June 12, 1956 J. NAAB 2,750,240

WEAR AND ADJUSTING DEVICE FOR PISTONS

Filed Sept. 21, 1954 2 Sheets-Sheet 1

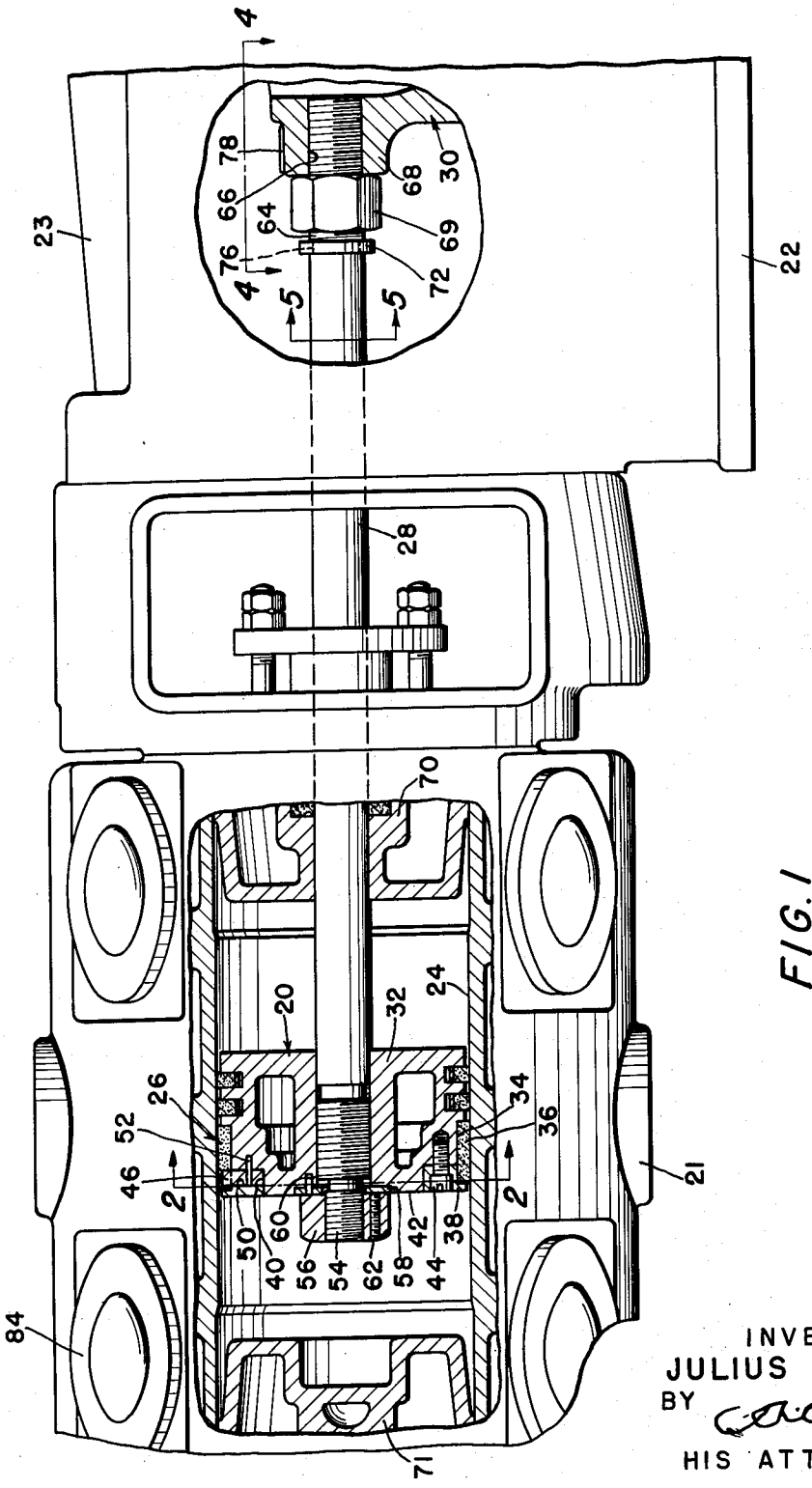


FIG. 1

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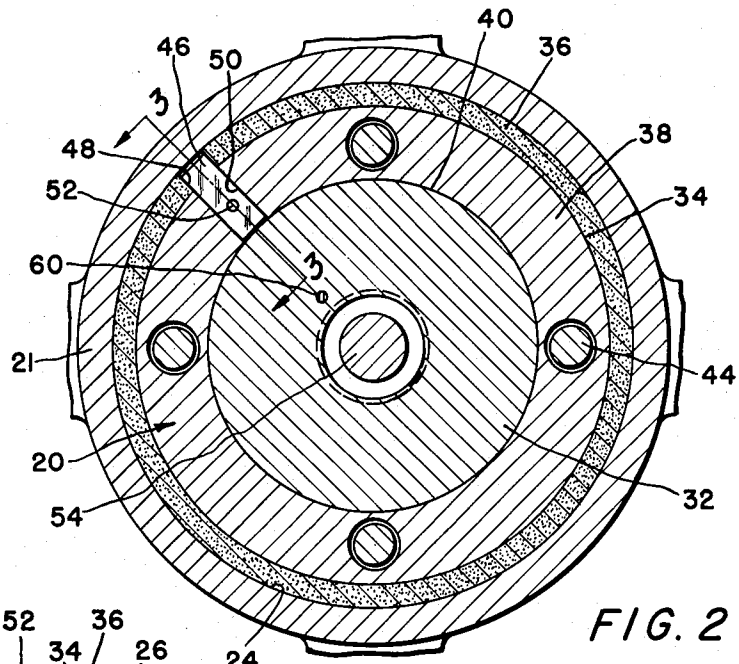


FIG. 2

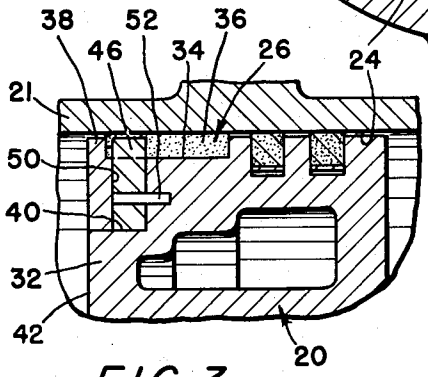


FIG. 3

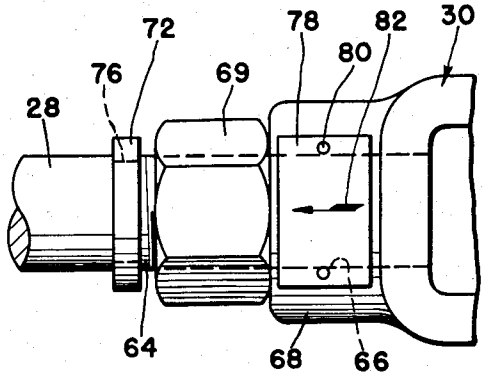


FIG. 4

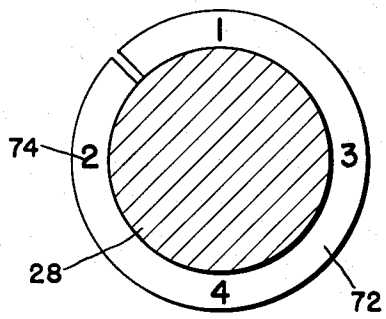


FIG. 5

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WEAR AND ADJUSTING DEVICE FOR PISTONS

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Application September 21, 1954, Serial No. 457,497

5 Claims. (Cl. 309—4)

This invention relates to pistons, and more particularly to a wear and adjusting device for reciprocatory pistons.

One object of the invention is to allow for the expansion of a piston of high expansive material in a wearing device thereon of low expansive material.

Another object is to maintain coaxiality of the piston and the cylinder bore throughout the life of the wearing device.

A further object is to provide adjusting means for such a wearing device to distribute the wear thereon.

Other objects will become apparent from the following description of the accompanying drawings, which illustrate a preferred embodiment of the invention in which similar numerals refer to similar parts.

Fig. 1 is a side elevation of a portion of a compressor, partly in section, equipped with a wearing device and adjusting means constructed in accordance with the practice of the invention,

Fig. 2 is a transverse view taken along the line 2—2 in Fig. 1, looking in the direction indicated by the arrows,

Fig. 3 is a transverse view taken along the line 3—3 in Fig. 2, looking in the direction indicated by the arrows,

Fig. 4 is a plan view of the adjusting means taken along the line 4—4 in Fig. 1, looking in the direction indicated by the arrows, and

Fig. 5 is a transverse view taken along the line 5—5 in Fig. 1, looking in the direction indicated by the arrows.

Referring to Fig. 1 of the drawings, the invention is shown as applied to a piston assembly 20 reciprocable in a non-lubricated cylinder 21, which in this case is that of a horizontal single stage compressor including a bedplate 22 having a cover 23. The piston 20 is of sufficiently smaller outside diameter than the bore 24 of the cylinder 21 to prevent contact therebetween when supported substantially coaxial in the bore by a wearing device 26 mounted on the piston. Movement is transmitted to the piston assembly 20 from a suitable prime mover (not shown) by a piston rod 28 attached to the piston and to a crosshead 30 slidable in the compressor bedplate 22.

Referring in greater detail to the construction of the wearing device 26, the piston assembly 20 comprises a main body 32 of high expansive metallic material, in this case aluminum. The body 32 has an annular peripheral groove 34 for the accommodation of a split wearing ring 36 of low expansive material, such as graphitic carbon. The split ring 36 has an inside diameter slightly less than the bottom of the groove 34, such that the ring is expanded when assembled on the piston at atmospheric temperature to effect gripping contact between the ring and said groove bottom.

The body 32 includes removable means consisting of a ring 38, also of aluminum, having an outside diameter equal to that of the body 32 and forming therewith the groove 34. The ring 38 defines a side wall of the groove 34 for retaining the wearing ring 36 in slidable engagement with the walls of the groove and fits an annular recess 40 in the rearward peripheral surface of the body

32 and forms a continuation of the back face 42 thereof. The ring 38 is removably secured to the body 32 by screws 44 seating against the ring 38 and threaded into the body.

The wearing ring 36, when assembled in the groove 34, is of sufficiently larger outside diameter than the piston body 32 to ensure seating contact solely between the ring 36 and the cylinder bore 24. Furthermore, the outside diameter of the ring 36 is such that, when the compressor is at normal operating temperature, the whole peripheral surface of the ring 36 will be in engagement with the bore 24.

Thus, in accordance with the practice of the invention, as the temperature of the piston body 32 rises following the start of compression, the aluminum body 32 expands a greater amount than the carbon wearing ring 36 owing to the difference in their coefficients of expansion and the split ring 36 is forced to spread in the groove 34 until its entire peripheral surface is brought into contact with the surface of the bore 24 at the normal operating temperature of the compressor.

In order to position the ring 36 in the groove 34 and maintain a desired angular relation between the ring and the piston 20 during operation of the compressor, a stop 46 is provided which lies in the split 48 in the ring 36 and is seated in a radially extending slot 50 in the ring 38 between two of the screws 44. A dowel 52 extending through the stop 46 into the piston body 32 prevents the stop from sliding outwardly and riding on the bore 24.

It will be understood that the combined weights of the piston assembly 20 and the piston rod 28 cause the occurrence of greatest wear on the bottom side of the wearing ring 36. As the wear at this point of a ring progresses, the piston drops from its substantially coaxial position in the cylinder bore 24 and approaches the bottom side thereof.

Before the ring 36 becomes worn to a degree permitting body contact between the piston body 32 and the cylinder bore 24, it is desirable to return the piston 20 to its central position in the bore 24 and at the same time to distribute the wear as evenly as possible around the periphery of the ring 36. To accomplish this, the piston 20 and the rod 28 are adapted to be turned relatively to the bore 24 to bring unworn areas of the ring periphery to the bottom of the bore. To this end, the rearward terminal portion 54 of the rod 28 is threaded into the piston body 32 and locked in place by a nut 56 screwed on the end of the rod and seating against a washer 58 which is embedded in the body 32 and fixedly positioned by a dowel 60 extending through the washer into the body. A set screw 62 screwed through the nut and bearing against the washer 58, serves to prevent the nut 56 from loosening on the rod 28.

The other end 64 of the rod 28 is threaded to fit a threaded hole 66 in the rearward end 68 of the crosshead 30, in which the rod is turned for adjustment of the piston 20 in the bore 24. A locknut 69 screwed on the forward end 64 and seated against the rearward portion 68 of the crosshead, locks the rod in any desired angular position relative to the crosshead.

In order to obtain maximum wear from a single wearing ring 36, the piston 20 and the rod 28 are rotated selectively in the bore 24 from their original position to one of three other equally spaced positions each time wear on the ring 36 permits the piston to sag in order to create a predetermined clearance between the piston and the bottom side of the bore. This procedure necessitates the use of slightly larger end clearances between the ends of the piston 20 and the front and back heads, designated 70 and 71, respectively, of the cylinder 21 than are normally provided, since the piston and the rod are moved longitudinally in the bore 24 toward either one

of the heads when the rod is turned in the threaded hole 66. However, by the employment of a fine pitch thread in hole 66, the size of the required end clearances and the corresponding volumetric efficiency of the compressor are held to a minimum.

To facilitate positioning of the piston in the aforementioned locations, adjusting means is provided at the forward end 64 of the rod 28. Said means comprises a split indicating ring 72 having the numerals "1," "3," "4" and "2," designated 74, stamped on one of its end faces at quarterly intervals in clockwise order. The ring 72 is seated in a matching groove 76 adjoining the thread on the forward portion 64 of the rod 28 and should be fixedly secured thereto in any well known manner with the numerals 74 facing the piston 20 and with the numeral "1" in the uppermost position. In this connection it will be understood that the stop 46 should be positioned angularly on the piston 20 to form a 45° angle with any one of the four maximum wear points on the wearing ring 36 corresponding in alignment to the numerals 74 on the ring 72. This stop position eliminates the possibility of the split 48 riding on the bore 24 at the bottom of the piston where it would reduce the effective supporting area of the ring 36.

A plate 78, fastened to the topside of the rearward portion 68 of the crosshead 30 by screws 80, has an arrow 82 thereon to serve as an index for alignment with the numerals 74 on the indicating ring 72 to indicate the angular relation of the rod and the piston with respect to the crosshead.

The wear and adjusting device is operated in the following manner. Since the carbon wearing ring 36 is the sole support for the piston 20 and supplies the only lubrication therefor, it will require periodic inspection. This may be conveniently accomplished with the removal of, either an inlet or discharge valve and only the cover 84 of which is shown, from the upper back end of the cylinder 21 by ascertaining the clearance between the upper side of the ring 38 and the wall of the bore 24. In the initial position of the wearing ring and the numeral "1" in alignment with the arrow 82, and which may be conveniently seen when the cover 23 is removed from the bedplate, this top clearance may have, for example, a minimum value of .044" and the bottom clearance a maximum value of .036".

When it is found that the top clearance has increased to a maximum of say, .065", and in which case the bottom clearance will be .015" the piston 20 should be adjusted rotatively to place the ring 36 in a new wearing position. This may be accomplished by loosening the locknut 69 and turning the piston and rod assembly clockwise until the numeral "2" is in alignment with the arrow 82, after which the locknut is tightened. In this way the piston 20 is returned to the position in the bore 24 in which the top and bottom clearances will again be .044" and .036", respectively.

Likewise, when the top clearance has increased to a maximum of approximately .065" for the second and third times, the piston and the rod are rotated counterclockwise to bring the numerals "3" and "4" successively into alignment with the arrow 82.

When the greatest wear area on the wearing ring 36 has again worn to an unsafe degree, the ring 36 must be replaced and the above-described procedure will be repeated.

It will be noted that the total rotative adjustment of the piston 20 amounts to only three quarters of a turn of the rod 28 in the crosshead 30, a condition which also enables the end clearances to be held to a minimum.

Thus, a simple and effective wear and adjusting device is provided, which is conveniently inspected and serviced and which obtains the maximum degree of wear from a single wearing ring.

I claim:

1. In a wearing device, a body of high expansive material having an annular peripheral groove, wearing means in the groove consisting of a ring of a lower expansive material than the body material having a smaller inside diameter than the diameter of the groove and being split to enable said ring to expand within the groove, said body including removable means forming therewith said groove and retaining the ring therein, and means for preventing rotative movement of the ring in the groove.

2. In a wearing device, a piston of material with a high coefficient of expansion having an annular peripheral groove, a wearing ring of graphitic material with a low coefficient of expansion in the groove and having a smaller inside diameter than the diameter of the groove and being split to enable said ring to expand within the groove, said piston including a removable ring defining a side wall of the groove for retaining the wearing ring therein, and a stop in the groove for preventing rotative movement of the wearing ring in the groove.

3. A piston for a non-lubricated cylinder, comprising a plurality of sections, one of said sections being of high expansive metallic material, the other of said sections forming with the one section an annular peripheral groove, a wearing ring of a low expansive graphitic material in the groove and having a smaller inside diameter than the diameter of the groove and being split to enable said ring to expand within the groove, said other of said sections retaining the ring in the groove, and a stop in the groove to cooperate with the ends of the wearing ring for maintaining a desired angular relation between the ring and the piston.

4. Adjusting means for distributing the wear on a wearing ring of low expansive graphitic material non-rotatably mounted on and supporting a piston of high expansive metallic material in a non-lubricated cylinder, a piston rod fixedly connected at one end to the piston, and a crosshead rotatably connected to the other end of the rod, said rod being selectively rotatable to various angular positions relative to said crosshead, comprising means for locking the rod in any one of said positions against rotary movement with respect to the crosshead, and position indicating means on the rod and on the crosshead cooperating with each other to indicate the angular relation of the rod and the piston with respect to the crosshead.

5. In combination, a piston for a non-lubricated cylinder, said piston being of high expansive metallic material and having an annular peripheral groove, a wearing ring of a low expansive graphitic material in the groove and having a smaller inside diameter than the diameter of the groove and being split to enable said ring to expand within the groove, said piston including a removable ring forming therewith said groove and defining a side wall of the groove to retain the wearing ring therein, a stop between the ends of the wearing ring for maintaining a desired angular relation between the wearing ring and the piston, a piston rod fixedly connected at one end to the piston, a crosshead threadedly connected to the other end to said piston rod, said rod being selectively rotatable to various angular positions relative to said crosshead, a nut locking the rod in any one of said positions against rotary movement with respect to the crosshead, and position indicating means on the rod and on the crosshead cooperating with each other to indicate the angular relation of the rod and the piston with respect to the crosshead.

References Cited in the file of this patent

UNITED STATES PATENTS

327,666	Delagneau	Oct. 6, 1885
1,650,877	McMahon	Nov. 29, 1927
1,700,567	Ferlin et al.	Jan. 29, 1929
2,557,497	Carney	June 18, 1951

OTHER REFERENCES

Article in "Power," vol. 96, No. 7, July 1952, page 119.