Sept. 19, 1950 J. R. COFFEY 2,522,993

SEAL FOR DRIERS

Filed Dec. 12, 1947 2 Sheets-Sheet 1

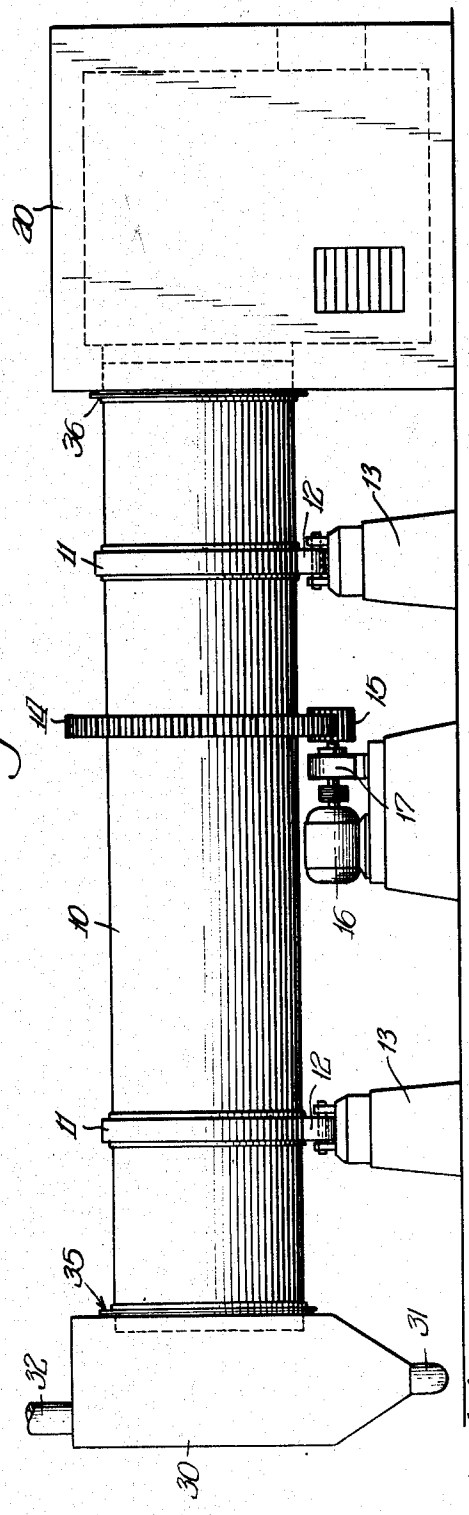


Fig. 1

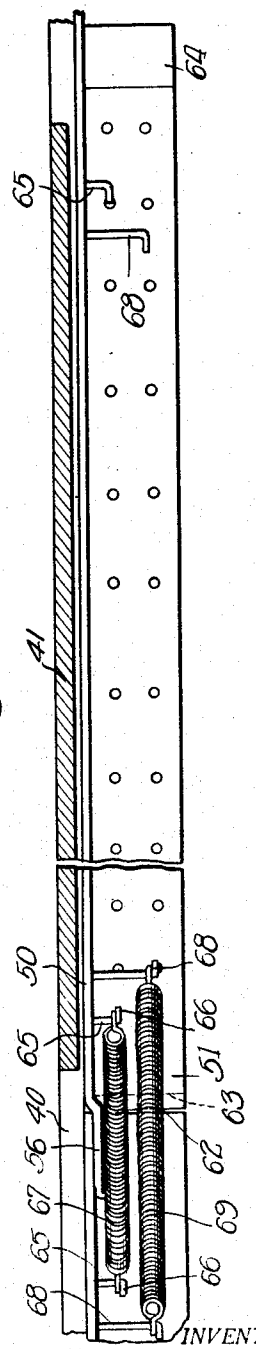


Fig. 4

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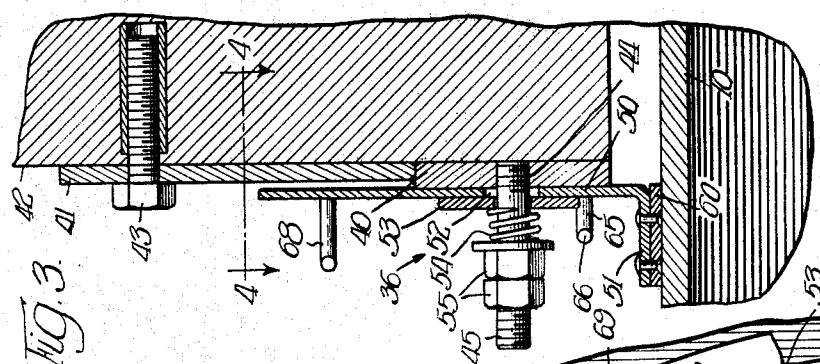


Fig. 3.

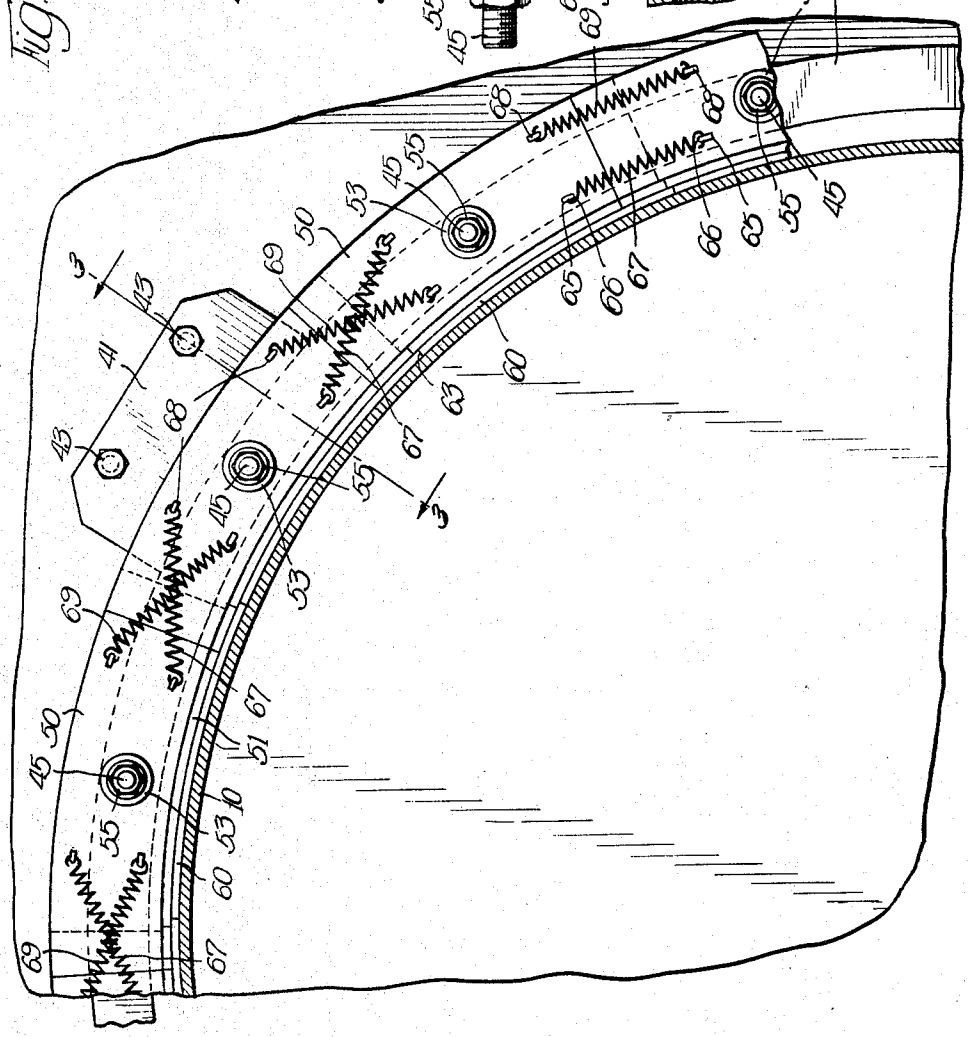


Fig. 2.

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Patented Sept. 19, 1950 2,522,993

UNITED STATES PATENT OFFICE

2,522,993

SEAL FOR DRIERS

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Application December 12, 1947, Serial No. 791,414

12 Claims. (Cl. 285—10)

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This invention relates to air seals for dryers and has for its principal object the provision of a new and improved device of this kind.

It is the main object of the invention to provide an improved air seal for rotary, cylinder type dryers.

Another object of the invention is to provide a seal for sealing space between the outer shell of a rotary, cylinder type dryer and tempering chambers and discharge hoods into which the shell projects.

Another object of the invention is to provide a circumferentially flexible seal composed of a plurality of individual rigid members articulated together.

Another object of the invention is to provide an air seal for dryers of this type which can be manufactured at low cost without sacrificing quality, and can be maintained in proper working condition economically.

Further objects of the invention not specifically mentioned here will be apparent from the detailed description and claims which follow, reference being had to the accompanying drawings in which a preferred embodiment of the invention is shown by way of example and in which:

Fig. 1 is a side elevational view of a dryer showing the seal applied thereto;

Fig. 2 is a fragmentary elevational view of a seal drawn to enlarged scale;

Fig. 3 is a cross sectional view taken substantially along the lines 3—3 of Fig. 2 looking in the direction of the arrows and drawn to an enlarged scale; and

Fig. 4 is a fragmentary plan view partly taken substantially along the lines 4—4 of Fig. 3 looking in the direction of the arrows.

Cylindrical dryers are frequently used to dehydrate comminuted material down to a low moisture content. Usually these dryers consist of a cylindrical drum rotatably mounted and rotated at slow speed about its longitudinal axis. Within the drum are lifting and showering media and sometimes steam pipes for heating, so that material fed into the drum will be tumbled and showered therein and will move from end to end thereof and be dehydrated during such movement. Usually the inlet end of the dryer shell is somewhat higher than the outlet end to facilitate movement of the material therethrough.

Frequently the inlet end of the dryer is projected into a tempering chamber wherein air or gas is heated, dried and/or otherwise prepared for movement through the dryer. The conveyors

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or chutes by which the material to be dried is fed into the dryer also extends through this tempering chamber. The outlet end of the dryer also extends into a box-like structure or discharge hood which receives the material emerging from the dryer and empties into the conveyor or other means by which this material is carried away from the dryer.

In certain instances the air in the tempering chamber is maintained above atmospheric pressure so as to force a stream of air through the dryer and in intimate contact with the material tumbling therein. In other instances an exhaust fan is connected to the discharge hood to reduce the pressure therein and thereby induces a flow of air through the dryer. In other instances both arrangements may be used.

It will be apparent that the large diameter cylindrical shell of the dryer which is constantly rotating during operation of the dryer cannot be tightly fitted into the walls of the tempering and discharge chambers, but rather an appreciable space must be left therebetween. It will also be apparent that if the space around the shell at the point of its entry into the tempering chamber is not blocked or sealed, the pressure in the tempering chamber will force a continuous stream of air through this space and the efficiency of the dryer will thereby be decreased. Similarly if the space between the end of the dryer and the discharge hood into which it projects is not sealed, vacuum in the discharge hood will draw air through that space thereby partially short-circuiting the dryer and with a consequent reduction in the volume of air flowing therethrough to the detriment of the drying operation. It is to the sealing of these spaces that the present invention particularly relates.

The cylinder shells of dryers of the type to which the invention refers are of large diameter, frequently seventy-two inches or more, and although these drums are accurately made it will be apparent that there is apt to be considerable variation from a true cylinder in the shell. The sealing element therefore must be flexible through a range sufficiently great to permit sealing notwithstanding these irregularities in the shell configuration.

Referring now to the drawings in more detail, the dryer consists of a cylindrical shell 10 containing bearing rings 11 that register with suitable rollers 12 that support the shell with its axis substantially horizontal. Rollers 12 are mounted on suitable bases 13 and the right-hand one of these bases as seen in Fig. 1 is preferably some-

what higher than the left-hand base so as to elevate the inlet end of the dryer above the outlet end. The shell also carries a ring gear 14 with which is meshed a pinion 15 that is driven by a suitable source of power such as a motor 16 through speed-reducing gearing 17 to rotate the dryer.

Within the dryer are lifting flights or shelves, and/or steam pipes and baffles, the particular type and arrangement of which form no part of the present invention.

At the right or inlet end of the dryer, as seen in Fig. 1, is a generally rectangular box-like structure 20 usually referred to as a tempering chamber, and the end of the dryer shell 10 projects into and part-way through the walls of this chamber. Within the chamber there may be located air cleaning and heating equipment, or if desired such equipment may be located externally of the chamber to discharge into it. The dryer cylinder may project into the tempering chamber through one wall of the latter, or may extend entirely through said tempering chamber by projecting through two opposite walls, and the conveyor or chute equipment by which the material to be dried is introduced into the dryer, may or may not enter the tempering chamber. Since this tempering and feeding equipment forms no part of the present invention, it has been omitted from the drawings to avoid unnecessary complication thereof.

At the left or outlet end of the dryer wall 10 is a similarly generally rectangular structure 30 commonly referred to as a discharge hood and out of the bottom of which a conveyor 31 leads to carry off the dried material received by the hood. A suitable duct 32 may lead out of the top of the discharge hood and to an exhaust fan, not shown, by which air is drawn out of the hood. Or a duct from a furnace or heater may be attached to the discharge hood 30, in which case the duct 32 leading to the exhaust fan is attached to the tempering chamber or to a stationary housing called a feed hood or throat piece. Generally the exhaust fan will discharge into a suitable dust collector such as a cyclone, so that minute particles of the product drawn out of the hood with the air current can be reclaimed. This equipment forms no part of the present invention and has been omitted from the drawings to avoid unnecessary complication thereof.

The seals 35 and 36, mounted upon the discharge hood and tempering chamber walls respectively, encircle the shell 10 of the dryer and serve to seal the space between this shell and the chamber walls. It is this seal to which the invention particularly relates.

As will be seen in Figs. 2, 3 and 4, the seal consists of a stationary ring 40 having ears 41 projecting radially from its outer edge, these ears being perforated to permit attachment of the ring to the wall 42 of the housing 20 by suitable means such as stud bolts 43. The inner edge of the ring 40 is concentric with the shell 10 of the dryer and coincides with the innermost edge of the opening in the wall 42 through which this dryer shell projects. Ring 40 contains a plurality of threaded openings 44 into which studs 45 are threaded. The surface of the ring 40 away from the wall 42 projects beyond the corresponding surface of the ears 41 and is machined smooth and flat so as to facilitate forming the seal.

Mounted upon this ring are a plurality of

shoe sections which together form an articulated ring that is disposed concentrically of the shell 10 and ring 40. Each of these shoe sections consists of an annular portion 50 which contains a flange 51 on its inner edge. The flange is formed as a section of a cylinder whose diameter is slightly greater than the diameter of the shell 10. The annular portion 50 of the shoe section contains a perforation 52 through which the stud bolt 45 projects. A washer 53 fits over the stud and against the annular portion 50 and is pressed thereagainst by a spring 54 that is tensioned by nuts 55 threaded on the stud. Spring 54 presses the annular portion 50 tightly against the ring 40, and maintains it in seal-forming engagement therewith. Since the perforation 52 in this annular portion is substantially greater than the diameter of the stud, it will be apparent that limited movement of the shoe with respect to the ring 40 is possible.

As shown in Fig. 3, the wall 42 of the tempering chamber is assumed to be composed of masonry or concrete, and a sealing surface thereon is formed by the ring 40. In certain instances the walls of this chamber may be composed of metal which is smooth enough to form a seal with the shoe portion 50. In such instances the studs 45 may be threaded directly in the wall of the chamber and the ring 40 omitted.

As will be seen best in Fig. 4, the one end of the annular portion 50 of the shoe is bent out of the plane of the remainder of that portion in the direction of the flange to form an ear 56, which projects beyond the end of the flange 51 of the shoe and overlaps the end of the adjacent shoe. This overlapping of the shoe sections in the portions thereof in engagement with the ring 40 facilitates maintaining a seal therewith throughout the range of movement of the individual shoe sections.

Mounted upon the flanges 51 of each shoe section is a sealing member 60 which may conveniently be composed of a fibrous material impregnated in the manner of ordinary brake lining. As shown, this material is attached to the flange by rivets countersunk therein, although other forms of attachment may be used. As will be seen in Figs. 2 and 4, the lining 60 is terminated short of the end 62 of the flange 51 adjacent the ear 56, as shown at 63, and projects beyond the flange 51 at the opposite end of the shoe as shown at 64. By this overlapping of the flange and seal-forming member, a tight seal can be maintained throughout the range of movement of the shoe sections with respect to each other.

Fixed to and projecting from the annular portion 50 of each shoe and in juxtaposition to flange 51 thereon is a post 65 on the outer end of which is formed a hook 66. These posts and hooks 65 and 66 are located adjacent each end of the shoe. Also mounted upon the annular portion 50 of each shoe adjacent each end thereof is a second hook 68.

Springs 67 and 69, which may be coil springs, are attached to posts and hooks 65 and 68. As shown, spring 67 may be attached at one end to the inner post 65 on one section and at the other end attached to the outer post 68 of the adjacent section, and spring 69 may be attached to the outer post 68 of the first section and at the opposite end to the inner post 65 of the second section. As will also be seen in Fig. 2, spring 67 may be attached at both ends to posts 65 of adjacent sections, and spring 69 attached at both

ends to posts 68 of those sections. Either arrangement may be used, and in certain instances both may be used to form a seal.

Springs 67 and 69 are tensioned to draw the adjacent shoe sections together, and are thereby tensioned to draw the seal-forming members 60 into tight engagement with the outer surface of the shell 10. The seal so formed effectively blocks the opening between the rotating shell 10 and the stationary housing into which it projects, preventing the entrance of air through this space. As the drum rotates, any irregularities in the surface of the shell 10 will cause a corresponding movement of the shoe then engaging that irregularity, the shoe moving to compensate for the irregularity without breaking the seal between the element 60 and the drum, or between the annulus 50 and the ring 40. It has been found that dryers equipped with the seals of the present invention have operated more efficiently because of the minimizing of the entrance or escape of air or gas from the system.

From the foregoing, it will be apparent that the sealing device of the present invention consists of a plurality of short rigid sections which are individually mounted and are connected together to form an articulated ring which is flexible circumferentially. The individual sections are movable through a limited range, both with respect to each other and with respect to the member on which they are mounted, and this movement is achieved without breaking the seal.

The sealing device of the present invention possesses many advantages. The combination of a fixed ring permanently mounted upon the stationary housing and carrying an articulated ring composed of a plurality of individual rigid shoes each of which bears a sealing member that is maintained in engagement with the drum forms a simple, inexpensive and highly efficient seal. Maintenance of the seal is inexpensive and since the seal is entirely exposed to view, inspection and adjustment thereof as may be required is easily accomplished.

While the invention has been shown by illustrating and describing a preferred embodiment of it, such embodiment has been by way of example only, as there are many modifications and adaptations which can be made by one skilled in the art within the teachings of the invention.

Having thus complied with the statutes and shown and described the preferred embodiment of the invention, what is considered new and is to be protected by Letters Patent is pointed out in the appended claims.

What is claimed is:

1. The combination with a dryer having a cylindrical shell which is rotatable and a stationary housing into which the shell projects, of a seal for closing the space between the housing and the shell comprising a ring fixed upon the housing concentrically of the shell and having an inside diameter greater than the outside diameter of the shell, a plurality of rigid members of L cross section and having an annular portion and an arcuate portion, each of which members contains a perforation in its annular portion, studs fixed on said ring and each projecting through the perforation in one of said members, the diameters of said studs being substantially less than the diameters of the perforations to permit limited movements of the members with respect to the ring, seal-forming members fixed to the arcuate portions of the rigid members and engaging said shell, and means interconnecting adjacent ones of said rigid members for urging the same together to thereby urge said seal-forming members into seal-forming engagement with said shell.

2. The combination with a dryer having a cylindrical shell which is rotatable and a stationary housing into which the shell projects, of a seal for closing the space between the housing and the shell comprising, a ring fixed upon the housing concentrically of the shell and having an inside diameter greater than the outside diameter of the shell, a plurality of rigid members of L cross section and having an annular portion and an arcuate portion, each of which members contains a perforation in its annular portion, studs fixed on said ring and each projecting through the perforation in one of said members, the diameters of said studs being substantially less than the diameters of the perforations to permit limited movements of the members with respect to the ring, seal-forming members fixed to the arcuate portions of the rigid members and engaging said shell, and means including springs encircling said studs and nuts threaded thereon and engaging said springs for maintaining said annular portion in seal-forming engagement with said ring.

3. The combination with a dryer having a cylindrical shell which is rotatable and a stationary housing into which the shell projects, of an air seal for closing the space between the housing and shell comprising, a ring fixed upon the housing and encircling the shell at a substantially uniform distance therefrom, a plurality of interleaved rigid arcuate members disposed upon the ring and projecting therefrom radially inwardly toward the shell, each of said members being L-shaped in section and being mounted on the ring for limited movement with respect thereto, a seal-forming member attached to each of said members and engaging said shell and spring means interconnecting adjacent ones of said members and tensioned to hold said seal-forming members in sealing engagement with said shell.

4. The combination with a dryer having a cylindrical shell which is rotatable and a stationary housing into which the shell projects, of an air seal for closing the space between the housing and shell comprising, a ring fixed upon the housing and encircling the shell at a substantially uniform distance therefrom, a plurality of interleaved rigid arcuate members disposed upon the ring and projecting therefrom radially inwardly toward the shell, each of said members being L-shaped in section and being mounted on the ring for limited movement with respect thereto, a seal-forming member attached to each of said members and engaging said shell and spring means for maintaining said arcuate members in seal-forming engagement with said ring.

5. An air seal for a rotatable cylindrical dryer shell comprising, a fixed annulus encircling the dryer and spaced therefrom, a movable multi-section annulus disposed against said fixed annulus and encircling said dryer, means for supporting the movable annulus on said fixed annulus, said means permitting limited movement of the movable annulus with respect to the fixed annulus, seal-forming means carried by the movable annulus and engaging the dryer shell, and spring means carried between adjacent sections of the movable annulus for urging said seal-forming means into seal-forming engagement with the dryer shell.

6. A seal as claimed in claim 5 in which the seal-forming means is in sections corresponding in number and length with the annulus sections and fixed to said annulus sections in offset relation thereto so that a portion of each annulus section overlaps the seal-forming means on an adjacent annulus section.

7. A seal as claimed in claim 5 in which each section of the multi-section annulus is of L section and has an annular portion engaging the fixed annulus, which annular portion has an end section that is offset from the remainder of the portion and overlaps the annular portion of an adjacent section.

8. A seal as claimed in claim 5 in which each section of the multi-section annulus is of L cross section and has an annular portion engaging the fixed annulus, which annular portion has an end section that is offset from the remainder of the portion and overlaps the annular portion of an adjacent section and in which the seal-forming means is in sections with each section fixed to a section of the multi-section annulus in offset relation thereto and projects from the end thereof opposite said end section and is overlapped by the end section of an adjacent annulus section.

9. The combination with a dryer having a cylindrical shell which is rotatable and a stationary housing into which the shell projects, of a seal for closing the space between the housing and the shell comprising, a stationary ring fixed on the housing concentrically of the shell, a flanged articulated ring encircling the shell, means securing the articulated ring in seal-forming engagement with the stationary ring, said securing means permitting limited radial and circumferential movement of the articulated ring with respect to the stationary ring, seal-forming means fixed on the flanges of the articulated ring, and means carried by the articulated ring for moving said ring with respect to the stationary ring to maintain said seal-forming means in seal-forming engagement with said shell.

10. The combination with a dryer having a cylindrical shell which is rotatable and a stationary housing into which the shell projects; of a seal for closing the space between the housing and the shell comprising: a stationary ring mounted on the housing concentrically of the shell, an articulated ring encircling the shell and disposed against the stationary ring, means securing the articulated ring in seal-forming engagement with the stationary ring, said securing means permitting limited radial and circumferential movement of the articulated ring with respect to the stationary ring, seal-forming means carried by the articulated ring and engaging the shell, and means for holding said seal-forming means in seal-forming engagement with the shell.

11. The combination with a dryer having a cylindrical shell which is rotatable and a stationary housing into which the shell projects, of a seal for closing the space between the housing and the shell comprising: a stationary ring mounted on the housing concentrically of the shell, an articulated ring encircling the shell, means securing the articulated ring in seal-forming engagement with the stationary ring, said means permitting limited movement of the articulated ring with respect to the stationary ring, seal-forming means on the articulated ring, and means carried by the articulated ring for maintaining said seal-forming means in seal-forming engagement with said shell.

12. A circumferentially flexible air seal for closing the space between a fixed housing and a cylindrical shell rotating within an opening in said housing, comprising an articulated ring encircling said shell consisting of overlapping arcuate segments, each section having an annular portion for attachment to the wall of the fixed housing; spring means attached between and on the annular portion of adjoining segments for forcing them inwardly; a seal-forming means between said ring and shell; studs fixed in the said housing for fastening the annular portions of said segments to the housing; a perforation in the annular portion of each segment for the insertion of said studs, which perforation is larger than the studs to permit limited movement therein, and spring means encircling said studs for maintaining the section in seal-tight engagement with the housing during said movement.

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REFERENCES CITED

The following references are of record in the file of this patent:

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Number	Name	Date
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