Dec. 4, 1962 K. J. NISPER ET AL 3,066,398

RING INSTALLER

Filed Sept. 21, 1959 5 Sheets-Sheet 1

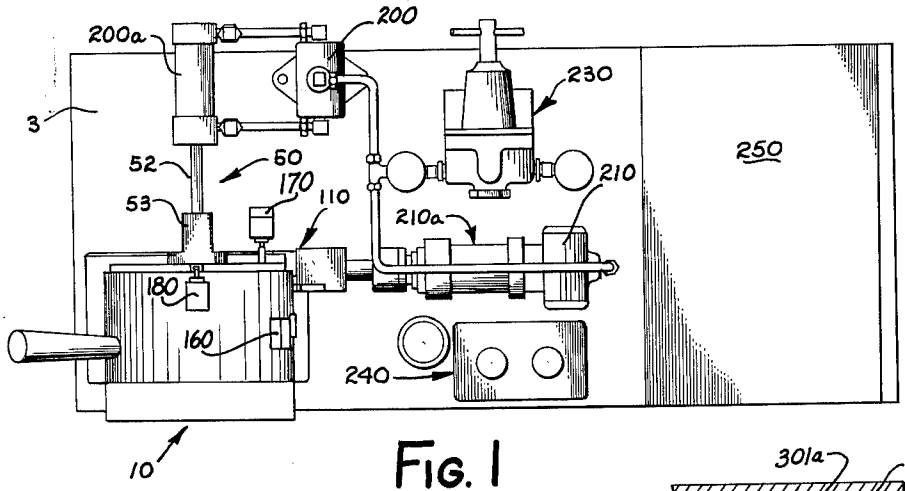


FIG. 1

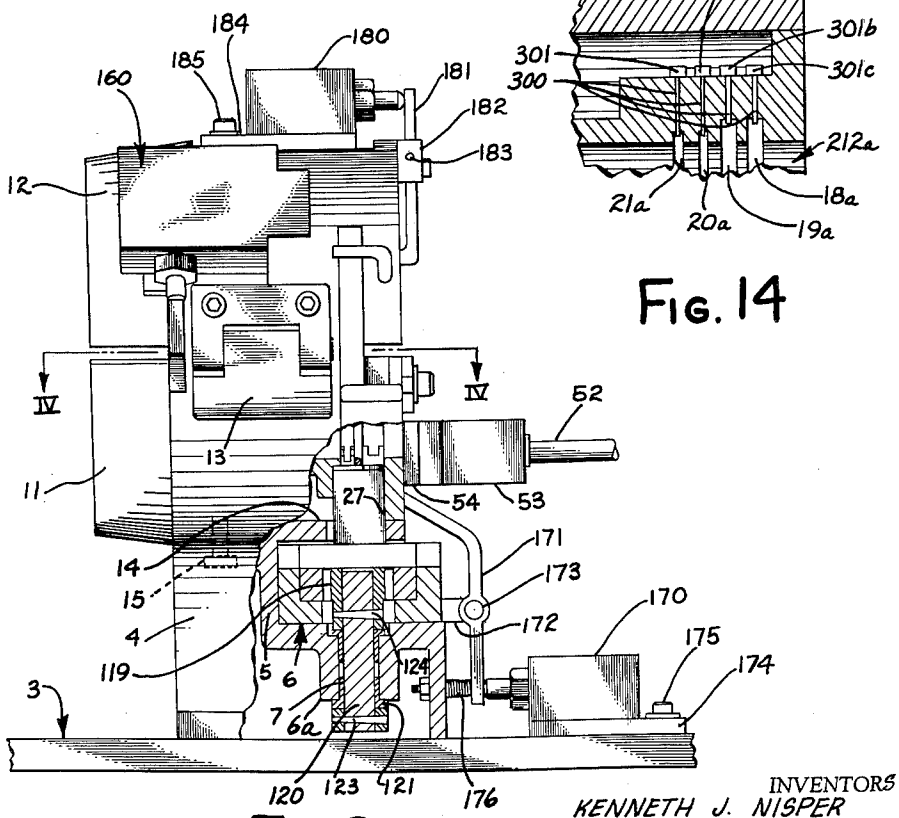


FIG. 2

FIG. 14

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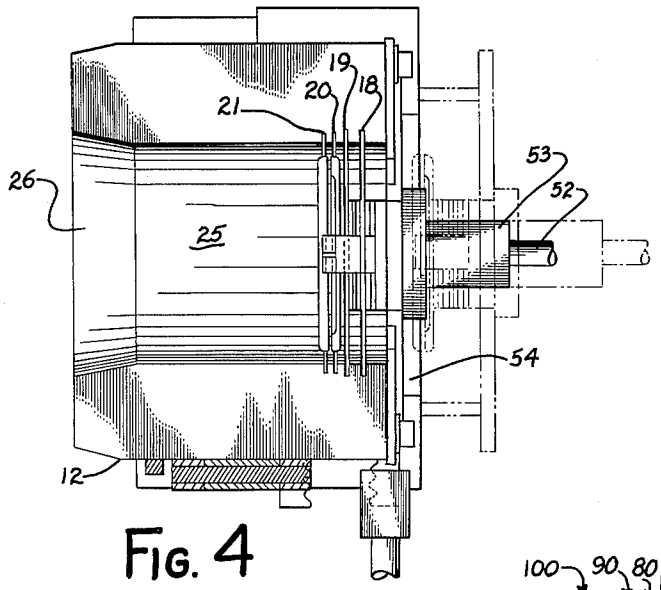


FIG. 4

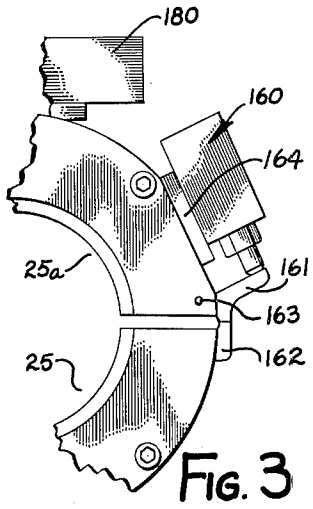


FIG. 3

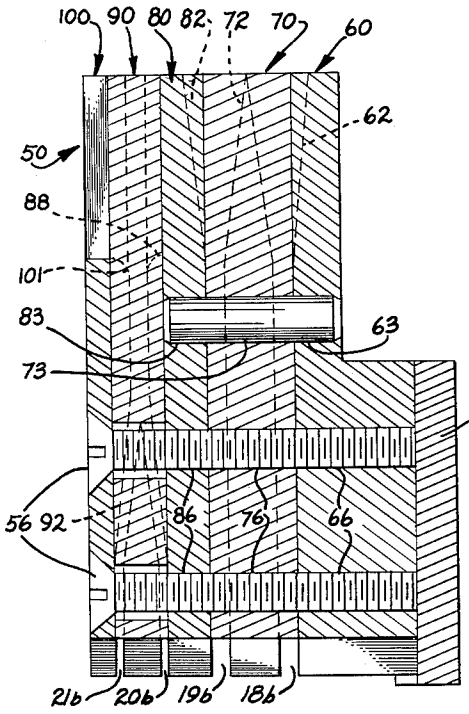


FIG. 5

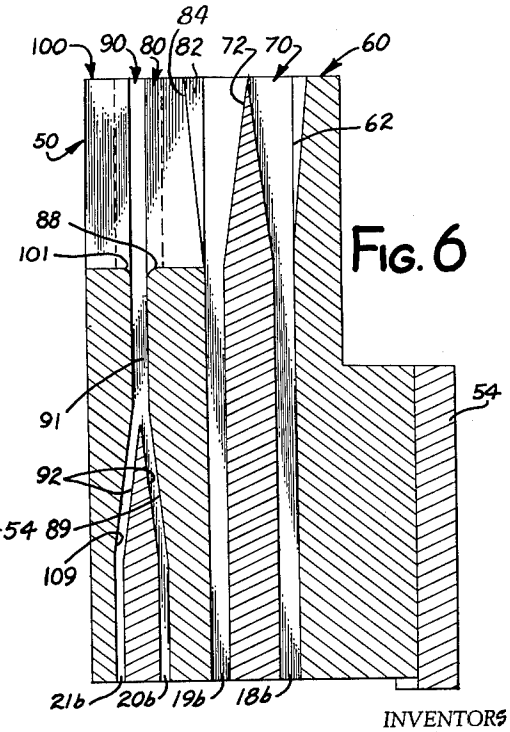


FIG. 6

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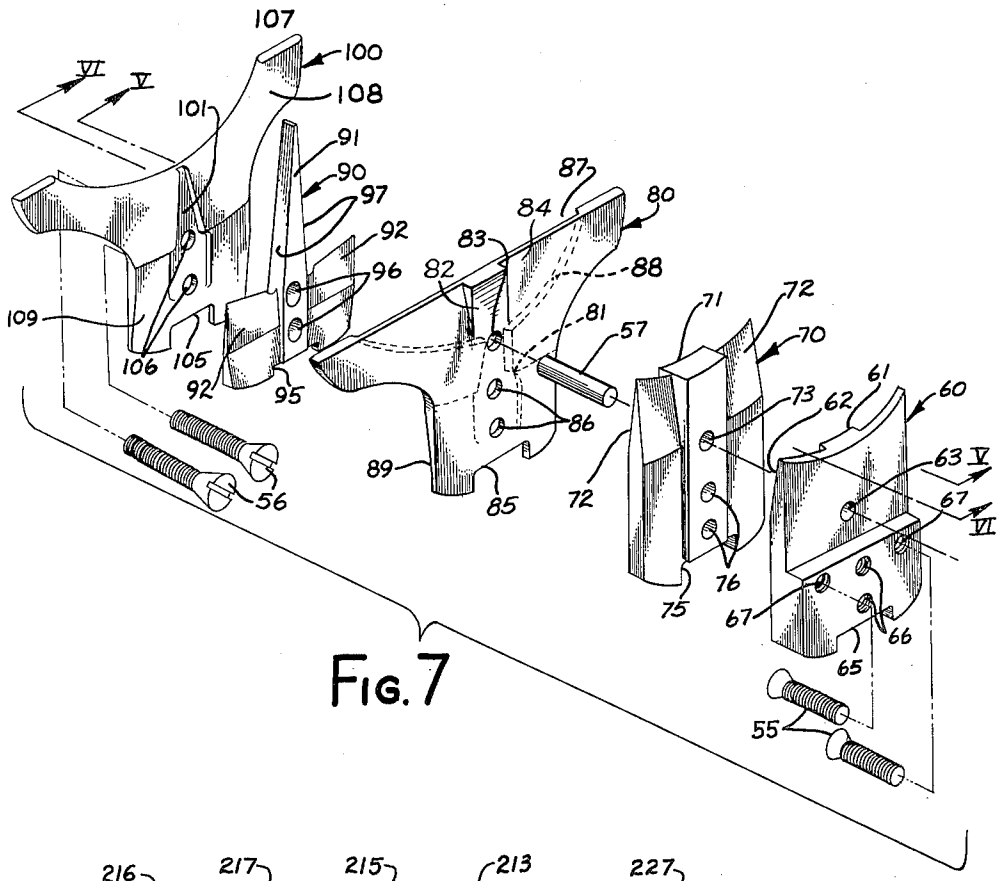


FIG. 7

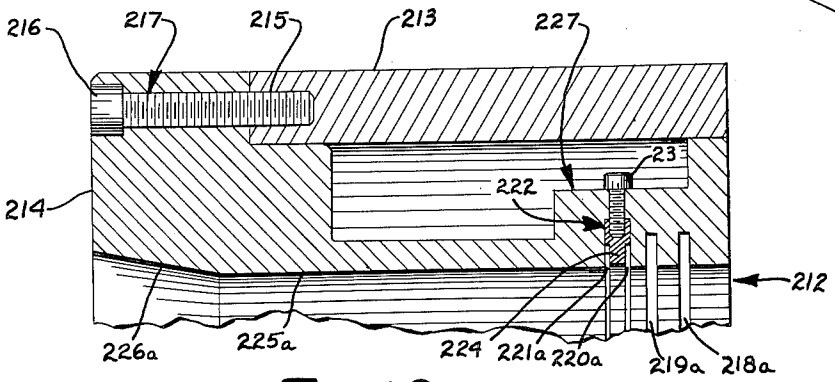


FIG. 12

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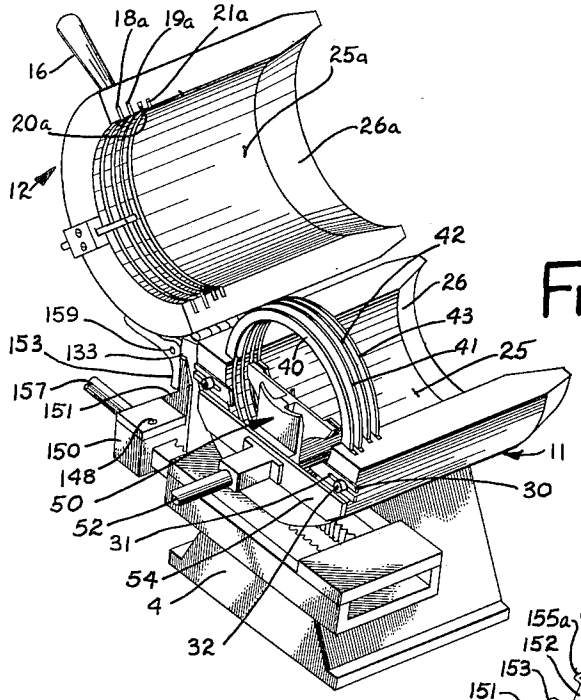


FIG. 8

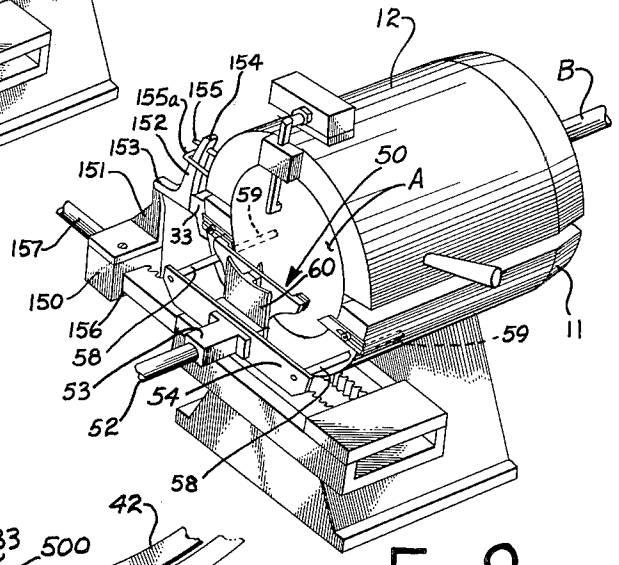


FIG. 9

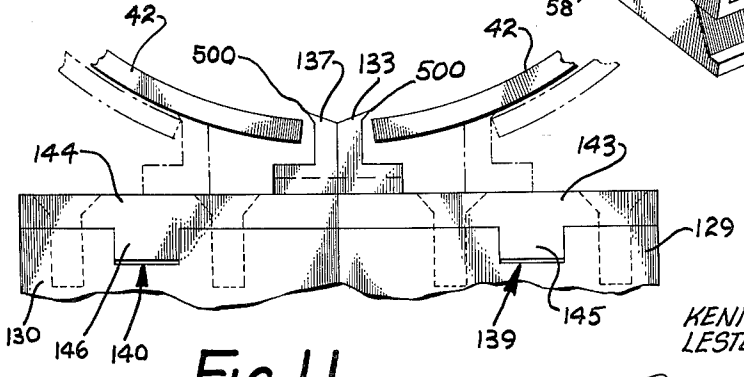


FIG. 11

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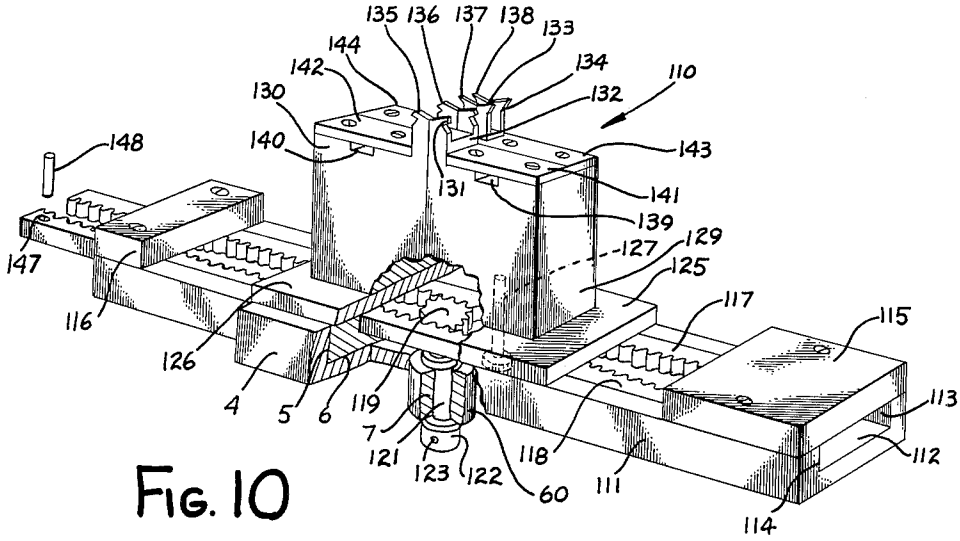


FIG. 10

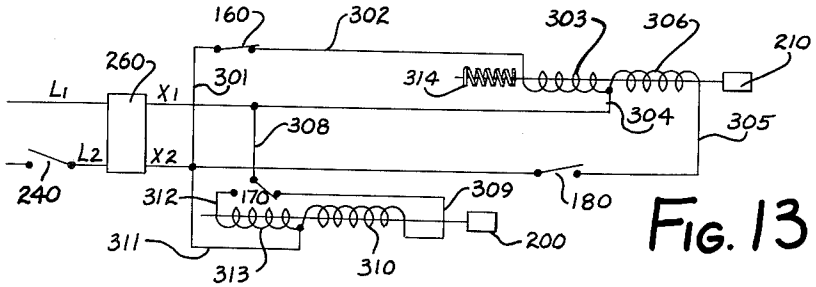


FIG. 13

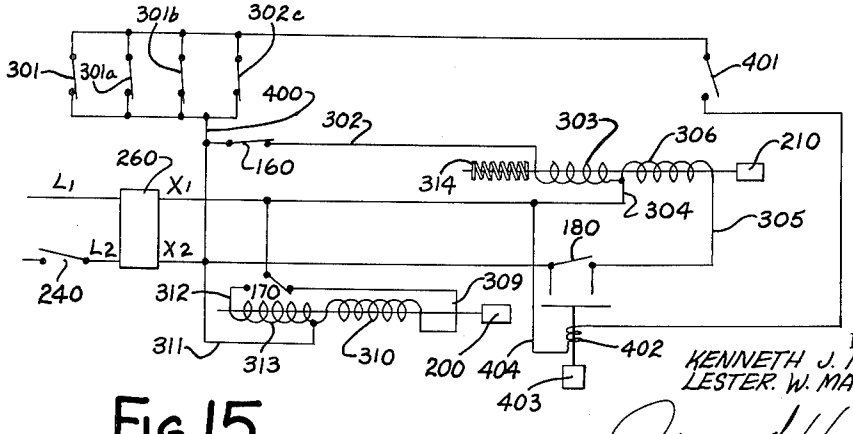


FIG. 15

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United States Patent Office

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RING INSTALLER

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Filed Sept. 21, 1959, Ser. No. 841,152
16 Claims. (Cl. 29—222)

This invention relates to a device for installing piston rings on a piston, and more particularly to a piston ring installer which is semi-automatic.

The conventional piston currently in use generally has three ring grooves to accommodate compression and oil rings. The groove nearest the top of the piston accommodates the compression ring or first compression ring, the next groove accommodates the intermediate ring or second compression ring, and the third groove furthest from the top of the piston accommodates the oil ring. The compression ring and intermediate ring are usually one piece rings and of solid cross sectional dimension. However, the oil ring often consists of two separate rings or rails with a separate spacer member positioned therebetween. Since the inside diameter of the piston rings is less than the outside diameter of the piston it is necessary that the rings be expanded so that they may be slipped over the piston and seated in the appropriate grooves. The rings are provided with a gap which allows the rings to be expanded to a diameter so that they will slip over the piston and seat in the appropriate grooves.

In spite of the great advancements in automation, the installation of piston rings on pistons largely is still done by hand today. Since it is necessary to place two compression rings, two rails and a spacer on the piston, it is necessary that one workman handle the piston several different times, or that the piston be handled once by several different workers to install the necessary number of piston rings on one piston. It is a primary object of this invention to disclose a piston ring installer which will necessitate the handling of the piston only once.

An object of this invention is to provide a fixture in which the piston rings may be inserted and held in a given position to facilitate installation of the rings on a piston.

It is a further object of this invention to disclose a fixture in which all of the rings for one piston are assembled thereon at the same time.

Still another object is to disclose a fixture having a loader which quickly, accurately and automatically positions the piston rings in grooves of the fixture.

Still another object is to disclose a means for spreading the piston rings within the fixture to allow a piston to pass through the expanded rings, and to provide means for allowing the rings to retract and seat themselves within the grooves of the piston.

Another object is to show a piston ring installer which makes insertion of the piston in the fixture difficult unless the piston rings have been properly positioned and expanded to allow the piston to pass therethrough.

A further object is to disclose a piston ring installer bearing certain limit switches which are actuated by inserting the piston in the fixture. The actuation thereof automatically withdraws the ring loader so that the top of the piston is no injured and allows the rings to contract and seat in the piston grooves when the piston is in the desired position. Further, this arrangement eliminates the manual effort which would otherwise have to be exerted to remove the loader. Thus, in the absence of significant resistance the operator is facilitated in moving the piston positively against the positioning stops.

It is an additional object to provide a piston ring

installer having a hinged cover, which, when open, facilitates positioning the piston rings in the fixture grooves, and when closed, assists in positioning the piston rings and trips a switch which automatically expands the piston rings within the fixture to allow the piston to be inserted therethrough.

It is still a further object to disclose a piston ring installer having a pivoted cover which when moved to the open position facilitates removal of the piston after the rings have been installed thereon.

Another object is to show a piston ring installer which has a pivoted cover, and upon opening the pivoted cover and removal of the piston a switch is actuated which automatically returns the ring loader to ring loading position.

Among other primary objectives of this invention is a piston ring installer which is compact and relatively simple. These features substantially reduce its initial cost and the resulting equipment is more durable and dependable. Also it requires less skill on the part of the operator to use it. It also is particularly designed to assure proper installation of the rings eliminating such improper ring installation as twisting, omission of rings or rails, location of both rails of the oil ring on one side of the spacer, improper seating of the rails about the spacer and accidental failure to install any rings on a piston. All of these types of improper ring installation are experienced with present ring installation methods.

The invention is particularly designed to automatically, quickly and positively separate the rails of the oil ring and place one on each side of the spacer.

These and other objects will become more evident in the following specification made in conjunction with the accompanying drawings wherein:

FIG. 1 is a plan view of the piston ring installer.

FIG. 2 is a partially broken, side elavational view of the fixture of the piston ring installer.

FIG. 3 is a fragmentary view of the spreader actuation or cover switch and switch actuating means.

FIG. 4 is a cross sectional view taken along the plane IV—IV of FIG. 2.

FIG. 5 is an enlarged central sectional view of the ring loader taken along the plane V—V of FIG. 7.

FIG. 6 is an enlarged sectional view of the ring loader taken along the plane VI—VI of FIG. 7.

FIG. 7 is an exploded view of the ring loader.

FIG. 8 is a perspective view of the piston ring installer fixture showing the cover of the fixture open, and the piston ring loader in the piston loading position with the piston rings inserted in the grooves of the fixture.

FIG. 9 is a perspective view of the piston ring installer fixture with the fixture cover closed and locked, and the piston inserted therein with the piston ring loader fully retracted.

FIG. 10 is a perspective view of the piston ring spreaders and piston ring spreading mechanism.

FIG. 11 is a fragmentary view of the rail spreaders showing the spreader teeth in the expanded position in phantom.

FIG. 12 is a fragmentary sectional view of a modified form of the fixture cover.

FIG. 13 is a schematic view of the pneumatic and electrical system of the piston ring loader.

FIG. 14 is a fragmentary sectional view of a further modification of this invention.

FIG. 15 is a schematic diagram of a modified valve and electrical control system of this invention.

FIG. 1 of the drawings shows the piston ring installer assembly including a base **3**, fixture **10**, loader **50**, ring spreader **110**, solenoid actuated air motors **200***a* and **210***a*, air regulator valve **230**, and terminal board **250**.

Secured to the piston ring installer base 3 by threaded fasteners or some other well-known means is a fixture support 4 (FIG. 2). The support 4 has an L-shaped platform formed therein having a vertical side 5 and a horizontally disposed side 6. The platform side 6 has a projection 6*a* extending downwardly from the bottom surface thereof with a circular vertical aperture 7 therethrough (FIGS. 2 and 10). The projection forms a guide means for the shaft of a pinion gear 119 to be explained more fully hereinafter. The support 4 has a fixture engaging surface 14 with apertures extending therethrough to accommodate threaded fasteners which secures the fixture 10 to the support 4 as shown in FIG. 2.

The fixture 10 is a generally cylindrically shaped housing severed along a horizontal plane at its geometric center to form a bottom 11 and a top or cover 12. The bottom and cover have bores 25 and 25*a* respectively (FIG. 8). The cover and bottom are chamfered at 26*a* and 26 respectively to facilitate introduction of the piston to the bore formed by the cover 12 and bottom 11. The bottom 11 and cover 12 are joined by a hinge 13 (FIG. 2) at one side of their complementary edges to allow the cover 12 to pivot about the bottom 11. Thus, when the cover 12 is closed the bottom and cover form a substantially complete cylinder. The bottom 11 is fixed to the fixture support 4 by means of threaded fasteners as previously described.

Positioned in the end opposite from the chamfer 26 of the cylindrical bottom 11 are a compression ring groove 18, a second compression ring or intermediate ring groove 19, a first oil rail groove 20 and a second oil rail groove 21. These are machined in the inside surface of the bore 25 (FIG. 4). The grooves 18, 19, 20 and 21 are spaced axially along the bore 25 to correspond exactly with the spacing of the ring grooves for the compression ring, intermediate ring and oil ring of the piston on which the rings are to be installed. The cover 12 has a compression ring groove 18*a*, an intermediate ring groove 19*a*, a first oil rail groove 20*a* and a second oil rail groove 21*a* machined in the bore 25*a*, and spaced axially therealong to correspond and align exactly with the grooves 18, 19, 20 and 21 in the bottom 11. Thus, when the cover 12 is in the closed position, the grooves 18 and 18*a*, 19 and 19*a*, 20 and 20*a*, and 21 and 21*a* form substantially continuous circular grooves throughout the inner periphery of the cylinder formed by the bottom 11 and cover 12 when the cover 12 is in the closed position. The receptive grooves in the cover and bottom are of sufficient radial depth to allow the piston rings, when expanded, to seat depressed within the grooves sufficiently to allow the piston to be passed through the rings. The respective grooves are of a width which allows the piston rings to easily slide into and out of the grooves, yet restrains the rings against warpage that would prevent their seating in the ring grooves of the piston.

A spreader block aperture 27 (FIG. 2) is formed through the fixture bottom 11 in the vicinity of the grooves, and is adapted to receive spreader blocks to be explained in detail hereinafter.

FIG. 8 shows a compression ring 40, intermediate ring 41, first oil rail 42, and second oil rail 43 positioned within the respective grooves 18, 19, 20 and 21. It can also be seen from FIG. 8 that when the cover 12 is closed upon the bottom 11 the grooves 18*a*, 19*a*, 20*a* and 21*a* will receive and seat the respective rings 40, 41, rail 42, and rail 43, to position substantially the whole circumferential periphery of the rings and rails axially with respect to the piston grooves.

A handle 16 is secured to the cover 12 by any well-known manner to facilitate opening and closing the cover 12 with respect to the fixed bottom 11. Thus, it is a simple matter to pivot the cover 12 to the open position by grasping the handle 16 and lifting it.

FIG. 12 is a fragmentary view of a preferred form of the fixture cover. Although the fixture bottom is not shown, it is to be understood that it would be of the same design as the fixture cover of FIG. 12.

The fixture cover is designated generally as 212. The fixture cover 212 is a two-piece unit having a shell 213 and a sleeve unit 214. The shell 213 has a threaded aperture 215 aligned with aperture 217 in one end of the sleeve 214. The shell 213 and the sleeve 214 are secured together to form an integral unit by threaded fasteners 216 which appear at several positions around the fixture cover 212. The fixture cover 212 has a bore 225*a* adapted to receive a piston. The bore 225*a* is chamfered at 226*a* to assist in guiding the piston into the bore 225*a*. Formed within the bore 225*a* and at the end opposite the chamfer 226*a* is a compression ring groove 218*a*. Axially spaced from the groove 218*a*, in the direction of the chamfer 226*a*, is a second compression ring groove or intermediate ring groove 219*a*. Spaced a further distance towards the chamfer 226*a* is a rail groove 222. The rail groove 222 is provided with a T-shaped insert 224 which is secured within the groove 222 by fasteners 23 which appear about the outer periphery of the sleeve 214. The T-shaped insert 224 provides a first rail groove 220*a* which is formed by one side of the vertical leg of the T-shaped insert 224 and the one side of the groove 222. A second rail groove 221*a* is formed by the other side of the vertical leg of the T-shaped insert 224 and the other side of the groove 222. Thus, it can be seen that the fixture cover 212 is provided with grooves which correspond with the grooves 18*a*, 19*a*, 20*a* and 21*a* of the fixture cover of FIG. 8.

The fixture cover 212 is constructed so that the sleeve 214 is replaceable and may be removed by removing the threaded fasteners 216 and replacing it with another unit having differently sized or spaced ring and rail grooves, to correspond with a piston having a different ring and rail groove arrangement. Therefore, when the fixture 10 of the ring installer is provided with a fixture cover such as 212, and a similar type bottom, the piston ring installer can be used for installation of rings and rails on several types of pistons by merely changing the sleeve 214. The sleeve 214 is of reduced outer diameter at the portion 227 aligned with the groove 222, providing clearance for the heads of the fasteners 23. When the sleeve 214 is removed from the shell 213, the fasteners 23 are readily accessible and may be removed, and a differently shaped insert 224 installed within the groove 222 to allow for the use of differently sized rails. Thus, the piston ring installer fixture 10 may in some instances be adapted for a different type piston groove arrangement by merely changing the insert 224 in the unit 214. It will be understood that corresponding changes will be made in the fixture bottom.

To assist in placing the piston rings and oil rails within the grooves 18, 19, 20 and 21 of the bottom 11, a ring loader generally designated as 50, is provided on the bottom 11 (FIGS. 4, 8 and 9). Bores 59 (FIG. 9) are provided in the end face of the bottom 11. Guide rods 58 are slidably positioned within the bores 59 and are reciprocated therein by means to be described more fully hereinafter. Secured to the guide rods 58, in any well-known manner, is a cross arm 54. The cross arm 54 is secured to the loader piece 60 (FIG. 9) by the screws 55 shown in FIG. 7. An actuator rod 52 is secured to a block 53, which in turn is centrally disposed and secured to the cross arm 54 in any well-known manner.

FIGS. 5, 6 and 7 best illustrate the specific features of the ring loader 50.

The ring loader 50 is an assembly of the separate pieces 60, 70, 80, 90 and 100 secured together as an integral unit by screws 56 installed through the apertures 106, 96, 86 and 76 and threadedly engaging the apertures 66. The ring plate 60, the ring divider plate 70 and the rail plate 80 have dowel apertures 63, 73 and 83 respectively. The dowel 57 is positioned within each of these apertures

and serves the purpose of keeping the upper portion of these pieces in alignment.

The ring plate 60 is an L-shaped member having threaded apertures 67 adapted to receive the screws 55 which secure the ring plate 60 to the cross arm 54. The ring plate 60 also has the threaded aperture 66. The ring plate 60 has a tapered surface 62 facing the adjacent ring divider plate 70. The tapered surface 62 extends downwardly from the top of the plate for a portion of the height of the ring plate 60. Centrally located on the side of the ring plate 60 adjacent the ring divider 70 is a generally rectangular vertical guide member 61. The vertical guide 61 extends from the top of the ring plate to the bottom of the tapered surface 62. The notch 65 is located centrally in the bottom surface of the ring plate 60 and extends throughout the thickness of the ring plate 60.

The ring divider 70 is a wedge shaped member, having wedge surfaces 72 extending downwardly from the divider's upper end a portion of the height of the ring divider 70. Centrally disposed within the ring divider 70 is a vertical guide member 71 of generally rectangular shape. The vertical guide member 71 extends from the top surface of the ring divider 70 downwardly to the notch 75 formed in the bottom surface of the ring divider 70. The notch 75 extends through the thickness of the divider and aligns with the notch 65. One side of the vertical guide member 71 is formed to abut against the vertical guide member 61 of the ring plate 60.

Adjacent the ring divider 70 is a first rail loading plate 80. The rail plate 80 is a Y-shaped member having a web-like member between the arms of the Y. The rail load plate 80 has one side the lower portion of which is flat and the upper portion of which is in the form of a bevel 84. A vertical guide surface 82 is formed in the beveled portion 84. The vertical guide surface 82 and beveled surface 84 are complementary to the vertical guide surface 71 and wedge surface 72 of ring divider plate 70. The other side of the rail load plate 80 has a notch 81 formed therein shaped to correspond to and receive the vertical guide member 91 of rail divider 90 to be described more fully hereinafter. Centrally located in the bottom surface of the rail loading plate 80 is a notch 85 which extends through the thickness thereof and aligns with the notches 65 and 75.

On the side facing the rail divider 90 the rail loading plate 80 has a shallow concave depression 87 forming a rounded shoulder 88 at its lower extremity. The lower end 89 of the plate is tapered downwardly away from the rail divider 90. The upper limit of the tapered area 89 generally corresponds to the upper edge of the wedge surfaces 92 of the rail divider 90.

Adjacent the rail loading plate 80 is a rail dividing plate 90. The lower portion of the rail divider 90 is a generally wedge shaped member having wedge surfaces 92 which diverge downwardly for a portion of approximately one-half the height of the rail divider 90. The wedge surfaces 92 divide the abutting rails axially in a manner to be explained more fully subsequently. Projecting upwardly from the center of the lower portion of the rail divider 90 is a rail spreader or vertical guide member 91. The vertical guide member 91 is spear shaped, having downwardly and outwardly sloping faces 97 positioned normal to the wedge faces 92. Its other faces are flat, one of which seats in the notch 81 of the rail load plate 80. The rail divider 90 has a notch 95 centrally located in the bottom surface extending through the thickness thereof and aligned with the notches 65, 75 and 85. The rail plate 90 is provided with apertures 96 which receive screws 56.

Adjacent the rail divider 90 is a second rail loading plate 100. The second rail load plate is a generally Y-shaped member. The face of the rail loading plate 100 adjacent the rail divider 90 has a notch 101 disposed therein which corresponds to the shape of the vertical guide member 91 of the rail divider 90 and is adapted to receive it. The top face has a concave depression 107 terminating in a rounded shoulder 108 aligned with and corresponding to the depression 87 and shoulder 88 on the first rail loading plate 80 respectively. The lower portion 109 of the plate is tapered downwardly away from the rail divider 90. The upper limit of the tapered area 109 generally corresponds to the upper edge of the wedge surfaces 92 on the rail divider 90. The other face of the second rail load plate is flat. The second rail load plate also has a notch 105 centrally located and extending through the thickness of the plate. The notch 105 is aligned with the notches 95, 85, 75 and 65. The second rail plate 100 has apertures 106, which are countersunk on the flat side of the plate, to receive the head of screws 56.

FIGS. 5 and 6 best show the rail loading assembly 50 in the assembled position. The ring plate 60, ring divider 70, first rail loading plate 80, rail divider 90, and second rail load plate 100 are secured together by the screws 56. It can be seen how the dowel 57 aligns the ring plate 60, ring divider 70, and first rail load plate 80, by passing through the apertures 63, 73, and 83, of the respective plates. This assembly is secured to the cross arm 54 by the screws 55. The cross arm 54 is reciprocated by means which will be described more fully hereinafter.

The ring loader assembly 50 in the assembled position leaves a space 18*b* between the ring plate 60 and ring divider 70, and a space 19*b* between the ring divider 70 and plate 80, a space 20*b* between the first rail load plate 80 and the rail divider 90, and a space 21*b* between the rail divider 90 and the second load plate 100. When the ring loader assembly 50 is in the in position or load position, the spaces 18*b*, 19*b*, 20*b* and 21*b*, accurately align with the grooves 18, 18*a*, 19, 19*a*, 20, 20*a*, 21 and 21*a*, respectively of the bottom 11 and cover 12 of the fixture. Thus, it can be seen when the ring loader assembly 50 is in loading position, rings inserted in the spaces 18*b*, 19*b* and rails inserted in the spaces 20*b* and 21*b* will be introduced accurately into the grooves 18, 19, 20 and 21 when forced downwardly.

The tapered surface 62 of the ring plate 60 complements one surface of the wedge 72 of ring divider 70 so that a compression ring such as 40 inserted between the ring plate 60 and ring divider 70 will be guided accurately into the space 18*b* and eventually into the bottom groove 18. The other side of the wedge surface 72 of ring divider 70 forces the second compression ring or intermediate ring 41 into the space 19*b* and groove 19 in a similar manner. Likewise, the first rail 42 is guided by one side of the wedge 92 of rail divider 90, and the second rail 43 is guided into space 21*b* by the other side of wedge surface 92 of rail divider 90. The apex of the wedging surfaces 92 is almost a knife edge. The spacing between the faces of the rail loading plates 80 and 100 at this point is such that it will just permit the passage of two rails placed in side by side position. Thus, the wedge surfaces 92 positively separate the rails and prevent both rails from entering the same one of the slots 20*b* or 21*b*. Positive separation of the rails is essential to prevent accidental installation of both rails on one side of the oil ring spacer.

The vertical guide surfaces 61 and 71 of ring plate 60 and ring divider 70 require that the part in the first compression ring 40 be positively located to index with the spreaders before it can be forced into the space 18*b*. The vertical guide surface 71 performs the same function for the second compression ring or intermediate ring 41. The vertical guide member 91 of rail divider 90 assures that both the first and second rails 42 and 43 are spread before they can be forced into the respective spaces 20*b* and 21*b*. The opening of the gap or part in the rings and rails is necessary to pass the rings and rails over the spreaders.

It can now be seen that it is a simple matter for one operator to load the compression ring, intermediate ring,

and the first and second rails in the fixture bottom **11** quickly and accurately. It is preferable that the rings entering the channels **18***b* and **19***b* seat in their respective grooves **18** and **19** of the lower half of the housing simply by dropping into position by reason of their weight. The operator does not force the respective rings into the respective grooves; it is only necessary that the rings and rails be properly seated in the loader **50**. Closing of the cover **12** forces the rails into the grooves.

A continuous notch through the bottom surface of the ring loader assembly **50** is provided by the notches **65**, **75**, **85**, **95** and **105** of the respective plates. This notch provides a clearance passageway for the spreaders and permits the ring loader assembly **50** to be returned past the teeth of the ring spreader mechanism **110** now to be explained.

The ring spreader mechanism **110** is supported on the platform of the support **4** and extends in a direction transverse to the movement of the ring loader assembly **50** and the piston as it is advanced into the bore formed by the cover **12** and the bottom **11** (FIGS. 2, 10 and 11). The ring spreader mechanism **110** has a guide track **111** having a bottom **112** and sides **113** and **114**. The bottom **112** of the guide track rests upon the platform surface **6** of the support **4**, and the side **114** of the slide block abuts against the platform surface **5** of the support **4** as best shown in FIGS. 2 and 9. The guide track **111** extends a substantial distance on either side of the fixture **10**. Secured to the sides **113** and **114** of the guide track **111** at one end thereof, by suitable fasteners, is a front slide plate **115**, and at the other end of the guide track is a rear slide plate **116** also secured to the side walls **113** and **114** by suitable fasteners.

Disposed within the slide block **111** are racks **117** and **118**. The racks are of a size to slide closely within the guide track. The teeth of the racks are directed toward each other. Disposed between and meshed with the racks **117** and **118** is a pinion gear **119**. The pinion gear is located centrally of the slide block **111**. The pinion **119** is fixed with respect to the slide block **111** and the racks **117** and **118** by a pinion shaft **120**, secured to the pinion by a tapered pin **124**, the shaft extending through the aperture **7** of the support **4**. The shaft is rotatable mounted in a bearing **121** fitted in the platform. The shaft is secured by a collar **122** on its lower end. The collar is attached by a tapered pin **123**.

The rack **118** extends beyond the rear slide plate **116** and the complementary end of the guide track **111**. A lock block **150** (FIG. 8) is secured to the rack **118** by a dowel pin **148**. Also secured to the lock blocks by a suitable means is an actuator rod **157** the operation of which will be described more fully hereinafter.

In accordance with well-known mechanical principles if the rack **118** is moved longitudinally in one direction, the rack **117** will move in the opposite direction due to the operation of the pinion **119**. Thus, the racks move in opposite directions.

Secured to the rack **117** is a rack plate **125** by any well-known type fastener. Secured to the rack **118** is a second rack plate **126**. The rack plates are so attached to their respective racks that they move with accuracy and without play or twisting. The rack plate **125** is secured by screws **127** to a ring spreader block **129** (FIG. 10). One of the screws **127** is illustrated for the sake of clarity. The ring spreader block **129** has formed integral therewith a compression ring spreader tooth **131** and an intermediate ring spreader tooth **132**. The spreader teeth **131** and **132** project an appreciable distance above the top surface of the ring spreader block **129**. The rack plate **126** is secured by screws, such as **127**, to ring spreader block **130**. The ring spreader block **130** has compression ring and intermediate ring spreader teeth **135** and **136** which are formed integral therewith and project above the top surface thereof. The teeth **135** and **136**, as well as the teeth **131** and **132**, are spaced to correspond to the spacing of the grooves **18** and **19** in the fixture bottom **11**. As shown in FIG. 10 the slide blocks **129** and **130** are arranged to lie in juxtaposition. Also, the teeth **131**, **135** and **132**, **136** have surfaces which lie in juxtaposition, and form in effect two separable but complementary teeth when in the position illustrated in FIG. 10.

The ring spreader blocks **129** and **130** have transverse keyways **139** and **140** respectively machined transversely across their top surfaces (FIGS. 10 and 11). A first rail plate **143** has a key **145** (FIG. 11) seated in the keyway **139** of slide block **129**. Also, formed integral with the rail plate **143** are rail spacer teeth **133** and **134**. These extend upwardly from the top surface of the rail plate **143**. The spreader tooth **133** corresponds with the first rail groove **20** in the fixture bottom **11**, and the spreader tooth **134** corresponds with the second rail groove **21** in the fixture bottom **12**.

A second rail plate **144** has a key **146** which fits within the keyway **140** of the ring spreader block **130**. Also formed integral with the rail plate **144** are rail spreader teeth **137** and **138**. The rail teeth **137** and **138** are spaced axially so as to correspond respectively to the grooves **20** and **21** in the fixture bottom **12**. Teeth **137** and **138** extend upwardly from the top surface of the rail plate **144** and are aligned with the rail teeth **133** and **134**, respectively, and when the slide blocks are in the load position, they abut (FIG. 11). When in this position the teeth **133**, **137** and **134**, **138** in effect form two separable rail spreader teeth. The rail plates **143** and **144** are secured to the spreader blocks **129** and **130**, respectively, by any conventional type threaded fasteners. Cover plates **141** and **142** are secured to the spreader block **129** and **130**, respectively, by conventional fasteners. The plates **141** and **142** are positioned to cover a portion of the keyways **139** and **140** of the respective spreader blocks.

As previously described, the ring spreader assembly **110** is mounted on the platform surfaces **5** and **6** of support **4**. The fixture **10** is also secured to the support **4** by fasteners **15**. In securing the fixture **10** to the support **4** the spreader block aperture **27** (FIG. 2) is positioned over the spreader blocks **129** and **130**. Thus, the spreader blocks **129** and **130** extend upwardly into the fixture spreader block aperture **27**. The spreader blocks **129** and **130** have a height somewhat less than the thickness of the fixture bottom **11**. The tops of the spreader teeth projects slightly in the bore **25**. This projection is such that the projection into the bore occurs only when the teeth are closed or together. When they are spread, they are withdrawn into the respective ring and rail grooves to provide clearance for the piston on which the rings are to be mounted. The teeth each have a small lateral projection **500** at their upper ends (FIG. 11). This, as shown, provides a positive grip for the ring or rail. In closed position the lateral width of the teeth is such that the gap in the rails and rings as seated in the loader (FIG. 7) permits the rings and rails to pass down over the teeth without interference.

Since the ring spreader block **129** is secured to the rack plate **125** which in turn is secured to the rack **117**, the spreader block **129** and its associated ring and rail spreader teeth will move in the direction of the rack **117**. Similarly, the spreader block **130** which is secured to the rack plate **126** which in turn is secured to the rack **118** will move in the direction of the rack **118**. Thus, it can be seen that when the rack **118** is actuated, the ring spreader blocks **129** and **130** will move oppositely of each other causing the teeth pairs **131** and **135**, **132** and **136**, **133** and **137**, and **134** and **138** to separate.

As previously stated the spaces **18***b*, **19***b*, **20***b* and **21***b* of the ring loader assembly **50** are axially aligned to correspond with the grooves **18**, **19**, **20** and **21** of the fixture bottom **11**, when the ring loader assembly **50** is in the ring loading position. Since the ring and rail spreader teeth of spreader blocks **129** and **130** also correspond with

the grooves 18, 19, 20 and 21 of the fixture bottom 11, it follows that the rings and rail spreader teeth also correspond with the spaces 18*a*, 19*a*, 20*a* and 21*a* of the ring loader assembly 50. Thus, when the ring loader assembly 50 is in the ring loading position the vertically projecting ring and rail spreader teeth project into the continuous slot formed by the slots 65, 75, 85, 95 and 105, in the ring loader assembly 50. The ring and rail spreader teeth are also axially aligned with the spaces 18*b*, 19*b*, 20*b* and 21*b* of the ring loader assembly 50. Thus, when the rack 118 is actuated, the ring and rail spreader teeth are spread or separated and force the rings and rails into the grooves or slots in the inside face of the bore. When the ring and rail spreader teeth are returned to their abutting position, the lateral width of the teeth of each aligned pair is less than that of the notch in the bottom of the ring loader assembly 50. This permits the ring loader 50 to move past them axially of the bore.

When the rings 40, 41 and rails 42 and 43 are inserted in the ring loader assembly 50, the vertical guide members 61, 71 and 91 of the ring loader 50 cause initial but limited spreading of the rails. This is unnecessary in the case of the rings. The vertical guide members 61, 71 and 91 maintain the part of the rings and rails in aligned and indexed position until they have passed over the respective spreader teeth. This is accomplished when the operator inserts the rings and rails and if they are not depressed by the operator as to pass over the spreader teeth, then they will be so depressed when the fixture cover 12 is closed. It will be recognized that when necessary to spread the rings the loader may be easily adapted to accomplish this.

When the rack 118 is actuated the rings and rails are expanded into the grooves since separation of the ring and rail spreader teeth causes the diameter of the rings and rails to increase. With the rings fully expanded, the piston may be inserted and the rack moved in the opposite direction. This releases the rings and rails to seat in the appropriate grooves in the piston. The means for actuating the rack 118 will now be described.

A lock block 150 is secured to the rack 118 by a dowel pin 148. Engaged in the lock block 150 is an actuator rod 157 which leads to a double acting, solenoid controlled air motor 210*a* (FIG. 1). The air motor 210*a* reciprocates the rack 118 which in turn spreads and closes the ring and rail teeth of the spreader blocks 129 and 130. The sequence of operation of the air motor 210*a* will be explained more fully hereinafter.

An arm 151 projects above the lock block 150 for movement with the lock block. Axially aligned with the arm 151 is a latch 152. The latch 152 is pivotally mounted on a latch bracket 33 which in turn is secured to the fixture bottom 11. The latch 152 is also L-shaped and has a finger 153 adapted to engage the arm 151. The latch 152 has a second finger 154 which lies adjacent the fixture cover 12. The finger 154 is provided with an adjustable stud 155 which determines the distance between the finger 154 and the fixture cover 12. As best shown in FIGS. 8 and 9 the latch finger 153 assumes a vertical position when the rack 118 is moved to the in or closed position. In this position the fixture cover 12 may be opened. However, when the rack 118 is moved to the extended or expanded position, the latch finger 153 is pivoted to a horizontal position by the arm 151. In this position, the adjustable stud prevents the fixture cover 12 from being opened. Thus, the arm 151 in combination with the latch finger 153 is a safety device, preventing the fixture cover 12 from being opened when the rings are expanded. Further, should the cover be opened before the rings and rails are fully seated in the grooves of the piston, they may be misaligned with the grooves because of their tendency to warp axially when circumferentially expanded. The grooves of the cover positively prevent this.

An L-shaped latch retaining member 155*a* secured to the fixture cover 12 and surrounding the latch finger 154 prevents the stud 155 from dropping away from the cover 12 when the arm 151 is retracted.

Mounted on the fixture cover 12 adjacent the hinge 13 is a switch 160 (FIGS. 2 and 3). The switch 160 is secured to a switch base 164 which is secured to the fixture cover 12. A switch actuator 161 is pivotally mounted on the fixture cover 12 by the pin 163. The switch actuator 161 is aligned with the actuator button of the switch 160. A stationary stop 162 is secured to the fixture bottom 11, and aligns with the pivoted switch actuator 161. When the fixture cover 12 is opened the pivoted switch actuator 161 is lifted away from the stop 162 and the switch 160 assumes its normally closed position. However, when the cover 12 is closed the pivoted switch actuator 161 strikes the surface of the stop 162, causing the switch actuator 161 to pivot about the pin 163 opening the switch 160. The purpose of switch 160 will be explained more fully hereinafter.

The switch 170 is located on the base 3 at the front of the fixture 10 (FIG. 2). The switch 170 has a switch base 174 secured to the base 3 by a fastener 175. A bracket 172 is secured to the support member 4 and pivotally mounts the rocker arms 171 by means of the pivot pin 173. The rocker arm 171 has one end extending into the bore of the fixture 10, and the other end positioned so as to actuate the switch 170. The rocker arm 171 is biased in the bore of the fixture by a spring 176 mounted on the support 4 directly opposite the switch 170. The purpose of switch 170 will be explained more fully hereinafter.

Mounted on the top of the fixture cover 12 is a switch 180. The switch 180 has a base 184 secured to the cover 12 by the fastener 185. A rocking lever 181 is pivotally mounted to the bracket 182 by a pin 183. The bracket is secured to the cover 12. One end of the lever 181 extends into the bore of the fixture 10, and the other end actuates the switch 180. The lever 181 does not extend axially into the bore of the fixture 10 as far as the switch actuator 171. The reason for this and the operation of the switch will be explained more fully hereinafter.

FIG. 13 is a schematic diagram of the electrical circuit. Power is supplied by the lines L_1 and L_2, to the transformer 260 when the switch 240 is closed. The transformer 260 is connected to the lines X_1 and X_2. A line 301 leads from X_2 to the normally closed switch 160. A line 302 leads from the other side of switch 160 to the holding coil 303 of a solenoid operated air valve 210. A line 304 connects the other side of holding coil 303 with line X_1 to complete a circuit. Line X_2 also connects directly with switch 180 which is normally open. The switch 180 is connected to the solenoid actuating coil 306 of solenoid operated valve 210 by line 305. The other side of coil 306 is connected to line X_1 to complete a circuit. Another line 308 leads from the line X_1 to the throw member of a single throw double pole switch 170. Line 309 leads from one pole of the switch to solenoid actuating coil 310 of solenoid operated air valve 200. The line 311 leads from the other side of solenoid actuating coil 310 to the line X_2 to complete a circuit. Switch 170 is normally in the closed position with respect to the coil 310. A line 312 leads from the other pole of switch 170 to solenoid actuating coil 313 of solenoid operated air valve 200. Line 311 is common to both coils 310 and 313, and when the switch 170 is moved from its normal position to close line 312, a circuit is completed through coil 313 and the circuit through coil 310 is deenergized. The operation of switches 160, 170 and 180 in conjunction with the air motors 200*a* and 210*a* along with the general operation of the piston ring installer will now be explained.

Operation

Referring to FIG. 1 the overall layout of the piston ring installer can be seen. The fixture 10 is secured to

the base 3 via the support member 4. The solenoid operated air motors 200*a* and 210*a* are secured to the base 3, and so positioned so as to be aligned with the ring loader assembly 50 and the ring spreader mechanism 110 respectively. The motor 200*a* is connected to the ring loader assembly 50 by the connecting rod 52 and block 53. The motor 210*a* is connected to the ring spreader assembly 110 by the rack actuating rod 157 and the lock block 150. A conventional type air regulator valve 230 is connected with the air motor valves 200 and 210, which operate the air motors 200*a* and 210*a* respectively, and with the main air supply line. Stop-start switch 240 and terminal board 250 are also secured to the base 3. Thus, the piston ring installer fixture, the pneumatic system and electrical system are all compactly installed on the base 3 of the piston ring installer.

When it is desired to operate the piston ring installer the switch 240 is closed, and air is supplied through the air regulator valve 230 to the valves 200 and 210. The fixture cover 12 is in the open position as shown in FIG. 8. The ring loader assembly 50 is in the ring load position and the fixture can be loaded with the required rings and rails.

A compression ring, such as 40, is seated about the vertical guide surface 61 and pressed downwardly toward the fixture bottom 11. The tapered surface 62 and complementary wedge surface 72 of the ring plate 60 and ring divider 70 respectively guide the compression ring into the space 18*b* formed by the ring plate 60 and ring divider 70. The compression ring is depressed until the ends thereof settle over the ring spreader teeth 131 and 135. An intermediate ring, such as 41, is seated about the vertical guide surface 71 and guided into the space 19*b* formed between the ring divider 70 and the rail load plate 80 by the wedge surface 72. The ring is depressed until the separated ends thereof pass over the spreader teeth 132 and 136. The rails 41 and 42 are seated about the vertical guide surface 91 between the rail loading plates 80 and 100. As they are forced downwardly into the loader they are automatically separated circumferentially by sloping surfaces 97 of spreader member 91 and divided axially by the wedge surfaces 92 and caused to pass one into each of the bifurcated spaces 20*b* and 21*b*. Their open ends are caused to pass over the rail spreader teeth pairs 133 and 137 and 134 and 138.

The compression ring, intermediate ring, first rail, and second rail, are now at least partially seated within the grooves 18, 19, 20 and 21 of the fixture bottom 11. Since, as previously explained, the spaces 18*b*, 19*b*, 20*b* and 21*b* are axially aligned with the grooves 18, 19, 20 and 21, when the ring loader assembly 50 is in the loading position, the compression ring intermediate the ring, first rail, and second rail when inserted in the ring loader assembly 50 are automatically guided into the proper grooves in the fixture bottom 11.

The cover 12 is then closed and the grooves 18*a*, 19*a*, 20*a* and 21*a* register with and seat over the respective rings and rails, since the spacers 18*b*, 19*b*, 20*b* and 21*b* are also axially aligned with the grooves 18*a*, 19*a*, 20*a* and 21*a* of the fixture cover 12 when the ring loader 50 is in the load position. Upon the closing of the fixture cover 12 the switch 160 is actuated by the pivoted switch actuator 161 striking the stop 162. The switch 160 is normally closed and when actuated opens the circuit to holding coil 303 which normally holds the solenoid operated valve 210 of air motor 210*a* positioned to keep the motor extended and the spreaders closed. With the holding coil de-actuated a spring 314 shifts the air valve 210 causing air to be admitted to the left side of air motor 210*a*, as viewed in FIG. 1. This moves the motor 210*a* to retracted position or to the right in FIG. 1. Retraction of the motor 210*a* causes the racks 117 and 118 to open the spreaders. This opens the rings and rails ready for removal of the loader 50 in insertion of the piston A. The spreading of the ring and rail spreader teeth cause the rings and rails to expand completely into the grooves 18, 19, 20 and 21 of the fixture bottom 11 and into the groves 18*a*, 19*a*, 20*a* and 21*a* of the fixture cover 12. The rings and rails are so expanded that they move entirely into their respective grooves in the fixture bottom 11 and cover 12.

It will be understood that the point of contact between the switch actuator 161 and the stop 162 is radially inward of the pivot axis of the cover hinge 13. Unless this relationship is maintained the switch actuator and stop arrangement for switch 160 as herein disclosed will be inoperative.

The timing of operation of the switch 160 with relation to the closing of the cover 12 is most important. The cover must have closed sufficiently to seat the rings and rails in the grooves 18*a*, 19*a*, 20*a* and 21*a* of the cover and to have forced the rings and rails down over the spreader teeth 131, 135, 132, 136, 133, 137, 134 and 138 before the switch is tripped. Failure to accomplish each of these steps before tripping the switch 160 could cause malfunction of the device.

It is most important that the rings and rails be introduced into the groves of the bottom 11 and cover 12 before they are expanded since one of the basic functions of these grooves is to hold the rings and rails against warping and twisting when they are circumferentially expanded. This latter tendency of the rings when expanded is one of the great problems plaguing conventional methods of ring installation.

The fixture cover 12 is so dimensioned and mounted with respect to the fixture bottom 11 that it is impossible to insert the piston, without using force, unless the rings and rails have been fully expanded. Until the switch 160 has been tripped the cover closes too far to admit the piston to the fixture bore. The expansion of the rings and rails causes the fixture cover 12 to lift or rise a sufficient amount to allow the piston to slide easily within the bore. Thus, the full expansion of the rings and rails into the grooves of the fixture cover 12 provides an indication to the operator that the fixture is in a position to receive the piston for ring and rail installation. However, if the rings and rails are not fully expanded to raise the fixture cover 12, the operator is warned that something is wrong when he tries to insert a piston in the bore. Thus, the dimensioning and positioning of the fixture cover 12 in combination with the expansion of the rings provides a safety device preventing the face and side walls of pistons from being injured by rings and rails which might not be properly seated in the cover and bottom grooves.

Before inserting the piston in the bore a rail spacer is placed in the oil groove of the piston. If any of the rings require an expander, these also are installed at this time. The piston is advanced in the bore and as it progresses the head of the piston strikes the rocker arm 171. The rocker arm 171 is positioned so that the piston head makes contact with it just before the advancing piston head would have made contact with the second rail load plate 100 of the ring load assembly 50. Thus, the advance of the piston causes the switch 170 to be actuated before the piston head makes contact with the ring loader assembly 50.

When the switch 170 is actuated, the normally open portion of the switch is closed and the normally closed portion of the switch is opened. Upon closing the normally open portion of the switch 170 the coil 313 of the solenoid operated air valve 200 of air motor 200*a* is actuated admitting air into one side of the double acting air motor 200*a*. The air motor 200*a* is secured to the loader actuator rod 52 and block 53 which are in turn secured to the ring load assembly 50. Thus, when the air motor 200*a* is actuated to retract, the ring loader 50 is withdrawn from the bore of the fixture. It is desirable to have the ring loader 50 withdrawn by some mechanical means rather than merely pushed out of the way by the

piston, since it could injure the piston head surface, and its manual withdrawal requires operator effort which over a period of time could lead to failure to fully insert the piston against its locating stops. Thus, the ring loader 50 is withdrawn from the bore by the air motor 200*a* ahead of the advancing piston.

The piston A continues to advance and eventually contacts the lever 181. The lever 181 makes contact with the piston just before the piston comes to rest against the stops 30. Lever 181 closes switch 180 energizing coil 306 of the solenoid operated valve 210 of air motor 210*a*. This admits air to the other side of double acting air motor 210*a* moving the rack 118 to the left, as viewed in FIG. 1, or toward the fixture 10. This closes the spreader blocks 129 and 130 to the position shown in FIG. 10. Due to the inherent resiliency of the rings and rails they naturally contract and seat within the appropriate ring grooves formed in the piston A. The stops 30 position the piston so that the ring grooves in the piston are axially aligned with the grooves 18, 18*a*, 19, 19*a*, 20, 20*a*, and 21, 21*a* of the fixture bottom and cover 11 and 12 respectively.

The piston rings are now installed and the piston is ready to be removed from the fixture 10. The cover 12 is now opened to allow the piston and its installed rings and rails to be removed vertically from the fixture bottom 11. As the fixture cover 12 is opened the switch actuator 161 no longer holds the switch 160 open since the stationary member 162 no longer applies actuating pressure thereto, and switch 160 returns to its normally closed position. Switch 160 in its normally closed position provides a circuit through the holding coil 303 of solenoid operated valve 210 of air motor 210*a* and maintains the valve in this position against the force of the spring biasing means 314.

Again it is important that switch 160 be closed before opening of the cover 12 disengages the lever 181 from the face of the piston A. Should the switch 180 open before the switch 160 closes the spring 314 (FIG. 13) moved automatically shifts the valve 210 to cause the air motor 210*a* to retract once again spreading the rings.

As the piston is lifted the rocker arm 171 is biased back into the bore of the fixture by the spring 176 and the switch 170 returns to its original position causing the normally open portion of the switch to open and the normally closed portion of the switch to close. Upon closing of the normally closed portion of the switch a circuit is completed through the coil 310 of solenoid operated valve 200 of air motor 200*a* and the circuit to coil 313 is opened which causes the valve to move to its starting position wherein air is admitted to the other side of double acting air motor 200*a*. This causes the rod 52 to extend returning the ring loader 50 to the bore of the fixture. The loader and spreader mechanism are now restored to their original positions and the cycle has been completed. The loader is now ready to be charged with a new set of rings and rails to be installed on another piston.

The retraction of the rack actutaing rod 157 automatically moves the arm 151 into locking position beneath the latch 152. This locks the cover against being opened until the spreaders have been closed and the rings released. This has a dual purpose. First, it positively prevents the fixture from being opened until the rings have been released to seat in the ring grooves of a piston. It is a safety device to prevent occasional omission of the rings from a piston. Secondly, the rings when spread are under substantial circumferential tension. Should the cover 12 be accidentally opened they might fly out of the fixture injuring personnel.

The weight of the cover 12 is preferably selected so that should the rails be omitted in charging the loader, the spreading of the remaining rings will not produce sufficient force to lift the cover. The omission will be automatically brought to the attention of the operator because the piston will then refuse to enter the bore of the fixture easily.

FIG. 14 illustrates a refinement of detention means for this problem which will automatically warn the operator of the omission of any one ring or rail. For this purpose a separate pin 300 is installed to normally project into each of the ring and rail grooves 18*a*, 19*a*, 20*a* and 21*a* of the cover. Each of the pins 300 operates one of the switches 301, 301*a*, 301*b* and 301*c*. These switches are normally closed and are wired in parallel. When the rings and rails occupy each of the grooves 18*a*, 19*a*, 20*a* and 21*a* and the cover 12 is closed the rings and rails will force all of the pins 300 up opening all of the switches 300, 300*a*, 300*b* and 300*c*. However, should any one of the rails or rings be omitted, the corresponding one of the switches 301, 301*a*, 301*b* and 301*c* will fail to open, effectively stopping further operation of the fixture.

One manner in which this objective can be executed is illustrated in FIG. 15. In this arrangement a line 400 is tapped off line 302. The line 400 passes through the switches 301, 301*a*, 301*b* and 301*c* in series. The line 400 also passes through the normally open switch 401 which is designed to be closed by the last fraction of extending movement of the air motor 210*a* and connects with one side of normally open bypass relay 402. Line 404 connects the other side of relay 402 with line X1. If all rings and rails are present all of the switches 301, 301*a*, 301*b* and 301*c* will have been opened and the closing of switch 401 will be ineffective. However, should one of them have failed to open the closing of switch 401 will close the relay 402 which bypasses switch 180 and energizes coil 306 returning the spreaders to their juxtaposed position. The relay 402 is equipped with a holding device 403 which holds the relay closed until it has been manually reset. This prevents continued operation of the fixture until the difficulty has been corrected.

It is now apparent that the piston ring installer disclosed herein provides a means for installing piston rings quickly and accurately. The piston ring loader positions the rings and rails within the fixture so that the rings and rails must of necessity fit into the appropriate grooves of the fixture bottom and cover. Also, the rings must be fully expanded into these grooves before the piston can be inserted into the cylinder for purposes of installation. The combined electrical and pneumatic system provides a means for automatically installing the rings and rails on the piston. Therefore, where it was previously necessary for the piston to be handled several times in installing the rings and rails, the present invention provides means whereby the piston need be handled only once by the operator using the piston ring installer.

Thus, the steps of installing rings and rails on a piston using the piston ring installer disclosed herein are as follows. The ring loader 50 is charged with the compression ring, intermediate ring, first rail, and second rail. The fixture cover 12 is closed which automatically expands the rings and rails within the grooves of the fixture cover 12 and bottom 11. This raises the cover 12 slightly, permitting easy insertion of the piston. The operator then grasps the piston upon which a rail spacer has been previously installed and slides it into the bore of the fixture 10. The operator does not release the connecting rod B secured to the piston throughout the process of advancing the piston within the bore. As the piston advances a limit switch is tripped which automatically removes the loader from the path of the piston. Immediately following the piston's engagement with the stop members 30 and its simultaneous engagement with the lever 181 of switch 180, the rings and rails are automatically released into the ring grooves of the piston and the piston is ready for removal from the fixture. The operator then grasps the handle 16 of the fixture cover 12 with the other hand, raises the cover, permitting the hand holding the connecting rod to lift the piston vertically from

the fixture bottom 11. By the time the operator has disposed of this piston the piston ring installer has reset itself automatically and is ready to be loaded with a new set of rings and rails. Thus it can be seen that the piston ring installer of this invention provides a means for installing piston rings and rails which is simple, effective, and saves many man hours.

While a preferred embodiment of this invention has been described, it will be understood that other modifications and improvements may be made thereto. Such of these modifications and improvement as incorporate the principles of this invention are to be considered as included in the hereinafter appended claims unless these claims by their language expressly state otherwise.

We claim:

1. A piston ring and rail installer comprising: fixture means, said fixture means having a bottom and a cover pivotally movable between an open and a closed position; a bore defined by said bottom and said cover in its closed position and adapted to receive a piston; groove means in said bottom and cover concentric with said bore and disposed in spaced planes normal to the axis of said bore, said groove means being adapted to receive piston rings and rails; ring and rail spreader means aligned with said annular groove means; to expand said rings and rails into said bore groove means to allow said piston to pass within said bore; said groove means being radially dimensioned so that the cover is partly opened by an expansion of the rings sufficient to allow the piston to be inserted in the bore; and means to retract said spreader means to allow the rings and rails to seat in appropriate grooves in the piston.

2. A piston ring and rail installer comprising: a housing defining a bore; said bore being adapted to receive a piston; grooves in said housing concentric with said bore and disposed in spaced planes normal to the axis of said bore, said grooves being adapted to receive piston rings and rails; a ring and rail loader axially slidable in said bore, in one position said loader being aligned with said grooves and adapted to guide said rings and rails into said grooves; ring and rail spreader means aligned with said grooves; said loader having opener means for opening the rings and rails to pass about said spreader means; expander means for opening said spreader means to expand said rings and rails within said grooves and out of said loader to allow a piston to pass through said rings and rails to align the grooves of said piston with said rings and rails to receive said rings and rails upon closing of said expander means.

3. A piston ring and rail installer comprising: fixture means, said fixture means having a bottom and a cover pivotally movable between an open and a closed position; a bore defined by said bottom and said cover in its closed position and adapted to receive a piston; groove means in said bottom and cover concentric with said bore and disposed in spaced planes normal to the axis of said bore, said groove means being adapted to receive piston rings and rails; ring and rail loading means axially slidable in said bore, in one position said loader being aligned with said grooves and adapted to guide rings and rails into said grooves; said loader means having ring and rail opener means aligned for opening the rings and rails; spreader means received in the opened rings and rails for expanding said rings and rails into said groove means to allow removal of said ring and rail loader and to allow a piston to pass within said bore and through the rings and rails; and means to retract said spreader means to allow the rings and rails to seat in appropriate grooves in the piston.

4. A piston ring and rail installer comprising: fixture means, said fixture means having a bottom and a cover pivotally movable between an open and a closed position; a bore defined by said bottom and said cover in its closed position and adapted to receive a piston; groove means in said bottom and cover concentric with said bore and disposed in spaced planes normal to the axis of said bore, said groove means being adapted to receive piston rings and rails; a ring and rail loader adapted to be axially introduced into said bore, said ring and rail loader having ring and rail receptive guide surfaces forming spaces which in one position of said loader are axially aligned with the grooves in the bore whereby rings and rails inserted in said loader are directed into said bore grooves; ring and rail spreader means aligned with said grooves, said loader having opener means for opening the rings and rails to pass about said spreader means; expander means to open said spreader means to expand the rings and rails into said groove means to allow a piston to pass through the rings and rails; said loader being charged with rings and rails when said cover is open, the closing of said cover forcing the rings and rails onto said spreader means for expanding said rings and rails into said grooves, and said spreader means upon closing allowing the rings and rails to seat in appropriate grooves in the piston.

5. A piston ring and rail installer comprising: fixture means, said fixture means having a bottom and a cover pivotally movable between an open and a closed position; a bore defined by said bottom and said cover in its closed position and adapted to receive a piston; groove means in said bottom and cover concentric with said bore and disposed in spaced planes normal to the axis of said bore, said groove means being adapted to receive piston rings and rails, ring and rail loading means axially slidable in said bore, said loading means having guide passages and opener means for guiding rings and rails into said groove means; ring and rail spreader means aligned with said grooves, the rings and rails being guided onto said spreader means by said loading means; means operated automatically upon closing said fixture to expand said rings and rails out of said loading means and into said bore groove means to allow passage of a piston within said bore and withdrawal of said ring and rail loader therefrom and means operable upon a piston being inserted in said bore a predetermined distance to automatically retract said spreader to release the rings and rails to seat in appropriate grooves in a piston.

6. A piston ring and rail installer comprising: fixture means, said fixture means having a bottom and cover pivotally movable between an open and a closed position; a bore defined by said bottom and said cover in its closed position and adapted to receive a piston; groove means in said bottom and cover concentric with said bore and disposed in spaced planes normal to the axis of said bore, said groove means being adapted to receive piston rings and rails; ring and rail loading means adapted to be axially reciprocated between a position within said bore in axial alignment with said groove means and a position outside said bore; ring and rail spreader means aligned with said grooves, said loading means having guiding and opening passageways for receiving and opening the rings and rails and guiding them onto said spreader means; said spreader means being operated automatically upon closing said cover to expand said rings and rails out of said loading means and into said groove means to allow passage of a piston through the rings and rails and withdrawal of said ring and rail loader from said bore; means operable upon a piston being inserted in said bore a predetermined distance to automatically withdraw said ring loader from said bore; and additional means to automatically retract said spreader means to release the rings and rails to seat in appropriate grooves in a piston upon the piston being inserted an additional distance in the bore sufficient to bring its grooves into alignment with said rings and rails and means responsive to the opening of said cover fixture and withdrawal of the piston to automatically return said ring and rail loader to a position aligned with said groove means in said fixture.

7. A piston ring and rail installer comprising: fixture means, said fixture means having a bottom and a cover pivotally movable between an open and a closed position;

a bore defined by said bottom and said cover in its closed position and adapted to receive a piston; groove means in said bottom and cover concentric with said bore and disposed in spaced planes normal to the axis of said bore, said groove means being adapted to receive piston rings and rails; ring and rail loading means having ring and rail guideways and openers; said loading means being axially reciprocable within said bore between a position in which said guideways are aligned with said groove means and a position outside said bore; ring and rail spreader means aligned with said grooves and operated automatically upon closing said cover to expand the rings and rails into said groove means and out of said loading means to allow passage of a piston through the rings and rails and withdrawal of said loading means therefrom; lock means operatively connected to said spreader means and engaging said fixture cover so that said fixture cover can not be fully opened when the spreader is in the ring expanding position; and means operable upon said piston being inserted in said bore a predetermined distance to automatically retract said loading means and release said spreader means to allow the rings and rails to seat in appropriate grooves in the piston and to release said lock means.

8. A piston ring and rail installer comprising: fixture means, said fixture means having a bottom and a cover pivotally movable between an open and a closed position; a bore defined by said bottom and said cover in its closed position and adapted to receive a piston; groove means in said bottom and cover concentric with said bore and disposed in spaced planes normal to the axis of said bore, said groove means being adapted to receive piston rings and rails; ring and rail loading means having ring and rail guideways; said loading means being reciprocable along said bore and in one position said guideways being aligned with said grooves and in another position said loading means being outside said bore; ring and rail spreader means aligned with said grooves and operated automatically upon closing said cover to expand said rings and rails out of said loading means and into said groove means to allow withdrawal of said loading means from said bore; said grooves being of such diameter that said cover is opened by an expansion of the rings by the ring spreader sufficiently to allow the piston to be inserted in the bore; and means to retract said spreader means to release the rings and rails to seat in appropriate grooves in the piston.

9. A piston ring and rail installer comprising: fixture means, said fixture means having a bottom and a cover pivotally movable between an open and a closed position; a bore defined by said bottom and said cover in its closed position and adapted to receive a piston; groove means in said bottom and cover concentric with said bore and disposed in spaced planes normal to the axis of said bore, said groove means being adapted to receive piston rings and rails; an aperture in said fixture bottom aligned with said ring and rail grooves; ring and rail spreader teeth disposed within said aperture and extending into said bore and being axially aligned with the ring and rail grooves in said bore; a ring and rail loader reciprocally mounted on said fixture for movement into and out of said bore, said ring and rail loader having members for partially opening the rings and rails and defining guide spades aligned with said spreader teeth and bore grooves when said loader is in one position in said bore whereby rings and rails inserted in said guide spaces pass over said spreader teeth and into said grooves, means for reciprocating said ring and rail loader; means to spread the spreader teeth and expand said rings fully out of said loader and into said grooves so that a piston may pass through said rings and rails and the ring and rail loader may be withdrawn and means to retract said spreader means to release the rings and rails to seat in appropirate grooves in the piston.

10. A piston ring and rail installer as in claim 9 wherein the means to spread the spreader teeth include ring and rail spreader blocks upon which the spreader teeth are mounted in juxtaposed position, said blocks being each mounted on a separate rack of a rack and pinion mechanism whereby movement of one of the racks causes the blocks and teeth to spread and expand the rings and rails.

11. A piston ring and rail installer comprising: fixture means, said fixture means having a bottom and a cover pivotally movable between an open and a closed position; a bore defined by said bottom and said cover in its closed position and adapted to receive a piston; groove means in said bottom and cover concentric with said bore and disposed in spaced planes normal to the axis of said bore, said groove means being adapted to receive piston rings and rails; ring and rail loading means having ring and rail guide and spreader ways; said loading means being axially reciprocable within said bore and in one position having said guide and spreader ways in axial alignment with said groove means; ring and rail spreader means aligned with said grooves and operated automatically upon closing said cover to expand said rings and rails out of said loading means and into said groove means to allow withdrawal of said ring and rail loader from said bore; and means to retract said spreader means to release the rings and rails to seat in appropriate grooves in the piston; limit switch means mounted on said cover and actuated by closing said cover to cause expansion of said ring and rail spreader means; a second limit switch means mounted on said base and extending axially into said bore to a point beyond said ring and rail loader means and operable by the insertion of a piston to cause withdrawal of said ring and rail loader means from the bore; a third limit switch means mounted on said cover and extended axially into the bore a distance less than the second limit switch means and operable when the piston is advanced in said bore to align its grooves with said groove means to cause retraction of said spreader means, said second limit switch means being operable to return said ring and rail loader means to its position within the bore when the fixture cover is opened and the piston and rings removed.

12. A piston ring and rail installer comprising: a housing defining a bore; grooves in said housing concentric with said bore, and disposed in spaced planes normal to the axis of said bore, said grooves being adapted to receive piston rings and rails; a ring and rail loader axially movable in said bore between advanced and a retracted position; said loader having ring and rail receiving channels which, in said advanced position of said loader are aligned with said grooves; spreader means, said loader having parting means for holding said rings and rails in partially open position to pass onto said spreader means; actuator means for opening and closing said spreader means; said spreader means, when open, forcing said rings and rails to seat in said grooves and out of said loader to receive a piston therethrough.

13. A piston ring and rail installer as defined in claim 12 wherein means are provided for retracting said loader as the piston is moved along said bore.

14. A piston ring and rail installer comprising: a housing having a semi-circular base and a semi-circular cover pivotally mounted to said base, said base and cover together, when fully closed, defining a bore of lesser diameter than that of the piston on which the rings and rails are to be installed; internal grooves in said housing concentric with said bore and disposed in spaced planes normal to the axis of said bore, said grooves being adapted to receive piston rings and rails; a ring and rail loader axially movable in said bore between advanced and a retracted position; said loader having ring and rail receiving channels which, in said advanced position of said loader are aligned with said grooves; spreader means; said loader having parting means for holding said rings and rails in partially open position to pass onto said spreader means; actuator means for opening and closing said spreader means; said spreader means, when open, forcing

said rings and rails to seat in said grooves and out of said loader; said rings and rails, when said spreader means is open, being spread to receive a piston therethrough and said cover being partially opened to increase the diameter of said bore sufficiently to receive the piston therein; said spreader means when closed releasing the rings and rails to seat in the grooves of the piston.

15. A piston ring and rail installer as defined in claim 14 wherein means are provided to lock said cover, said spreader means are open against further opening movement.

16. A piston ring and rail installer as defined in claim 14 wherein means are provided to lock said cover, said spreader means are open against further opening movement; means for retracting said loader as the piston is advanced along said bore.

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