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PISTON ASSEMBLY

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FIG. I.

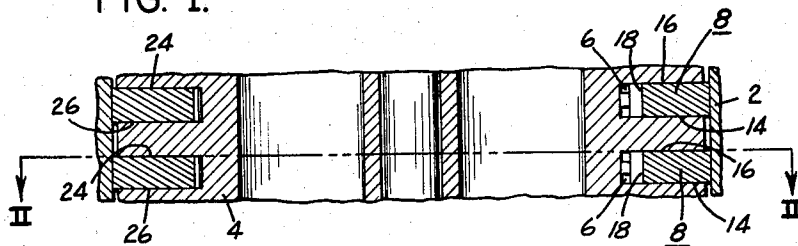
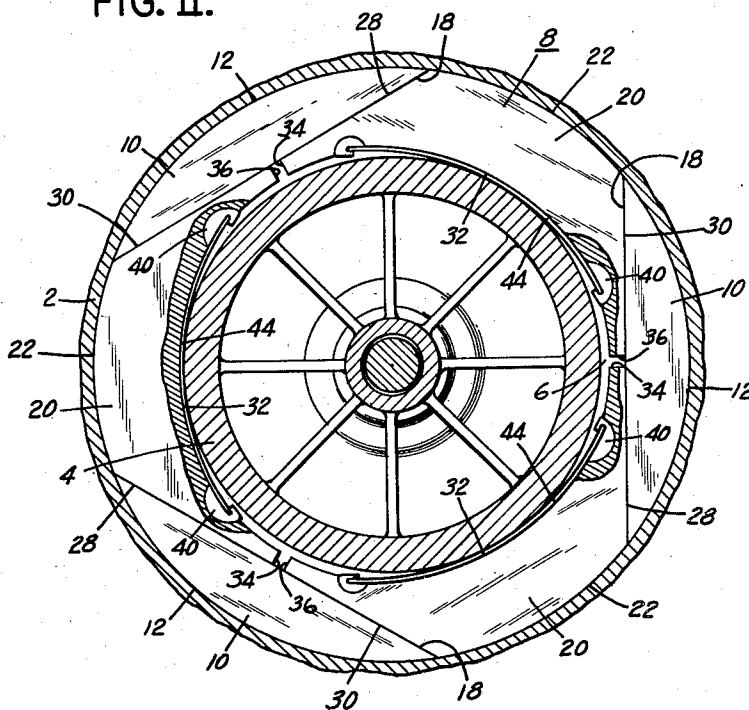


FIG. II.



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PISTON ASSEMBLY

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6 Claims. (Cl. 309—23)

Our invention relates to a packed piston assembly and more particularly to a packed piston assembly having a surface coating on the piston for preventing electrolytic corrosion between the piston and the piston packing.

At the present time numerous industrial applications require compressed air which is free of hydrocarbons due to the danger of an explosive hydrocarbon-air mixture. Still other industrial applications, such as those for the compression of oxygen, also require that the air be free of hydrocarbons. In order to meet these requirements it has been common practice to employ carbon packing or carbon piston rings on the compressor pistons in order to eliminate the need of lubricating in the compressor cylinder. It has also been general practice to employ aluminum pistons in such compressors due to the various advantages of the aluminum. In employing such aluminum pistons and carbon rings a serious problem has been encountered by the corrosion of the carbon ring due to the electrolytic corrosion between the aluminum piston and the carbon ring.

Heretofore various means have been employed to prevent electrolytic corrosion between the aluminum piston and the carbon rings. One method of preventing such corrosion is to provide the aluminum pistons with a ring groove insert of a different material, such as hard bronze, or Phosphor bronze, which separates the aluminum and carbon ring surfaces with a material which it not subjected to electrolytic corrosion between the various components. Such a structure, however, requires a built up piston or other complicated fastenings for the inserts such that this cost is prohibitive. Another method of minimizing electrolytic corrosion in such compressors is to plate the ring grooves with chromium or other suitable metal or material to separate the aluminum and carbon surfaces. Such a structure is difficult to obtain and consequently expensive due to the necessity of holding plated surfaces to extremely close tolerances.

Accordingly one object of our invention is to provide a new and improved piston assembly having at least a portion of the piston surface treated to prevent electrolytic corrosion between the piston and a piston ring in engagement with the treated surface.

Still another object of our invention is to provide a new and improved piston assembly having an aluminum piston with an electrolytic oxide coating on at least the surface thereof in engagement with a carbon piston ring.

Still another object of our invention is to provide a new and improved piston assembly having an aluminum piston with a sealed electrolytic oxide coating on at least the surface thereof in engagement with a carbon piston ring.

These and other objects of our invention will become more apparent when taken in conjunction with the following detailed description of a preferred embodiment of our invention and the following drawings, in which:

Figure 1 is a longitudinal sectional view of a portion of a piston-type compressor showing the piston and piston ring assembly.

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Figure 2 is a cross sectional view of the piston-type compressor as shown in Figure 1, taken substantially along the lines II—II thereof.

Referring to the drawings, a conventional compressor cylinder 2 is shown having an aluminum alloy piston 4 reciprocable therein. As shown piston 4 is provided with a plurality of grooves 6 which extend around its periphery and in each of which a segmental packing means 8, conventionally referred to as a piston ring, is located.

Each of the segmental piston rings 8, in the embodiment shown, comprises six pieces. Three of the pieces, namely those shown at 10, consist of carbon blocks having four surfaces: one cylindrical surface 12 adapted to engage the cylinder wall or bore, two plane surfaces 14 and 16 which bound the block in the axial direction, and a tangential plane surface 18 at right angles to the surfaces 14 and 16.

The three blocks 10 of a piston ring 8 are circumferentially spaced about the piston, and between them are arranged other carbon blocks 20. Blocks 20 also have cylindrical surfaces, shown at 22, adapted to engage the cylinder wall; substantially plane surfaces 24 and 26 bound blocks 20 in an axial direction; tangential plane surfaces 28 and 30 are provided to engage the tangential surfaces 18 of blocks 10; cylindrical surfaces 32 bound the blocks to form inner surfaces which, are located adjacent the bottom of the piston groove 6; other plane surfaces 34 and 36 connect the cylindrical surfaces 32 with the tangential surfaces 28 and 30 respectively to form shoulders or ends of the segments.

It will be noted that each of the blocks 10 and 20 forming a piston ring 8 are of a thickness so that the plane surfaces 14 and 16, and 24 and 26, respectively, are closely received between the sides of the ring groove 6 in which the blocks are located. Further reaction members 40 and resilient members 44 are provided to insure that each piston ring 8 properly engage the cylinder wall. Inasmuch as the particular form of a piston ring 8 and its operation does not form a part of our invention reference is made herein to Patent No. 2,768,040 of Willard E. Green entitled Packed Piston, patented on Oct. 23, 1956, in which the structure of such packed pistons is more fully described and claimed.

As indicated, it is the purpose of our invention to prevent electrolytic corrosion between the engaged surface of the aluminum piston 4 and each of the carbon piston rings 8. We have accomplished this purpose by providing the outer surface of the piston 4 with an electrolytic oxide coating in any suitable manner as is well known in the art. Accordingly piston 4 must be formed from an aluminum alloy which may be provided with an electrolytic oxide coating as is well known in the art. Various suitable means of forming such an electrolytic oxide coating may be utilized such as the chromic acid or sulphuric acid anodizing processes, as are well known in the art, so that the outer surface of the piston 4 increases its hardness with respect to the underlying base aluminum of the piston 4. Although in practice it is feasible to anodize the entire outer surface of the piston 4, it is to be realized that, for the purpose of our invention, it is only necessary to anodize the outer surface of the piston 4 which engages the carbon piston rings 8. Thus, only that area of the aluminum piston 4 formed by the grooves 6 which engages the surfaces 14, 16, 24 and 26 of the blocks 10 and 20 need to be anodized around the entire outer periphery of the aluminum piston 4.

Although the anodized piston structure as heretofore described substantially reduces the above mentioned electrolytic corrosion, it is to be realized that the described oxide coatings on the piston 4 have a certain porosity such that a certain amount of electrolytic corrosion will

occur between the piston 4 and the rings 8. Accordingly to further decrease such electrolytic corrosion the porous oxide film on the piston 4 may be sealed in any suitable manner, as is well known in the art, to decrease the porosity of the anodized outer surface of the piston 4. One particular means of sealing the anodized area of the piston is to immerse the anodized piston 4 in hot water which converts the oxide coating on the piston 4 to the monohydrate with a resulting increase in volume which seals the oxide film. If desired the anodized coating may also be sealed in solutions of sodium chromate or dichromate in which the chromate is absorbed in the pores of the anodized piston 4 and thus further adds to its corrosion resistance properties. It is to be realized, however, the particular method of forming the anodized coating and sealing such coating on the aluminum piston 4 is not critical for our invention.

By so sealing the oxide film on the aluminum piston 4 the resistant surface of the piston 4 is extremely hard and in practice has given excellent resistance to electrolytic corrosion. In addition, due to the well known art of so providing such anodized and coated surfaces on aluminum, such surfaces may be formed at a low cost and at a substantial reduction in cost with reference to the prior methods of preventing such corrosion as heretofore described. Under actual tests using pistons treated in the manner as heretofore described the electrolytic corrosion has been substantially reduced under extremely adverse conditions.

It is to be realized that the particular structure of the carbon ring 8 and piston 4, as shown in the drawings, is illustrative only of such structures, and that such components may be of any desired constructure as is well known in the art. Further it is to be noted that the principles of our invention are equally applicable to preventing electrolytic corrosion between any aluminum portion of a compressor in engagement with the carbon rings employed therein.

Having described a preferred embodiment of our invention in accordance with the patent statutes, it is to be realized that such embodiment is illustrative only and that modifications thereof may be made without departing from the broad spirit and scope of our invention. Accordingly, it is respectfully requested that our invention be interpreted as broadly as possible and as limited only by the prior art.

We claim as our invention:

1. An assembly comprising, a first member, a second member having a portion thereof engaging a portion of said first member, said portion of one of said members comprising an anodized aluminum alloy, said portion of the other of said members comprising a carbonaceous material and said other member having a surface spaced outwardly from said one member which is adapted to engage a surface located outwardly adjacent thereto with said one member being located in spaced relationship to said last mentioned surface.

2. An assembly comprising, a piston member, a ring member having an inner portion thereof engaging a portion of said piston member, said portion of said piston member comprising an anodized and sealed aluminum alloy, said portion of said ring member comprising a carbonaceous material, and said ring member having an

outer surface spaced outwardly from said piston member which is adapted to engage a surface outwardly adjacent thereto with said piston member being located in spaced relationship thereto.

3. An assembly comprising, a piston formed from an alloy of aluminum, a piston ring formed from a carbonaceous material with an inner surface thereof engaging at least one surface of said piston, said surface of said piston being anodized to provide an oxide coating, said anodized surface of said piston being sealed to reduce the porosity thereof, and said piston ring having an outer surface spaced outwardly from said piston which is adapted to engage a surface outwardly adjacent thereto with said piston being located in spaced relationship thereto.

4. An assembly comprising, a piston formed from an alloy of aluminum having at least one ring receiving groove extending around its outer periphery, a piston ring formed from a carbonaceous material and having a portion thereof received within said groove, said portion of said piston ring being engageable with the sides of said groove, at least said sides of said groove being anodized to provide an oxide coating, and said piston ring having an outer surface spaced outwardly from said piston which is adapted to engage a surface outwardly adjacent thereto with said piston being located in spaced relationship thereto.

5. An assembly comprising, a piston formed from an alloy of aluminum having at least one ring receiving groove extending around its outer periphery, said piston having its outer surface anodized to provide an oxide coating, a piston ring formed from a carbonaceous material and having an inner portion thereof insertable within said groove, said inner portion of said piston ring being engageable with the sides of said groove, and said piston ring having an outer surface spaced outwardly from said piston which is adapted to engage a surface outwardly adjacent thereto with said piston being located in spaced relationship thereto.

6. An assembly comprising, a piston member, a ring member having an inner portion thereof engaging a portion of said piston member, said portion of said piston member comprising an anodized aluminum alloy, said inner portion of said ring member comprising a carbonaceous material, and said ring member having an outer surface spaced outwardly from said piston member which is adapted to engage a surface outwardly adjacent thereto with said piston member being located in spaced relationship thereto.

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