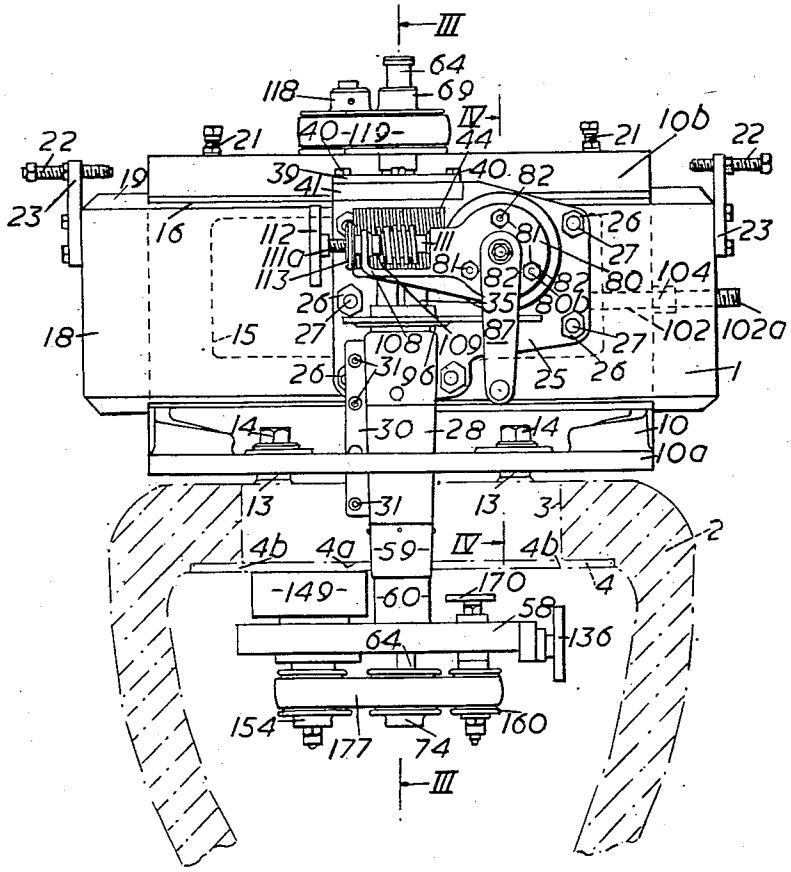
Oct. 15, 1957 A. WIERZBICKI 2,809,483

MACHINING OF PLANAR SEATINGS

Filed April 26, 1955 5 Sheets-Sheet 1

FIG. 1.



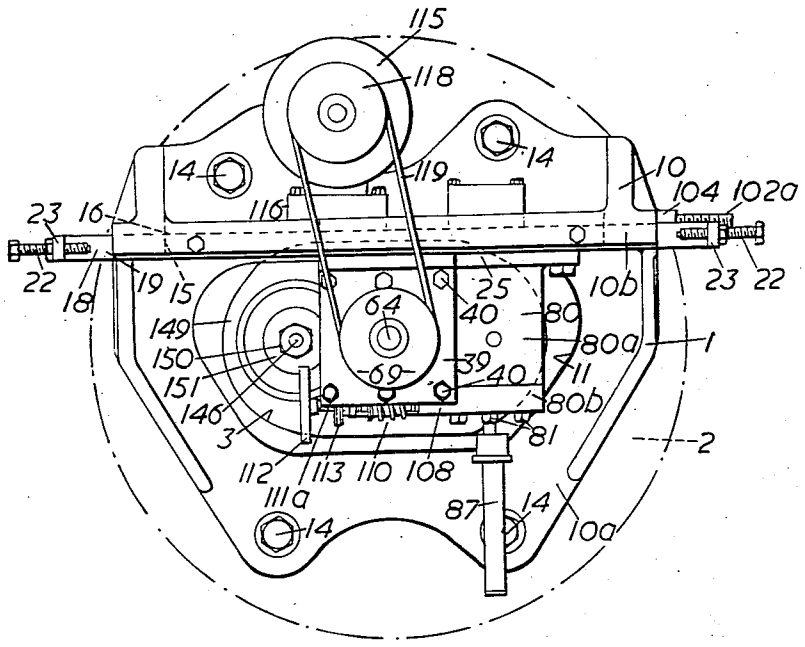

Inventor
Alexander Wierzbicki
By
Pennie, Edmonds, Morton, Barrows & Taylor
Attorneys

Oct. 15, 1957 A. WIERZBICKI 2,809,483

MACHINING OF PLANAR SEATINGS

Filed April 26, 1955 5 Sheets-Sheet 2

FIG. 2.




Inventor
Alexander Wierzbicki

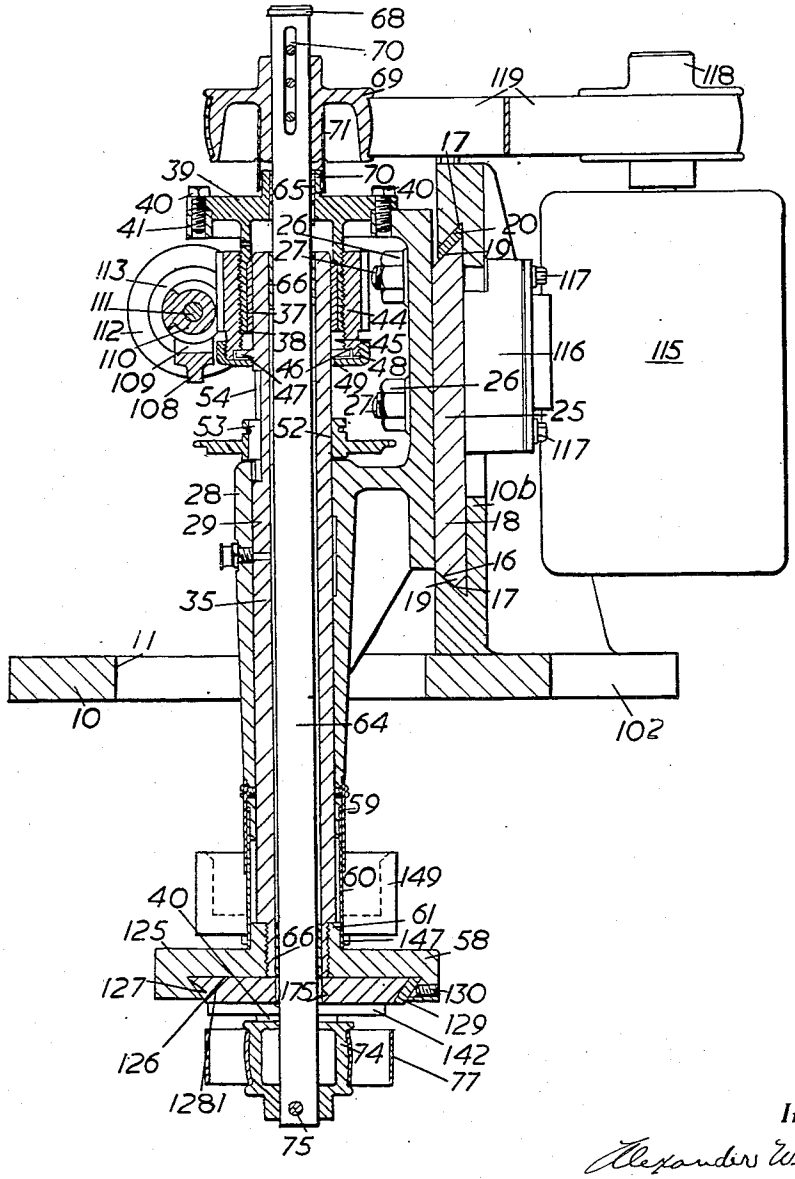
By
Dennison, Edmonds, Morton, Barrow & Taylor
Attorneys

Oct. 15, 1957 A. WIERZBICKI 2,809,483

MACHINING OF PLANAR SEATINGS

Filed April 26, 1955 5 Sheets-Sheet 3

FIG. 3.




Inventor

Alexander Wierzbicki

By

Pennie, Edmonds, Morton, Barrows & Taylor

Attorneys

Oct. 15, 1957 A. WIERZBICKI 2,809,483

MACHINING OF PLANAR SEATINGS

Filed April 26, 1955 5 Sheets-Sheet 4

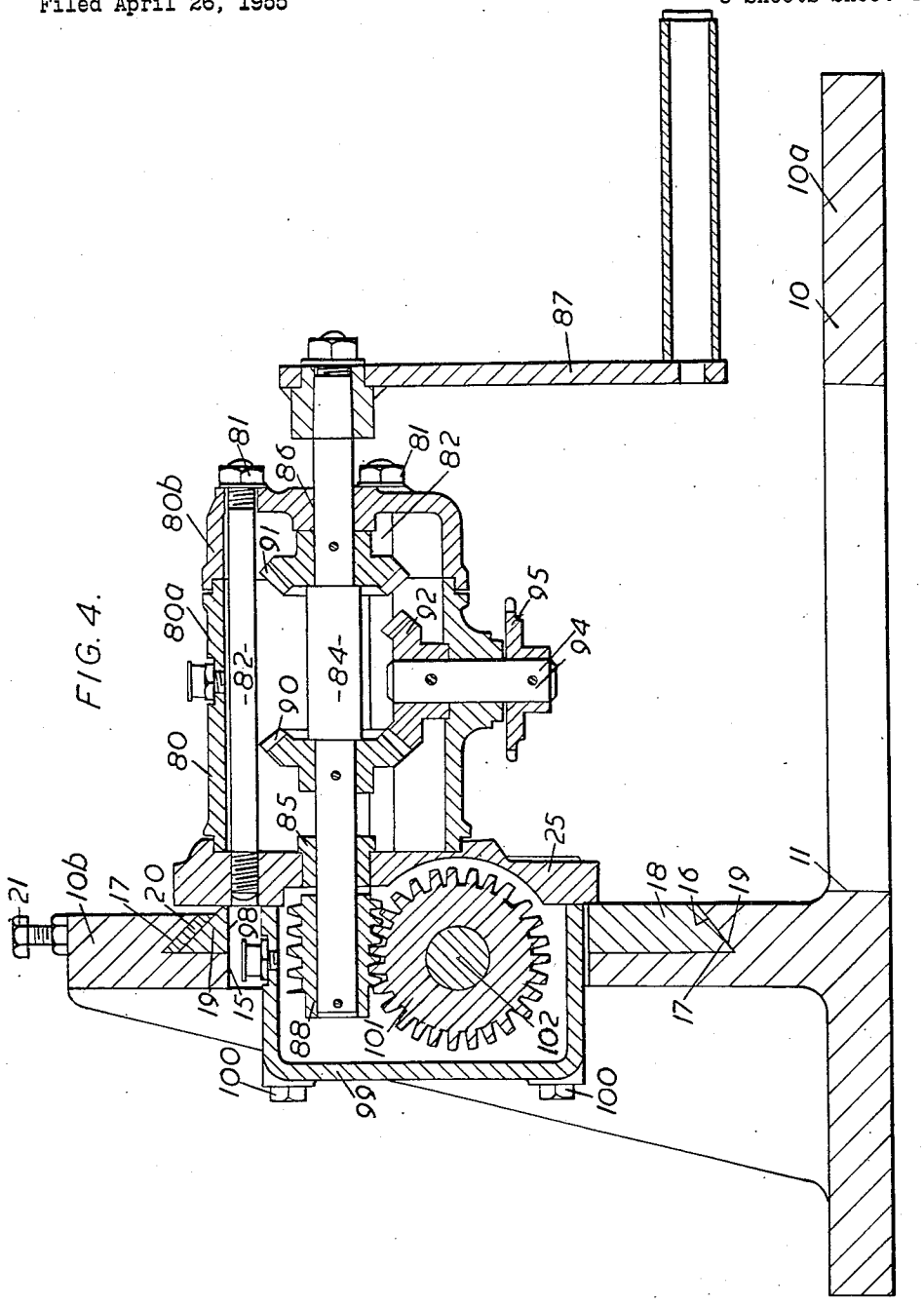



FIG. 4.

Inventor
Alexander Wierzbicki
By
Parmelee, Edmonds, Morton, Barrows & Taylor
Attorneys

Oct. 15, 1957 A. WIERZBICKI 2,809,483

MACHINING OF PLANAR SEATINGS

Filed April 26, 1955 5 Sheets-Sheet 5

FIG. 5.

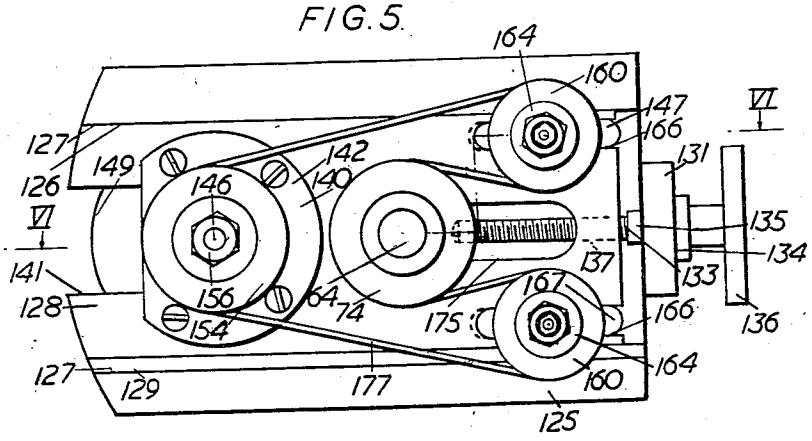
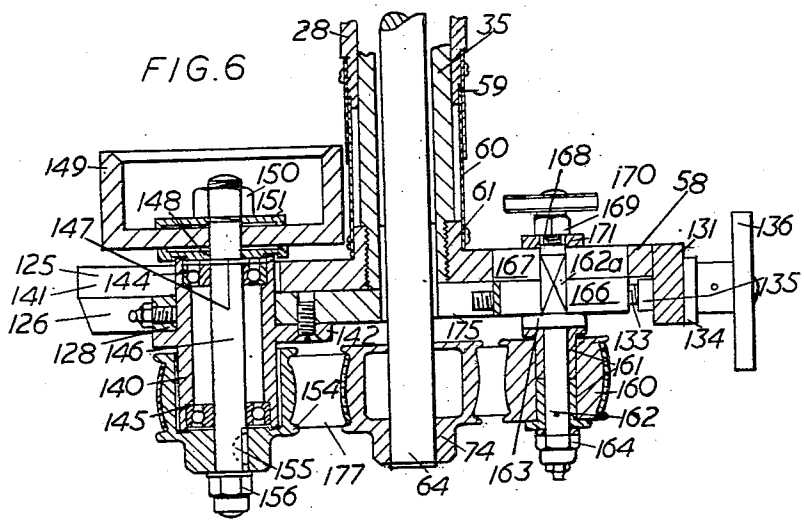



FIG. 6.




Inventor

Alexander Wierzbicki

By

Pennie, Edmonds, Morton, Barrows & Taylor

Attorneys

United States Patent Office 2,809,483 Patented Oct. 15, 1957



2,809,483

# MACHINING OF PLANAR SEATINGS

Alexander Wierzbicki, London, England, assignor to Dewrance & Co., Limited, London, England, a British company

Application April 26, 1955, Serial No. 504,054

Claims priority, application Great Britain April 30, 1954

7 Claims. (Cl. 51—241)

This invention relates to a grinding or/and lapping machine for use on seatings of the kind used as porthole cover planar seatings located within a vessel adapted to operate under internal pressure, for example a valve body, of the type in which the seating is raised above the surrounding surface and is of elongated annular form, and of the type in which the seating is formed with parallel sides and semi-circular ends.

An object of the invention is the provision of a machine for enabling such seatings expeditiously and accurately to be machined or/and lapped.

A further object is to enable joints between covers and port-holes of valve bodies or other pressure vessels to be reconditioned while the vessels are in their installed positions, a matter of great importance in the case, for example, of high pressure valves connected by welded joints to the associated pipe lines.

Further objects and advantages of the invention will be apparent from the subsequent description of an embodiment of the invention.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a front elevation of a seating grinding and lapping machine shown assembled in position on a valve body preparatory to a grinding operation, the upper part only of the valve body being shown, by chain lines and in cross-section;

Figure 2 is a plan view of the machine and valve body shown in Figure 1;

Figure 3 is a sectional side elevation of the machine taken on the line III—III of Figure 1 and as viewed in the direction indicated by the arrows, and drawn to a larger scale than Figure 1;

Figure 4 is a sectional side elevation of part only of the machine, taken on the line IV—IV of Figure 1 and as viewed in the direction indicated by the arrows, and drawn to a larger scale than Figure 1;

Figure 5 shows a lower part of the machine as viewed from underneath, and is drawn to a larger scale than Figure 1; and

Figure 6 is a sectional front elevation of a lower part only of the machine, taken on the line VI—VI of Figure 5 and as viewed in the direction indicated by the arrows.

The seating grinding and lapping machine **1** is shown assembled in operative position upon the bottom of an upturned valve body **2**, the valve being of a well known parallel-slide type welded in an inverted position in a high pressure steam main and normally including in its upper part (not shown) the slidable valve discs. The valve body **1** is formed in its upturned bottom surface with an opening or port **3** of greater length, taken from left to right in Figures 1 and 2, than width. At the inner end of the port **3**, a planar seating **4** encircles the port, this seating being engaged, when the valve is in operation, by a port hole cover, not shown, which is pressed by the fluid pressure within the valve body against the seating **4** to complete a fluid tight closure of the port hole.



The seating is formed with straight side parts, such as side part **4***a*, which are parallel to the major axis of the port-hole and with semi-circular end parts **4***b*, and in the valve body shown the seating is cut back into the top wall of the valve body. The machine of the present invention may also be utilised on elongated planar seatings which have end parts that are not semi-circular, but in that case the seatings must be proud of the surrounding wall surface of the valve body.

The machine **1** includes a base **10** which is in the form of a casting having a flat base part **10***a* and an upstanding, generally flat, flange **10***b* which extends the full length of the base part **10***a* and is located towards one side of the part **10***a*. The base part **10**a is formed with an elongated central aperture **11**. The base part **10***a* is formed with four spaced circular holes so disposed relative to the flange **10***b* that when the base part **10***a* is correctly fitted over four studs **13** permanently fixed to the bottom surface of the inverted valve body **2** the flange **10***b* extends in a direction which is parallel to the major axis of the port **3** and thus to the major axis of the seating **4**. The base **10** is clamped against shoulders on the studs **13** by cap nuts **14** which engage the upper surface of the base part **10***a* and engage screw-threaded upper portions of the studs **13**. These cap nuts **14** are normally replaced on the studs **13** when the machine **1** is not applied to the valve body and serve to protect the screw-threaded portions of the studs.

The flange **10***b* is formed with a large central aperture **15** and has that of its sides which faces the part of the base part **10***a* formed with the aperture **11** machined to form a machine slide groove (see Figure 3) extending from end to end of the flange and having undercut edges **17** and serving as a guide for a base reciprocatory member formed by a machine slide **18**. The slide **18** has chamfered edge portions **19** complementary to the groove edges **17**, and between the upper of the edge portions **19** and the upper of the groove edges **17** is provided in known manner a gib strip **20** (see Figure 3) adjustable by two adjusters **21** screw-threaded through the upper end of the flange **10***b* and bearing at their lower ends against the gib strip **20**. When the gib strip **20** is properly adjusted, the slide **18** can slide freely but without play along the groove **16**, that is to say in a direction parallel to the major axis of the port **3**. The extent of the endwise movement of the slide **18** in the groove **16** is limited by two stop screws **22**, which are adjustable within arms **23** bolted respectively to the opposite ends of the slide **18**, and each arranged to engage the adjacent end of the flange **10***b*.

A cast bracket **25**, clamped to the outer face of the slide **18** by nuts **26** engaging screw-threaded studs **27**, includes a downwardly extending sleeve **28** defining a bore **29** (see Figure 3) of circular transverse cross-section and split down one side, the sleeve being provided with radial flanges such as flange **30** on each side of the split. Stud bolts **31** extend through circular holes in one of the flanges and into screw-threaded holes in the second flange, and a limited decrease in the diameter of the bore **29** may be effected by tightening the bolts **31**.

A first driving shaft **35** of annular cross-section fits within the sleeve **28**, and extends beyond both ends of the sleeve, the diameter of bore **29** being so adjusted by the bolts **31** that the shaft **35** is rotatable within the sleeve **28** and is movable axially therein. The upper end of the shaft **35** extends through a bush **37** mounted in a downwardly depending circular boss **38** of a guide **39** clamped by stud bolts **40** to an outwardly projecting flange **41** of the bracket **25**. The exterior of the boss **38** is screw-threaded, and a feed gear worm wheel **44** has a screw-threaded axial bore **45** which operatively engages the boss **38** so that rotation of the worm wheel **44** causes it to

move axially of the boss **38**. A lower part of the bore **45** is formed with a shoulder **46** which operatively engages the upper face of a circumferential flange **47** formed on the shaft **35**, and a lower part of the exterior of a boss part **48** of the work wheel is screw-threaded and carries a screw-threaded retaining ring **49** which encircles the shaft and which has an upwardly facing surface which engages the lower face of the flange **47**. Thus rotation of the worm wheel **44** is effective to cause axial movement of the shaft **35** but is not effective to cause or restrain rotation of the shaft.

Mounted on the part of the shaft **35** which lies between the worm wheel **44** and the sleeve **28** is a chain wheel **52** which is slidable on the shaft **35** but is restrained against rotation thereon by a key **53** secured to the chain wheel **52** and slidable in a keyway **54** formed in the shaft 35.

The lower end of the shaft **35** is screw-threaded and extends into a support member **58** to which it is suitably locked. Dirt is excluded from the lower end of the shaft **35** by two concentric closely spaced sleeves **59** and **60** respectively secured to the lower end of the sleeve **28** and to an upwardly extending boss **61** formed on the support member **58**.

A second driving shaft **64** extends through the first driving shaft **35** and extends at its bottom end below the support member **58** and at its top end above the guide **39**, being journalled in a bearing **65** in the guide **39** and in two spaced bearings **66** provided in the bore of the first driving shaft 35. At its upper end the shaft **64** is formed with an enlargement **68** which serves to retain on the shaft a belt pulley wheel **69** having flanged or beaded edges and which is axially slidable on the shaft but is keyed against rotation thereon by a feather key **70** secured to the shaft. Dirt is excluded from the upper end of guide **39** by a cylindrical sleeve **71** mounted on a lower boss of the pulley wheel **69** and fitting about a cylindrical projection **72** formed on the top of the guide **39**. A belt pulley wheel **74** having flanged or beaded edges is mounted on the lower end of the shaft **64** and is located against movement thereon by a taper pin **75** extending through the wheel and the shaft.

Mounted on the bracket **25** to one side of the shafts **35** and **64** is a gear box **80** comprising a cylindrical body part **80***a* and an end cover **80***b*, both parts being clamped to the slide **18** by nuts **81** screw-threaded onto the outer ends of three studs **82** which extend through the parts **80***a* and **80***b* and into the bracket **25**. Extending axially of the gear box **80** is a shaft **84** (see Figure 4) which extends through bearings **85** and **86** provided respectively in the bracket **25** and in the cover **80***b*, the shaft **84** extending forwardly beyond the cover **80***b* and having fixedly mounted on its forward end a crank handle **87**, and extending rearwardly beyond the bracket **25** and having fixedly mounted on its rearward end a worm **88**. Also fixedly mounted on the shaft **84**, inside the gear box **80**, are two oppositely facing bevel gear wheels **90** and **91**. A third bevel gear wheel, **92**, is positioned in the gear box **80** between the wheels **90** and **91** and is fixedly mounted on a short vertical spindle **94** which extends through the bottom of the gear box and has fixedly mounted on its lower end a chain wheel **95** so arranged as to lie coplanar with the chain wheel **52**, to which it is coupled by a chain **96** (see Figure 1) when that wheel is resting on the top of the sleeve **28**. The disposition of the three bevel gear wheels **90**, **91** and **92** is such that if the shaft **84** is in the position shown in Figure 4, rotation of the crank handle **87** in an anti-clockwise direction as seen in Figure 1 will cause rotation of the spindle **94** and thus, by the chain **96**, of the shaft **35** in a clockwise direction, as seen in Figure 2; whereas if the shaft **84** is forced from the position shown in Figure 4 in a direction towards the left of that figure, to the limit of its travel, upon rotation of the crank handle **87** in a clockwise direction (as seen in Figure 1), the spindle **94** and thus the shaft **35** will continue to rotate in the same direction as before despite the reversal of direction of rotation of the crank handle.



The slide **18** is formed with a rectangular aperture **98** opposite the gear box **80**, and a worm gear cover **99** extends from the rear of the bracket **25** through this aperture **98** and through the aperture **15** in flange **10***b* and is clamped to the back of the bracket **25** by four stud bolts such as the bolts **100**. The worm **88** extends into the cover **99** and engages a worm wheel **101** mounted on a worm wheel shaft **102** which extends with its axis parallel to the direction of sliding of the slide **18** and is mounted in bearings (not shown) provided in end parts of the cover **99** and adapted to locate the shaft against axial movement. The worm wheel shaft **102** extends through one end of the cover, and the part **102***a* of the shaft which is outside the cover **99** is screw-threaded and operatively engages a nut member **104** suitably fastened to the flange **10***b* of the base **10**. This flange is cut away in the vicinity of the member **104** to accommodate the shaft part **102***a*. It will be seen that rotation of the crank handle **87** will effect rotation of the worm wheel shaft **102** which, by engagement with the nut member **104**, will cause the slide **18** to traverse relative to the base **10** in a direction parallel to the major axis of the port-hole seating **4** and in a sense dependent upon the sense of rotation of the crank handle. Furthermore, the crank handle **87** forms part of common operating means which effect both traversing of the slide **18** and rotation of the first driving shaft **35** together with the support member **58**, and whatever the direction of rotation of the crank handle **87**, the reaction between the worm **88** and the worm wheel **101** will cause the shaft **84** to assume an axial position such that the spindle **94** and thus the first driving shaft **35** will rotate in a clockwise direction, as viewed from above.

The cover **80***b* of the gear box **80** is formed with an integral lateral extension **108** which extends across the front of the feed gear worm wheel **44**, in which region it is formed with a gap **109** in which is disposed a worm **110** operatively engaging the feed gear worm wheel **44** and mounted on a shaft **111** journalled in bearings secured to the extension **108** and such that the shaft **111** is located against axial movement. An outward part **111***a* of the shaft **111** is provided with a grip wheel **112** by means of which the worm may be turned to effect rotation of the worm wheel **44** and thereby axial movement of the first driving shaft **35** together with the support member **58**, and a locking grip wheel **113** screw-threaded on the part **111***a* is axially movable thereon so that it can be clamped against the extension **108** to lock the shaft **35** in a desired axial position.

Also mounted on the slide **18** is an electric motor **115** clamped to a block **116**, which is itself secured to the rear face of the slide, by stud bolts **117**. The shaft of motor **115** has mounted upon it a belt pulley wheel **118** having flanged or beaded edges and connected by a flexible belt **119** to the belt pulley wheel **69**, and the tension of the belt may be adjusted by the provision of shims between the block **116** and the motor **115**.

It will be seen from Figure 1 that the shafts **35** and **64** extend through the port-hole **3** and that the support member **58** is disposed within the valve body below the seating **4** to be operated upon and extends laterally of the axes of the two shafts.

As shown most clearly in Figures 3, 5 and 6, the support member **58** comprises an elongated main part **125** rigidly fastened to the lower end of the first driving shaft **35** and having its lower face formed with a machine slide groove **126** having undercut edges **127** and into which is fitted a slide **128** retained in place by a gib strip **129** positioned between one of the edges **127** and the slide **128** and pressed into contact with the slide by adjustment screws such as the screw **130**. One end of the main part **125** is provided with a downwardly extending bracket **131** formed with a circular hole through which extends a

spindle 133 having an integral flange 134 and a separate collar 135 locked in position on the spindle, the parts 134 and 135 being on opposite sides of the bracket 131 and serving to locate the spindle against axial movement relative to the bracket. The outer end of the spindle is provided with a grip wheel 136 and the opposite end of the spindle is screw-threaded and operatively engages a screw-threaded hole 137 formed in the slide, whereby upon rotation of the grip wheel 136 the slide 128 is caused to move along the main part 125. Mounted on the slide 128 at the end remote from the hole 137 is a cylindrical housing 140 extending upwardly through the slide 128 and through a radially extending slot 141 formed in the main part 125 of the support member, the housing 140 being provided intermediate its ends with a radial flange 142 whereby the housing is clamped by countersunk screws to the slide. Mounted in the housing 140 adjacent its upper and lower ends respectively are co-axial ball journal bearings 144 and 145, of which the upper, 144, is of a type adapted to transmit a vertically downward thrust from its inner race to its outer race. A tool spindle 146 is fitted to the inner races of the two ball bearings, spindle 146 being formed with an integral flange 147 arranged to engage the upper surface of the inner race of the upper bearing 143 and formed with a flat upper face which provides a seating for a washer 148 on which sits a cup type grinding wheel 149 clamped against the washer and flange 147 by a nut 150 engaging a screw-threaded upper part of spindle 146 and acting through a washer 151 on the wheel 149. Mounted on the lower end of the spindle 146 is a belt pulley wheel 154 having flanged or beaded edges and locked to the spindle by a key 155 and by a nut 156 which engages a screw-threaded lower part of the spindle.

Also mounted on the slide 128 are two jockey pulleys 160 each having flanged or beaded edges and each of which is provided with a split bush 161 (see Figure 6) through which extends a spindle 162 formed with a medial flange 163 against the lower face of which the upper end of the bush 161 is clamped by a nut 164 which engages a screw-threaded lower part of the spindle and the lower end of the bush. Above the flange 163 each spindle 162 is formed with a part 162*a* of square transverse cross-section, the part 162*a* fitting within a slot 166 in the slide 128 and a slot 167 formed in the main part 125, the slots 166, 167 extending in a direction parallel to the direction of movement of the slide 128 relative to the main part 125. The upper end of each spindle 162 is screw-threaded as indicated at 168 and carries a nut 169 provided with a grip-wheel surface 170 and arranged to act through a washer 171 on the upper surface of the main part 125 so as to draw the flange 163 of the spindle tightly into contact with the lower surface of the slide 128, thereby rendering rigid the mounting of the jockey wheel spindle on the slide and at the same time, by pressing the slide against the part 125, locking the slide 128 against movement relative ot the main part 125. Greasing points are fitted at appropriate locations on the support member assembly.

The slide 128 is formed with a slot 175 extending parallel to the direction of its movement through the main part 125 and accommodating the lower end of the second driving shaft 64. A flexible belt 177 extends about the pulley wheels 154 and 160 (see Figure 5) and, between the jockey pulley wheels 160, about the pulley wheel 74 mounted at the foot of the second driving shaft 64. The second driving shaft 64 is slidable axially of the first driving shaft 35, but the tension in belt 177 acts to keep the pulley wheels 74 and 160 in alignment.

When it is desired to repair the seating of a valve port-hole cover which is of suitable configuration, the port-hole cover, the valve discs and the valve disc operating mechanism are removed, and a machine as described above and of suitable size is clamped to the valve body in the position shown in Figures 1 and 2. Assembly is usually facilitated if the grip wheel 112 is first adjusted to cause the first driving shaft 35 to move downwardly of the sleeve 28 as far as possible so as to provide a large clearance between the base part 10*a* of the mounting 10 and the support member 58. It is desirable, as a precautionary measure, first to remove the cup type grinding wheel 149 since it is fragile, and may be replaced readily when the machine is in position.

After ensuring that the rim of grinding wheel 149 is below the plane of the seating 4, the radial pitch of the spindle 146, upon which the grinding wheel 149 is mounted, from the axes of the two co-axial driving shafts 35 and 64 is adjusted in order that the grinding wheel may engage the full width of the seating 4 as the support member 58 is rotated. This adjustment is effected by first slackening off the grip wheels 170, and then adjusting the radial position of the grinding wheel by adjustment of the grip wheel 136. The driving belt 177 is then tensioned by sliding the spindles of the jockey pulley wheels 160 along the slots 166 in slide 128 and the jockey pulley wheels and the slide are locked in their adjusted positions by tightening of the grip wheels 170.

The support member 58 is traversed along the length of the port-hole 3 by rotation of the crank handle 87 until the grinding wheel 149 reaches a position in which it will, when raised, be effective to grind one extreme end part of the seating 4. The appropriate stop screw 22 is then set to limit the travel of the slide 18 to this position, the support member 58 is traversed in the opposite direction to find the other limiting position, and the second stop screw 22 similarly adjusted. When this has been done, it becomes impossible for the operator inadvertently to traverse the slide 18 so far that the grinding wheel 149 can operate beyond either end of the seating 4.

The actual grinding operation can now commence; motor 115 is energised and through the pulley wheel 118, the belt 119 and the pulley wheel 69 rotates the second driving shaft 64. The second driving shaft 64 is effective through pulley wheel 74, belt 177 and pulley wheel 154 to effect rotation of the tool spindle 146 and thus of the grinding wheel 149. The operator, by adjustment of the grip wheel 112 rotates the feed worm wheel 44 and thereby moves the first driving shaft 35 and, with it, the support member 58, bodily upwards, so that the grinding wheel contacts the seating 4, the requisite distance being judged by the operator from an examination of the seating and from his personal experience. The axial position of the first driving shaft 35 within the sleeve 28 is then fixed by tightening-up the locking grip wheel 113 against the extension 108. Rotation of the crank handle 87 in a clockwise direction (as seen in Figure 1) is effected by the operator and this causes both rotation of the support member, so that the grinding wheel 149 performs a planetary motion about the axes of the shafts 35, 64, and at the same time an axial movement of the slide 18 parallel to the major axis of the seating 4 in a sense determined by the axial position of the shaft 84. Thus the grinding wheel 149 acts upon the seating 4 from the starting point along the axis of port 3 up to the appropriate end of the seating.

When the grinding wheel 149 reaches the end of the seating 4, the appropriate stop screw 22 prevents continued rotation of the crank handle 87. Upon the direction of rotation of the crank handle 87 being reversed, the reaction between the worm 88 and the worm wheel 101 causes the shaft 84 to move axially to its alternative position in which it is effective to effect continued rotation of the support member 58 in the same direction as before but the rotation of the handle effects movement of the slide 18 in the opposite direction. The slide 18, with the support member 58, is then traversed along the length of the major axis of the seating in order that the whole of the seating shall have been operated upon by the grinding wheel 149.

In practice the operator will probably take several cuts

off the seating until it assumes a satisfactory condition, each cut being preceded by a further adjustment of the grinding wheel **149** towards the seating **4** under the control of the hand grip wheel **112** followed by a locking movement of the locking grip wheel **113**.

If desired, the grinding operation may be followed by a lapping operation. To perform this, the grinding wheel **149** is lowered away from the seating **4** by adjustment of the grip wheel **112**, the grinding wheel is replaced with a lapping disc of any suitable type and of a diameter equal to or slightly less than the outside diameter of the grinding wheel **149**, and a lapping operation is carried out along the same lines as the grinding operation. The lapping disc used will need to be formed with a countersunk central portion to take the nut **150**, the washer **151** being left off, and will need to be of sufficient thickness to ensure that the grip wheels **170** and **136** do not foul the seating or the surrounding parts of the valve body wall.

When the repair of the seating is completed, the machine is removed from the valve body and the cap nuts replaced on the studs **13**.

During the grinding operation, the grinding wheel **149** is rotated about its axis at high speed, it performs a planetary motion about the axes of the two driving shafts **35** and **64** and it is slowly moved to and fro along the major axis of the seating. By way of example, in the machine illustrated the motor rotates the grinding wheel **149** at a speed of about 5,000 R. P. M. and the gears are so arranged that with two complete turns of the crank handle **87** the grinding wheel **149** completes one revolution of its planetary motion while the slide **18** moves a distance of 0.009 inch in a direction parallel to the major axis of the seating **4**.

Furthermore, at all times the planetary motion of grinding wheel **149** takes place in the same sense about the axes of the shafts **35** and **64**, namely in a clockwise direction as viewed in plan. This eliminates any tendency for the formation of a step in the seating which might occur if the planetary motion were to reverse its direction; and in practice it has been found advantageous if the sense of the direction of the planetary motion is the same as that of the grinding wheel **149** about its own axis.

From the above description it will be understood that the invention includes the method of reconditioning planar cover seatings, at port-holes having annular internal cover seatings of elongated form provided within a valve body or other pressure vessel installed for service, of the type in which the seating is proud of the surrounding surface and of the type in which the seating is formed with parallel sides and semi-circular ends, which includes maintaining the body in its installed position, removing the cover from the port-hole, utilising external clamping means provided on the body adjacent the port-hole to locate and clamp in position on the body the base of the machine and operating the machine to grind or lap the cover seating.

What is claimed is:

1. A grinding or/and lapping machine for use on seatings of the kind described comprising a base provided with fixing means for clamping it in fixed position upon a workpiece, a base reciprocatory member slidably mounted on the base, straight guide surfaces on the base, complementary surfaces on the base reciprocatory member cooperating with the guide surfaces on the base, a support rotatably mounted on the base reciprocatory member having an axis of rotation normal to the direction in which said member is arranged to slide, a rotatable spindle mounted on the support for rotation therewith and having an axis of rotation parallel to but offset from that of the support, a grinding tool mounted on the spindle and fixed to rotate therewith, rotary driving means coupled to the spindle, feed means for causing axial movements of the tool, an operating handle rotatably journaled in the base reciprocatory member, means for traversing the base reciprocatory member, and rotation transmitting coupling means connecting the handle to the rotatable support and to the traversing means.



2. A machine as claimed in claim 1, wherein the coupling means includes an input shaft rotatable by the handle, an output shaft coupled to the rotatable support, a first reversing means coupling the input shaft to the output shaft, and a second reversing means for actuating the first-reversing means coupled to the input shaft and movable from a forward drive position to a reverse drive position and vice versa by reversal of the direction of rotation of the input shaft.

3. A grinding or/and lapping machine for use on seatings of the kind described comprising a base provided with fixing means for clamping it in fixed position upon a workpiece, a base reciprocatory member slidably mounted on the base, straight guide surfaces on the base, complementary surfaces on the base reciprocatory member cooperating with the guide surfaces on the base, first and second concentric driving shafts rotatably mounted on the base reciprocatory member and extending away from said member with their common axis normal to the direction in which said member slides, a support mounted on the first driving shaft and extending laterally from a part of that shaft remote from the base, a rotatable spindle mounted on the support with its axis parallel to and offset from that of the shafts, a grinding or lapping tool mounted on the spindle, rotary driving means coupling the second shaft to the spindle, means coupled to the second shaft for effecting its rotation, feed means for causing axial movements of the first shaft relatively to the base reciprocatory member and consequent axial movements of the tool, an operating handle rotatably journaled in the base reciprocatory member, means for traversing the base reciprocatory member, and rotation transmitting coupling means connecting the handle to the first shaft and to the traversing means.

4. A machine as claimed in claim 3, wherein the coupling means includes a worm shaft rotatably mounted in the base reciprocatory member, a worm mounted on the worm shaft, the operating handle being connected to the worm shaft, a worm wheel mounted in the base reciprocatory member engaging the worm, relatively rotatable co-acting nut and screw elements one of which is connected to the base while the other element is connected to the worm wheel and arranged to effect traversing movement of the base reciprocatory member relative to the base upon rotation of the handle, and wherein the coupling means includes direction-reversing gearing coupling the worm shaft to the support, the worm shaft being mounted for limited axial movement, the arrangement being such that upon reversal of the direction of rotation of the handle the reaction between the worm and the worm wheel causes limited axial movement of the worm shaft and a shift in the direction-reversing gearing.

5. A machine as claimed in claim 4, wherein the gearing coupling the worm shaft to the support includes two bevel gear wheels fixed in spaced relation on the worm shaft, a driving spindle extending normally to the worm shaft, and a third bevel gear wheel mounted on the driving spindle and disposed between the two bevel gear wheels, the two bevel gear wheels being adapted to alternatively engage the third bevel gear wheel upon axial movement of the worm shaft.

6. A machine as claimed in claim 5, wherein the driving spindle is disposed with its axis parallel to the axis of the first driving shaft, a chain wheel fixed to the driving spindle, a chain wheel keyed to but axially movable on the first driving shaft, and a chain extending around and coupling the chain wheels.

7. A machine as claimed in claim 3, wherein the coupling means includes an input shaft rotatable by the handle, an output shaft coupled to the first driving shaft, reversing means coupling the input shaft to the output shaft, and reversing means for actuating the traversing

means coupled to the input shaft and movable from a forward drive position to a reverse drive position and vice versa by reversal of the direction of rotation of the input shaft.

**References Cited** in the file of this patent

UNITED STATES PATENTS

1,972,086 Buckley ---------- Sept. 4, 1934
2,016,574 Myers et al. ---------- Oct. 8, 1935
2,364,506 Berezny ---------- Dec. 5, 1944
2,400,983 Dunn ---------- May 28, 1946
2,572,485 Hunter et al. ---------- Oct. 23, 1951
2,614,372 Kelly ---------- Oct. 21, 1952