moved back and forth by the plates and in unison with them, while maintaining its driven engagement with the shaft **152**.

The brush spindle **200** is carried by the plates **204** and **206** in ball bearings **248** and **250**. A gear **252**, disposed between the plates **204** and **206** and affixed to the spindle **200** by a taper pin **254**, is constantly driven by the gear **240**. The single spindle chuck and brush assembly, and the spindle mounting illustrated in Fig. 11 are typical of all four such assemblies and mountings. The gear **252** also meshes with, and drives, a gear **256** which is rotatably supported on a short shaft **258** carried by the plates **204** and **206**. The gear **256**, in turn, drives a gear **252**a, which is fast on a brush spindle **200***a*. The gear **240** also drives a gear **252***b* which is fast on a brush spindle **200***b*. The gear **252***b* drives the gear **256***a* which is rotatably supported on a short fixed shaft **258***a* carried by the plates **204** and **206**. The gear **256***a*, in turn, drives a gear **252***c* which is fast on a brush spindle **200***c*. The axes of the four spindles **200**, **200***a*, **200***b* and **200***c* are at equal intervals of 36 degrees along an arc which is concentric with the wheel **70** and the shaft **196**, the spindle axes being exactly aligned with the axes of the wheel carried work pieces in the at rest positions.

Cleaning liquid is delivered under pressure by a pump (not shown) to a conduit **260** to an arcuate sprinkler pipe **262**. The pipe **262** is provided with spray openings appropriately located for directing liquid on to the several brushes at all times. The liquid is caught and strained by means (not shown) and is again delivered to the pipe **262** in a well known manner.

I have described what I believe to be the best embodiments of my invention. I do not wish, however, to be confined to the embodiments shown, but what I desire to cover by Letters Patent is set forth in the appended claims.

We claim:

1. A machine for brushing hollow cylindrical work pieces comprising, in combination, means forming an inclined guideway on which the work pieces roll, means disposed adjacent to said guideway adapted to exteriorally brush hollow cylindrical work pieces, said last mentioned means including a plurality of brushing units, each of said units including a rotary brush and a sprinkler head cooperating therewith, a vertically disposed feed wheel having marginal pockets at equal circumferential intervals, the wheel having its periphery disposed across the discharge end of the guideway, means for rotating the wheel intermittently through steps equal in angular extent to the space from pocket center to pocket center to cause the work pieces to be separated one by one from the guideway and carried individually through a succession of brushing stations with a substantial period of rest at each station, brushing means at each station comprising a rotary brush and a carrying and driving spindle therefor, means for constantly rotating the spindles, means for automatically advancing the rotating brushes through the work pieces and retracting them while the wheel is at rest, and then retaining the brushes clear of the wheel while the wheel is in motion, and spring biased plungers at the respective brushing stations, disposed to ride the wheel periphery between pockets and to ride the work pieces when the work pieces arrive at the brushing stations, thereby to oppose rotation of the work pieces during brushing.

2. A machine for brushing hollow cylindrical work pieces comprising, in combination, means forming an inclined guideway on which the work pieces roll, means disposed adjacent to said guideway adapted to exteriorally brush hollow cylindrical work pieces, said last mentioned means including a plurality of brushing units, at least one of said units being adjustably mounted directly over said guideway, each of said units including a rotary brush and a sprinkler head cooperating therewith, a vertically disposed feed wheel having marginal pockets at equal circumferential intervals, the wheel having its periphery disposed across the discharge end of the guideway, means for rotating the wheel intermittently through steps equal in angular extent to the space from pocket center to pocket center to cause the work pieces to be separated one by one from the guideway and carried individually through a succession of brushing stations with a substantial period of rest at each station, brushing means at each station comprising a rotary brush and a carrying and driving spindle therefor, means for constantly rotating the spindles, means for automatically advancing the rotating brushes through the work pieces and retracting them while the wheel is at rest, and then retaining the brushes clear of the wheel while the wheel is in motion, and spring biased plungers at the respective brushing stations, disposed to ride the wheel periphery between pockets and to ride the work pieces when the work pieces arrive at the brushing stations, thereby to oppose rotation of the work pieces during brushing, each plunger being equipped with a roller for engaging the wheel and the work pieces, and each pocket being formed to have sufficiently extensive contact with the work pieces to hold them against rotation by and with the brush when they are pressed inward by the plunger.

3. A machine for brushing hollow cylindrical work pieces comprising, in combination, means forming an inclined guideway on which the work pieces roll, means disposed adjacent to said guideway adapted to exteriorally brush hollow cylindrical work pieces, said last mentioned means including three identical brushing units, each of said units including a rotary brush and a sprinkler head cooperating therewith, one of said units being adjustably mounted directly over said guideway whereby the rotating brush of said unit will engage the outer surface of the work piece contained within the guideway and the other two of said units being mounted on opposite sides of said guideway whereby the opposite exterior side portions of the work pieces contained within the guideway are engaged, a vertically disposed feed wheel having marginal pockets at equal circumferential intervals, the wheel having its periphery disposed across the discharge end of the guideway, means for rotating the wheel intermittently through steps equal in angular extent to the space from pocket center to pocket center to cause the work pieces to be separated one by one from the guideway and carried individually through a succession of brushing stations with a substantial period of rest at each station, brushing means at each station comprising a rotary brush and a carrying and driving spindle therefor, means for constantly rotating the spindles, means for automatically advancing the rotating brushes through the work pieces and retracting them while the wheel is at rest, and then retaining the brushes clear of the wheel while the wheel is in motion, and spring biased plungers at the respective

brushing stations, disposed to ride the wheel periphery between pockets and to ride the work pieces when the work pieces arrive at the brushing stations, thereby to oppose rotation of the work pieces during brushing, each plunger being equipped with a roller for engaging the wheel and the work pieces, and each pocket being formed to have sufficiently extensive contact with the work pieces to hold them against rotation by and with the brush when they are pressed inward by the plunger, and each plunger mechanism further including means for limiting inward movement of the plunger when an empty pocket comes opposite it.

4. A machine for brushing hollow cylindrical work pieces comprising, in combination, means forming an inclined guideway down which the work pieces roll, a vertically disposed feed wheel having marginal pockets at equal circumferential intervals, the wheel having its periphery disposed across the discharge end of the guideway, brushing means at each of a series of equally spaced brushing stations each comprising a rotary brush and a carrying and driving spindle therefor, means for automatically rotating the wheel intermittently through steps equal in angular extent to the space from pocket center to pocket center, to cause the work pieces to be carried individually through a succession of brushing stations and to be aligned at each station with one of the brushes throughout a substantial period of rest, a reciprocable frame upon which all the brushes and brush spindles are carried, drive gearing for the brushes movable by and with the frame, including an input gear common to all the brush spindles, a drive shaft, fixed against bodily movement, extending through said common input gear and keyed to it so that the gear can move with the frame relative to the bodily fixed shaft while maintaining its driven relationship with the shaft, and mechanism, including the frame, driven in timed relation with said feed wheel for automatically advancing the rotating brushes through the work pieces and retracting them while the wheel is at rest, and then retaining the brushes clear of the wheel while the wheel is in motion.

5. A machine for brushing hollow cylindrical work pieces comprising, in combination, means forming an inclined guideway down which the work pieces roll, and a rotary, vertically disposed feed wheel having marginal pockets at equal circumferential intervals, the wheel having its periphery disposed across the discharge end of the guideway for successively separating work pieces from the guideway as the pockets cross the guideway, the wheel comprising two thin outside discs and a comparatively thick intermediate disc rigidly united in juxtaposed relation, the outside disc having aligned circular openings at uniform angular intervals of sufficiently small diameter to obstruct the work pieces against axial movement but of sufficiently large diameter to avoid obstructing access to the interiors of the work pieces, and the intermediate disc having correspondingly spaced and located wide mouth parti-circular notches concentric with said opening and of larger diameter than said opening for supporting the work pieces stably stubstantially in axial coincidence with said openings.

6. A machine for brushing hollow cylindrical work pieces comprising, in combination, means forming an inclined guideway down which the work pieces roll, and a rotary, vertically disposed feed wheel having marginal pockets at equal circumferential intervals, the wheel having its periphery disposed across the discharge end of the guideway for successively separating work pieces from the guideway as the pockets cross the guideway, the wheel comprising two thin outside discs and a comparatively thick intermediate disc rigidly united in juxtaposed relation, the outside disc having aligned circular openings at uniform angular intervals of sufficiently small diameter to obstruct the work pieces against axial movement but of sufficiently large diameter to avoid obstructing access to the interiors of the work pieces, and the intermediate disc having correspondingly spaced and located wide mouth part-circular notches concentric with said opening and of larger diameter than said opening for supporting the work pieces stably substantially in axial coincidence with said openings, the openings in the outside discs being in communication with the exterior of the wheel through comparatively narrow slots which are formed in the disc margins, the construction and arrangement being such that a tool inserted endwise into a jammed work piece can be withdrawn radially through the slot for extracting the work piece from the wheel pocket.

7. A machine for brushing hollow cylindrical work pieces comprising, in combination, means forming an inclined guideway down which the work pieces roll in contiguous relationship, means for brushing the exterior surfaces of the work pieces as they travel down the guideway, a vertically disposed feed wheel having marginal pockets at equal circumferential intervals, the wheel having its periphery disposed across the discharge end of the guideway, means for rotating the wheel intermittently through steps equal in angular extent to the space from pocket center to pocket center to cause the work pieces to be separated one by one from the guideway and carried individually through a succession of brushing stations with a substantial period of rest at each station, brushing means at each station comprising a rotary brush and a carrying and driving spindle therefor, means for constantly rotating the spindles, and automatic mechanism for advancing the rotating brushes through the work pieces and retracting them while the wheel is at rest, and for retaining the brushes clear of the wheel while the wheel is in motion.

8. A machine for brushing hollow cylindrical work pieces comprising, in combination, means forming an inclined guideway on which the work pieces roll in contiguous relationship, a vertically disposed feed wheel having marginal pockets at equal circumferential intervals, the feed wheel having its periphery disposed across the discharge end of the guideway, means for rotating the wheel intermittently through steps equal in angular extent to the space from pocket center to pocket center and in a direction to cause the work pieces to be carried upward and around through a succession of brushing stations with a substantial period of rest at each station, means for brushing the interiors of the work pieces at the brushing stations, and a downwardly inclined chute separated by a whole number of pocket spaces and by at least a semi-circumference from the inclined guideway, the work pieces being transferable by gravity from the guideway to the wheel and from the wheel to the discharge chute, and the guideway including a hinged cover section adjacent the wheel, the discharge chute having a hinged floor section adjacent the wheel, means yieldingly holding the hinged cover section of the guideway down in normal position, and means yieldingly holding the hinged floor section of the chute up in normal position.

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