CONTACT SEAL SYSTEM AND METHOD FOR ROTARY AIR DUCTS

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ABSTRACT

An apparatus is disclosed to seal a sector-plate at a diaphragm for an air duct. The apparatus includes a flexible seal including a radial seal body. The radial seal body produces a travel path with a major axis when operatively coupled with the diaphragm. Mounting hardware includes a rail to maintain a defined beam position of the radial seal body relative to the diaphragm.
CONTACT SEAL SYSTEM AND METHOD FOR ROTARY AIR DUCTS

BACKGROUND

0001. Field of the Disclosure

The present disclosure relates generally to the field of contact seal systems that maintain separation between one or more compartments in a rotary air duct. More particularly, the present disclosure relates to an embodiment to a system for providing sealing of a pre-heater air duct of a rotary regenerative heat exchanger system to provide an improved radial seal design.

0002. Description of Related Technology

Referring to prior art FIG. 1, a rotary air preheater is illustrated for a furnace of conventional power plant. The rotary pre-heater includes a rotary regenerative heat exchanger. The rotary regenerative heat exchanger utilizes exhaust gas in from one or more processes to heat intake air to a furnace of a conventional power plant, for instance, a coal, gas, or combo gas-fired power plant. To maintain air containment, a radial seal is installed between one or more compartments or passageways (see FIG. 3). Referring to prior art FIGS. 1 and 2, conventional radial seals including seal elements 1, 15, e.g., flexible, elastic seal elements, attached to diaphragm 10, top and bottom, in a sector (see FIG. 3) to maintain and contain air flow separation between one or more sectors under sector plates, for instance, between an air intake duct and an exhaust duct. As illustrated in FIG. 3, seal elements 1, 15 illustrated in FIGS. 1 and 2 may be used as radial seals to provide isolation and separation to bypass air flow between sectors of a duct and/or between air intake ducts and air exhaust intake duct.

0003. Conventional radial seals are generally categorized into one of two types: non-contact seal and contact seal. Referring to FIG. 1, a conventional non-contact seal is seal element 15 that resembles a shape of a straight leaf with a 15 degree bend about 1 inch below a contact seal edge. Seal element 15 rides about 0.032 inches to 0.125 inches from the sector plate. In contrast as illustrated in FIG. 2, a conventional contact seal, e.g., seal element 1, rides along sector plate in full contact usually after rotor has been turned-down. In these conventional systems, seal element 1 typically has about 0.25 inches of usable spring travel. Seal element 1 is flexible to support elastic movability, and is clamped between shield 2 and seal support 3 that trails leading edge. During operation, seal element 1 may be subjected to a large cleaning force. For instance, several thousand pounds of force may be applied during a water wash or when other media, e.g., steam, compressed air, or cleaning media, is propelled towards it, for instance, from one or more jet nozzles (not shown).

0004. Continuing with FIG. 2, seal support 3 and shield 2 limit a range of motion of seal element 1 upon contact with a large cleaning force. However, upon extended application(s) as a contact seal, seal element 1 wear life may be shortened due to its lack of resistance to wear. In addition, seal element 1 (illustrated in FIG. 2) during thermal expansion may have its contact surface planes change during turn-down. For example, on conventional rotary preheater units, turn-down may be greater than 1 and ½ inches when conventional contact seals move away from the sector plate on a hot end of the rotor. Thus, even with proper installation, seal element 1 may yield negligible improved sealing characteristics to that of seal element 15 in FIG. 1. Seal element 1 installation may be problematic. Ease of installation, seal element 1 is typically spot welded together with seal support 3 and shield 2 and clamped to diaphragm 10 using mounting hardware 5 and holding strip 4. As such, these conventional systems provide limited opportunity for material selection of seal elements 1, 15 to meet individual requirements of power plants.

0005. For installation, seal set bar may be used for alignment of seal element 1 to sector plate. Seal set bar, e.g., a straight edge, sets or adjusts a predetermined level of interference fitting between seal element 1 with that of a sector plate contact surface in these conventional systems, interference fitting is provided typically within a range between 0.125 inches to 0.312 inches. Furthermore, interference fitting may be very time consuming as compared to other seal installation tasks. Interference fitting requires precise interference calculations to achieve desired sealing between sectors of a rotary regenerative air preheater. Furthermore, interference fitting calculations require an in-depth familiarity with physical dimensionality of an air duct system, e.g., height, width, and other clearance variables, to obtain accurate diaphragm, sector plate, and other rotational dimensionality turn-down values.

0006. In summary, the conventional rotary seals provide limited flexibility on choice of seal elements for rotary regenerative heat exchangers for a given exposure of harsh effluent erosive and corrosive constituents. Conventional seal systems require complicated installations, e.g., extensive familiarity or customization of sealing dimensionality, and require, in many instances, extensive replacement schedule of one or more sealing elements. As such, conventional seals have limited capability for selecting, customizing, or comparing material choices for flexible elements based on application or power plant requirements or needs.

0007. Thus, what are needed are apparatus and methods for providing a rotary sealing apparatus and process that provide advantages over conventional systems including any or all the following: reduced installation time, reduced frequency of replacement, increased travel distance of sealing element, increased selectivity options, seal customization based on one or more operational requirements to withstand one or more harsh particulate erosive elements, and reduced downtime during any or all the following: maintenance, and/or partial or full non-functionality of one or more boilers. In addition, other advantages would include improved air duct or chamber sealing or emissions flow in accordance with specifications or requirements, and ability to vary or adapt in accordance with one or more variables.

SUMMARY

0008. In one aspect, an apparatus is disclosed to seal a sector plate at a diaphragm for an air duct. The apparatus includes a flexible seal including a radial seal body, the radial seal body producing a defined major axis of displacement, e.g., “Y” axis of displacement, when operatively coupled with the diaphragm; and mounting hardware including a rail to maintain a defined major axis of displacement of the radial seal body parallel relative to the diaphragm.

0009. In another aspect, a method is disclosed to provide a rotary seal of air compartments during air input and exhaust within an air duct. The method includes disposing a radial seal body on a rail, mounting the radial seal body aligned along one end with a diaphragm, and displacing the seal body with a sector plate to generate an arc-shaped path of the radial seal body contact surface along a plane parallel to the diaphragm.
In another aspect, a system is disclosed to provide a rotary seal for air compartments of an air duct. The system includes a radial seal body disposed on a rail to form an angled mount on the rail operatively coupled to a diaphragm reference plane such that the radial seal body yields a defined arc-shaped path along extents, e.g., leading or trailing edge, of the radial seal body on which the major axis of displacement of the arc-shaped path lies along a plane parallel to the diaphragm as the rotor assembly rotates.

These and other embodiments, aspects, advantages, and features of the present disclosure will be set forth in part in the description which follows, and in part will become apparent to those skilled in the art by reference to the following description of the disclosure and referenced drawings or by practice of the disclosure. The aspects, advantages, and features of the disclosure are realized and attained by means of the instrumentalities, procedures, and combinations particularly pointed out in the appended claims.

Detailed Description

Reference is now made to the drawings wherein like numerals refer to like parts throughout.

As used herein, the term “segment” refers to, but is not limited to, a sector or a compartment containing heat-exchanging elements defined by two diaphragm sides, a rotor shell, and a rotor-post, e.g., see FIG. 3.

As used herein, the term “diaphragm(s)” refers to, but is not limited to, radial plate(s) that emanates from rotor-post outward to rotor shell. Plate(s) also provide surface which baskets, radial seals, e.g., flexible seal 102, and grating are mounted to. A leading plane of diaphragm as it rotates is also defined as diaphragm reference plane 117 (REF. PLANE 1), e.g., 90 degree mount reference plane 1, as it relates to flexible seal; e.g., see FIG. 3.

As used herein, the term “sector-plate” refers to, but is not limited to, a large flat surface that flexible seal contacts and forms sealed barrier between various ducts, e.g., air intake and exhaust; see FIG. 3.

As used herein, “flexible seal(s)” refers to, but is not limited to, flexible seal 102 that operates in a beam flexing mode;

As used herein, “single point at contact surface” refers to, but is not limited to, contact edge extents, e.g., leading edge or trailing edge, of flexible seal 102 which is used to describe the path that an edge makes when displaced by the sector-plate;

As used herein, “path of displacement” refers to, but is not limited to, when flexible seal is displaced by a sector-plate and the single point at contact surface forms an arc-shaped path referred to as “path of displacement” along major axis 108 and minor axis 110;

As used herein, “major and minor axis of displacement” refers to, but is not limited to, displacement of flexible seal by sector plate, where displacement is measured on “X” and “Y” axes. “Y” axis is on diaphragm reference plane 1 of the diaphragm and parallel to it. “X” axis is perpendicular to “Y” axis. “Y” axis correlates to distance that flexible seal contact surface interferes with sector-plate contact surface affecting a change in the elevation of seal resulting in displacement parallel to reference plane 1. “X” axis correlates with distance that contact surface moves in plane perpendicular to surface of diaphragm reference plane 1. Major axis refers to larger of the two displacements. The axis containing the larger of the two displacements is either parallel or perpendicular to the diaphragm reference plane 1. When displaced by sector-plate, prior art radial seal (contact seal configurations) operate with a major axis of displacement 109 perpendicular to the diaphragm reference plane 1 117, and a minor axis of displacement 111 that is parallel to the diaphragm reference plane 1 117. The key feature of flexible seal 102 in the present disclosure is that major axis 108 of displacement is parallel to diaphragm reference plane 1 117;

As used herein, “plane of disposition” refers to, but is not limited to, a plane of disposition belonging to flexible seal related to the major axis 108, or likewise major axis 109 of displacement and is either perpendicular to, or parallel with, the surface of the diaphragm reference plane 1. This is an identifier as to seal type, prior art seal element has major axis 109 perpendicular to diaphragm reference plane 1 117, and flexible seal 102 has major axis parallel to diaphragm reference plane 1 117;

As used herein, “contact surface” or “radial seal body contact surface” refers to, but is not limited to, extents (tips) of a leading or trailing edge of flexible seal 102 and or wear strip 141, 142 that contacts the sector-plate;

As used herein, “sector plate contact surface” refers to, but is not limited to, surface of sector plate face that makes contact with a tip or edge of flexible element 102 to form a seal;

As used herein, “beam position 131” refers to, but is not limited to, in drawings, e.g., FIGS. 5 and 6, and in the text to position of seal body fixably on rail such that a single point on the radial seal body contact surface, when displaced by the sector plate, yields an arc shaped path that possesses a major axis plane of displacement that is parallel to the “Y” axis which is the diaphragm reference plane 1 117;

As used herein, “universal format” refers to, but is not limited to, the present disclosure radial seal system which readily adapts to Jungstrom air preheaters, Howden air preheaters, and/or other like international manufacturers of air preheaters as well as axial seal applications on the selfsame air preheaters;

As used herein, “installation” refers to, but is not limited to, the present disclosure reduction in installation time as a function of the configuration of the seal system; and

As used herein, “turndown” refers to, but is not limited to, the deformation that rotor undergoes when it reaches operating temperature due to thermal expansion. This attribute is one of many driving process for producing a flexible seal.

Brief Description of the Drawings

FIG. 1 is an illustration of prior art non-contact radial seal including seal element;

FIG. 2 is an illustration of prior art contact radial seal including seal element;

FIG. 3 is an illustration of prior art duct system illustrating diaphragm with radial seals removed to illustrate radial seal attachment area;

FIG. 4 is an illustration of block diagram of contact radial seal including flexible seal of the present disclosure;

FIG. 5 is an illustration of mechanical implementation of contact radial seal using flexible seal, shield/stop, support/stop, and leaf spring of FIG. 4 for the present disclosure;

FIG. 6 is an illustration of mechanical implementation of contact radial seal using flexible seal, support/stop, and abrasive shield of FIG. 4 for the present disclosure;
FIG. 7 is a side exploded view of flexible seal of FIG. 4, 5, or 6 in accordance with the present disclosure;

FIG. 8 is a front perspective view of installed contact radial seal of FIGS. 4-6 on diaphragm reference plane 1 to seal a segment of prior art air duct system of FIG. 3 in accordance with the present disclosure; and

FIG. 9 is a side view of contact radial seal of FIGS. 4-8 of the present disclosure installed between an upper and lower sector-plate of the present disclosure.

OVERVIEW

In one salient aspect, the present disclosure includes apparatus and method of containing or isolating, inter alia, such as gases, solids, and liquids (e.g., fluids) that are byproducts of one or more reaction processes, including commercial power and energy generation and distribution. An apparatus is disclosed that seals sector-plate at diaphragm for an air duct. A flexible seal includes a radial seal body. The radial seal body which contains a major axis of displacement, e.g., a major axis on the "Y" axis of displacement, operatively coupled for movement parallel with the diaphragm and mounted in a defined position along the diaphragm. Mounting hardware includes a rail to maintain a defined beam position of the radial seal body relative to the diaphragm.

Broadly, the present disclosure provides a system and method for separating or containing emissions by disposing flexible seal having a contact surface to at least partially, functionally control a rate of emission or flow of gases. The system produced according to the present disclosure may find beneficial use for reducing or controlling emissions or condition air flow for one or more processes including, but not limited to, energy production, paper plant power generation, aluminum plant power systems, refinery systems, or the like.

The flexible seal may be used in industrial or commercial settings for maintaining proper flow over heat exchanging elements within the rotor where a level of flow or emissions is non-constant. For instance, where a level of emissions changes as a function of time, temperature, pressure, or the like, there is a need for controlling air flow or particle distribution.

Although the following discussion may use air ducts as an exemplary demonstration, it is to be understood that this discussion is not limiting and that the present disclosure may be used in other suitable applications.

EXEMPLARY EMBODIMENTS OF THE PRESENT DISCLOSURE

Referring now to FIGS. 1-9, exemplary embodiments of the contact rotary seal of the present disclosure are described in detail. It will be appreciated that while described primarily in the context of rotary regenerative air preheater air duct system, at least portions of the apparatus and methods described herein may be used in other applications, such as for example and without limitation, as axial seals on the self same unit, or control systems including components such as processes to control emissions or condition air flow.

Moreover, it will be recognized that the present disclosure may find utility beyond purely emissions and air flow concerns. For example, the contact rotary seal system and apparatus described subsequently herein may conceivably be utilized to improve other applications; e.g., increasing functionality, to improve energy efficiency and increase accuracy of measured or removed quantities. Other functions might include maintaining system parameters, during energy or power distribution or manufacturing, and so forth. Myriad of other functions will be recognized by those of ordinary skill in the art given the present disclosure.

As illustrated in FIGS. 5 and 6, flexible seal 102 includes major axis of displacement, e.g., major axis "Y" 108 of displacement, and minor axis of displacement, e.g., minor axis "X" 110 of displacement, at contact surface, e.g., radial seal body contact surface, of radial seal body 105 mounted on rail 115. Radial seal body 105 includes a beam position 131 relative to diaphragm reference plane 1. In one example, flexible seal 102 mounts, e.g., clamped, at a 90-degree mount reference plane to mounting hardware including rail 115 to maintain a beam position of radial seal body 105 relative to diaphragm. In one variant, diaphragm includes a radial plate that provides a surface to which radial seal body 105 coupled to rail 115 seals. When mounted on rail 115, flexible seal 102 acts as a beam, e.g., control beam, operatively coupled, e.g., swings or moves, for instance, between a lower end support/stop 121 and shield/stop 119, which is the seal flexing or beam flexing mode. For example, radial seal body 105 operates with an arc-shaped path along a major axis of displacement parallel to a mounting surface, e.g., 90 degree mount reference plane 1 of the mounting hardware, e.g., rail 115. As such, the major axis of displacement, e.g., major axis "Y" 108 of displacement, operatively coupled for motion relative to the diaphragm includes a parallel displacement of a radial seal contact surface as referenced to the diaphragm. In contrast as illustrated in prior art FIG. 2, seal element 1 mounted fixally parallel to diaphragm reference plane 1, there is a reduction in seal flexibility and travel, which is the seal compression or beam compression mode.

Referring to FIGS. 5 and 6, flexible seal 102 have a delta difference between flexible seal open and close positions that provides improved travel distance along a major axis of displacement when operatively coupled with the diaphragm reference plane 1. As such, when diaphragm rotates, flexible seal 102 moves free end of beam, e.g., radial seal body 105 of flexible seal 102, downward so that wear strip 141, 142 that contacts sector-plate with a consistent and minimal sealing spring force. In one illustrative example, plane of disposition travels over one inch along major axis of displacement and parallel to diaphragm reference plane 1. In one variant, wear strip 141 is installed on open end of flexible seal 102 prolonging a life of flexible seal 102 by protecting, and providing added material to radial seal contact surface to add wear life for edge of flexible seal 102 while end of flexible seal either is contacting or not contacting sector-plate. In one variant, wear strip, e.g., wear strip 142, may be fastened to trailing edge 124 of flexible seal 102 shedding spring force of leaf spring 125, and flexible seal 102 to the seal support/stop 121. In another variant, wear strip 141 may be mounted to either leading 122 or trailing edge 124 of flexible seal 102. Leaf spring 125 and flexible seal 102 provides predetermined spring force that sheds to outer shield and stop, e.g., shield/stop 119. In one example, support/stop 121 prevents motion of radial seal body 105 further than a stop displacement along a major axis of displacement; the major axis includes a further parallel displacement as referenced to the diaphragm. Furthermore, leaf spring 125 provides a constant spring force to preload and maintain a positive contact of radial seal contact surface during changes in elevation of flexible seal 102.

Referring to FIGS. 6 and 7, wear strip 142 sheds a predetermined spring force of leaf spring 125 and flexible seal
force calculations, e.g., flexibility, elasticity, pressure, resistance, contact strength. Flexible seal 102 has dimensionality of flexible seal tailoring to achieve desired force or resistance because flexible seal 102 acts both as a beam and fulcrum with rail adapter securing one end. As such, dimensionality of its seal body can be used to derive or compute torque and force.

[0051] Referring to FIG. 6, shield and/or stop, e.g., shield/stop 119, is replaced with abrasive shield 135 to withstand harsh environmental conditions. In one example, contact rotary seal of FIG. 6 is built to withstand harsh particulate erosive elements by use of a hardened wire mesh, which can either protect a shield or the sealing element 102 directly. Now turning to FIG. 9, when radial seal body contact surface is displaced by sector-plate, flexible seal 102 on rail 115 with radial seal body 105 acts as a beam in a substantially perpendicular like position to diaphragm reference plane 117, beam calculations remain stable across the entire range of travel. In one example, beam calculations remain stable over an approximate one inch of displacement. Conversely, prior art sealing system upon being displaced by sector-plate, beam is in a parallel position to diaphragm reference plane 117. Using Prior art contact radial seals, e.g., those shown in FIGS. 1 and 2, small changes, e.g., such as due to sector-plate irregularities, yield large abrupt changes in a spring force of sealing element applied; thus, these prior art systems generate an undefinable resulting seal spring force, which may cause excessive wear on a seal element.

[0052] Now turning to FIG. 2, rotary air pre-heaters contain segments made of radial partitions. While rotor rotates, diaphragm has flexible seal 1 while rotor turns from one segment to another while flexible seal 1 extends contacts sector-plate via radial seal, and radial seals being mounted to plane of diaphragm parallel to it (reference plane 1), extending until contacting the sector-plate at a preset distance based on a rotor turn-down. For the radial seals to which the path of displacement is described by a single point at the contact surface of radial seal, when displaced by sector-plate, results in the major axis 109 of displacement, e.g., see prior art FIG. 2, in a plane perpendicular to surface of diaphragm reference plane 117. As such, the prior art selfsame seal provides, e.g., possesses, a plane of disposition perpendicular to the surface of the diaphragm reference plane 117.

[0053] In the present disclosure, the path of displacement described by a single point at contact surface of flexible seal 102, that when displaced by sector-plate, results in major axis 108 of displacement in a plane parallel to diaphragm reference plane 117. A flexible seal 102 is mounted between a shield/stop 119, leaf spring 125, and a support stop 121 and then clamped to rail 115 in a beam position 131, relative to diaphragm referencing plane 1 with flexible seal 102 and leaf-spring 125 preloaded against the shield/stop 119, see FIG. 5, ready to seal with a relatively constant sealing force against the sector-plate, e.g., FIG. 5. In one variant, FIGS. 5 and 6 illustrate two different versions with the same planes of disposition which are both parallel with the diaphragm reference plane 117, which is the leading surface of the diaphragm as it rotates. As illustrated in FIG. 5, major axis of displacement is in a plane parallel to surface of diaphragm.

[0054] In accordance with the various embodiments above, a method is disclosed to provide a rotary seal of air compart-
ments during air input and exhaust within an air duct. The method includes disposing a radial seal body 105 on a rail
115, mounting the radial seal body 105 aligned along one end with a diaphragm, and displacing an arc-shaped path of a radial seal contact surface, e.g., single point at contact surface, along a plane parallel to the diaphragm. The method may also include providing a support stop 121 to restrict movement along an arc-shaped path of displacement of the radial seal body contact surface. The method may also include comprising providing a shield stop 119 to restrict movement of the arc-shaped path in an opposing direction of the arc-shaped path during seal flexing and releasing. The method may also include disposing of rotor, shell including segmented compartments, that are each capable of being sealed in a rotary fashion. In yet another variant, the method may include providing a single point of reference, e.g., single point at radial seal contact surface or contact surface, of the radial seal body 105. The method may further include forming one or more sealed compartments along or at extents of the radial seal body 105, wherein the rail 115 acts as a fulcrum and the radial seal body 105 acts as a beam to provide a force needed to maintain a constant sealing spring force along an entire range of travel of the extents of the radial seal body 105.

Furthermore, as illustrated in the above text and figures, a system is disclosed to provide a rotary seal, e.g., a series of flexible seal elements attached at diaphragm, for air compartments of an air duct. The system includes a radial seal body 105 disposed on a rail 115 disposed to form an angled beam mount reference plane, and a diaphragm operatively disposed to create an arc-shaped path with the contact surface, e.g., radial seal body contact surface or single point at contact surface, of the radial seal body 105 to which the major axis of the arc-shaped path lies along a plane parallel to the diaphragm. In one variant, the system includes a support stop 121 operatively secured to restrict movement along the arc-shaped path limiting displacement of the seal 102. In yet another variant, a shield stop 119 is operatively coupled to restrict movement along the arc-shaped path in an opposing direction of the rotor during seal flexing and at seal release. In still another variant, a rotor is disposed including segmented compartments, that are each capable of being sealed in a rotary fashion using a single point of reference at a contact location edges or extents of the radial seal body 105. In addition, system may include one or more sealed compartments formed along extents of the radial seal body 105, wherein the rail 115 acts fixably providing a fulcrum and the rail seal body 105 acts as a beam to provide the force needed to maintain a constant sealing spring force along an entire range of travel of the extents of the radial seal body 105.

In summary, the seal platform of present disclosure offers advantages over conventional seal configurations that it is modular by design allowing for custom applications without changing production tools. In one example, a major axis of displacement is parallel to diaphragm surface. The present disclosure provides full seal contact over up to one inch of travel as opposed the prior art of 0.30 inches of travel. Furthermore, the improved seal is mounted to an adapter rail that can be modified with holes that allow for seal elements to be clipped in place for a quick install and release. Advantageously, mounting flexible seals to rail 115 allows the seals to be installed without using a seal setting bar, which greatly reduces installation time. Seals can be custom designed as rail accommodates numerous designs within cost effective framework. Furthermore, other travel limiting stops can be implemented to extend seal performance.

We claim:
1. An apparatus to seal a sector-plate at a diaphragm for an air duct, the apparatus comprising:
a flexible seal including a radial seal body, the radial seal body having a major axis of displacement operatively coupled with a mounting hardware for motion relative to the diaphragm; the mounting hardware including a rail to maintain a beam position of the radial seal body relative to the diaphragm.
2. The apparatus of claim 1, wherein the diaphragm includes a radial plate that provides a surface to which the radial seal body coupled to the rail seals.
3. The apparatus of claim 1, wherein the major axis operatively coupled for motion relative to the diaphragm includes a parallel displacement of a radial seal contact surface as referenced to the diaphragm.
4. The apparatus of claim 3, wherein the radial seal body operates with an arc-shaped path along the major axis parallel to a mounting surface of the mounting hardware.
5. The apparatus of claim 1, comprising a support stop that maintains a relative position of the radial seal body along the major axis of displacement during a seal flexing and a seal release.
6. The apparatus of claim 5, wherein the support stop prevents motion of the radial seal body farther than a stop displacement along a major axis of displacement, the major axis includes a further parallel displacement as referenced to the diaphragm.
7. The apparatus of claim 1, comprising a leaf spring that provides a constant spring force to preload and maintain positive contact of a radial seal contact surface during changes in elevation.
8. The apparatus of claim 5, comprising a wear strip fastened to at least one of a leading or trailing edge at extents of the flexible seal to dissipate a predetermined spring force to the support stop.
9. The apparatus of claim 1, comprising a shield stop that maintains a seal stop during flexing or wear of the radial seal body.
10. The apparatus of claim 1, comprising a support stop that maintains a pushing force against the radial seal body to maintain axial alignment with the radial seal body to the diaphragm.
11. The apparatus of claim 7, wherein the mounting hardware includes a rail that forms part of an angled mount with a diaphragm reference plane.
12. A method to provide a rotary seal of air compartments during air input and exhaust within an air duct, the method comprising:
disposing a radial seal body on a rail;
mounting the radial seal body aligned along one end with a diaphragm; and
placing an arc-shaped path of a radial seal contact surface along a plane parallel to the diaphragm.
13. The methods of claim 12, comprising providing a support stop to restrict movement along an arc-shaped path of displacement of the radial seal contact surface.
14. The method of claim 12, comprising providing a shield stop to restrict movement of the arc-shaped path in an opposing direction of the arc-shaped path during seal flexing and releasing.
15. The method of claim 12, comprising disposing a rotor shell including segmented compartments that are each capable of being sealed in a rotary fashion.

16. The method of claim 13, comprising providing a single point of reference at a seal contact surface of the radial seal body.

17. The method of claim 12, comprising forming one or more sealed compartments along extents of the radial seal body, wherein a rail acts as a fulcrum and a radial seal body acts as a beam to provide a force needed to maintain a constant sealing spring force along an entire range of travel of the extents of the radial seal body.

18. A system to provide a rotary seal for air compartments of an air duct, the system comprising:
   a radial seal body disposed on a rail disposed to form an angled beam mount reference plane; and
   a diaphragm operatively disposed to create an arc-shaped path with a radial seal contact surface of the radial seal body to which a major axis of the arc-shaped path lies along a plane parallel to the diaphragm.

19. The system of claim 18, comprising a support stop operatively secured to restrict movement along the arc-shaped path limiting displacement of the radial seal body.

20. The system of claim 19, comprising a shield stop operatively coupled to restrict movement along the arc-shaped path in an opposing direction of a rotor during rotary seal flexing and flexible seal release.

21. The system of claim 20, comprising a rotor shell disposed including segmented compartments that are each capable of being sealed in a rotary fashion using a single point of reference at a contact location edges of the radial seal body.

22. The system of claim 18, comprising of one or more sealed compartments formed along extents of the radial seal body, and a rail acts fixably providing a fulcrum and the radial seal body acts as a beam to provide a force needed to maintain a constant sealing spring force along an entire range of travel of the extents of the radial seal body.