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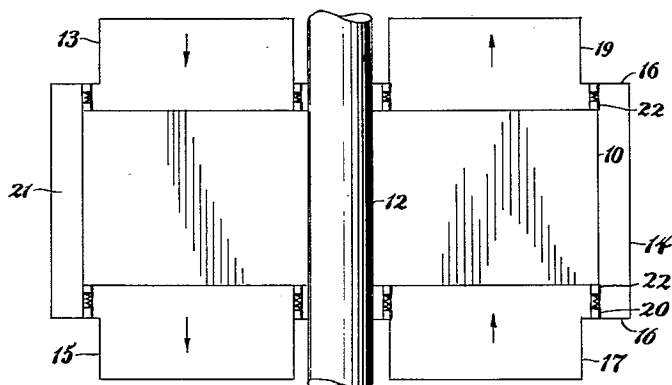


Fig. 1

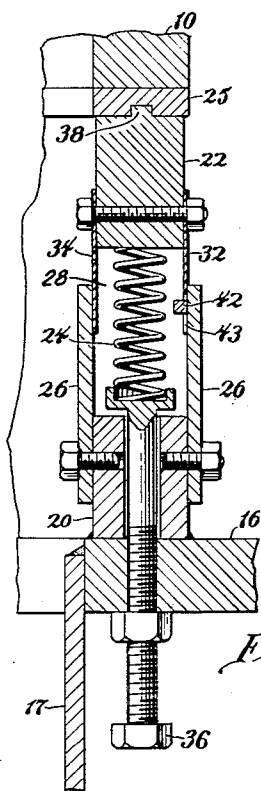


Fig. 2

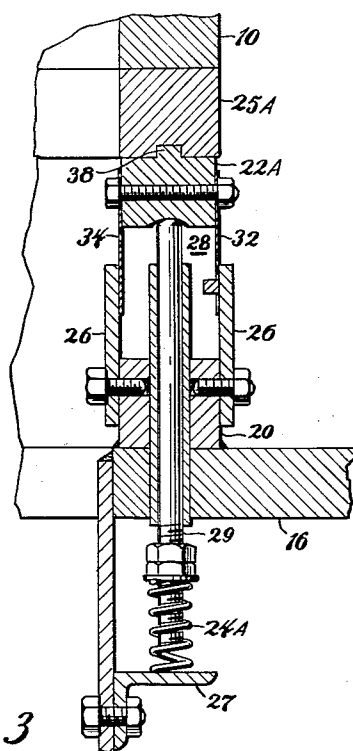


Fig. 3

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1

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The present invention relates to rotary regenerative heat exchange apparatus or the like and particularly to improved circumferential seals adapted for use between the rotor and its enclosing housing.

In a rotary regenerative heat exchanger a cylindrical rotor has compartments that carry metallic heat transfer plates alternately between a low pressure heating fluid and a high pressure fluid to be heated. The rotor is surrounded by a housing having end or sector plates formed with openings that provide for the flow of the heating fluid and the fluid to be heated. In order to preclude the flow of fluids through the clearance space between the rotor and housing in a way to bypass the heat transfer material carried by the rotor it is customary to provide the rotor with circumferential seals that bear against the sector plates or other stationary parts of the housing.

Since the end plates and other stationary parts of the housing are subjected to constant extremes of temperature they tend to distort more than the enclosed rotor that is constantly turning between the heating fluid and the fluid to be heated whereby the rotor is never permitted to attain the extreme temperatures of either fluid and it is therefore not subject to the same extremes of thermal deformation as is the housing.

In such view the present invention contemplates an improved circumferential sealing means of novel form that seals against a portion of a rotary heat exchanger which is subject to a minimum of distortion.

Moreover, the present invention contemplates a sealing means that utilizes available fluid pressure to maintain abutting parts thereof in a fluid-tight relationship. These and other improvements will be better understood upon consideration of the following detailed description when read in conjunction with the drawings in which:

FIGURE 1 is a sectional elevation in digrammatic form of a rotary regenerative heat exchanger embodying the present invention.

FIGURE 2 is a fragmentary sectional elevation showing the detailed construction of an improved sealing device.

FIGURE 3 is a fragmentary sectional elevation showing the detailed construction of a slightly varied form of sealing device.

In the drawings the numeral 10 designates the cylindrical shell of a rotor that is divided into sector shaped compartments by radial partitions connecting it to a rotor post 12 which is driven by a motor and reduction gear not illustrated. The rotor compartments contain regenerative heat exchange material usually in the form of heat absorbent plates that are spaced apart to permit flow there through of the heating fluid and the fluid to be heated.

The heating fluid enters the heat exchanger through a duct 13 connected to a boiler or other source of heat and is discharged, after passing over the heat absorbent material, through an outlet duct 15 to which an induced draft fan (not shown) is usually attached. As the rotor turns slowly about its axis, the heated heat exchange material is moved into the stream of air or other fluid to be heated that is admitted through a duct 17. After passing over the hot heat absorbent material and absorbing heat therefrom the stream of air is conveyed to a boiler furnace or other place of use through a duct 19.

2

A housing 14 enclosing the rotor 10 is provided at either end with end or sector plates 16 that are apertured to permit the various fluids to flow through the rotor. In order that the fluid streams will not bypass the rotor and flow through the annular clearance space 21 between the rotor 10 and housing 14 it is customary to provide circumferential seals that bridge the space therebetween.

In accordance with this invention therefore, the circumferential seals comprise an annular base member 20 that is mounted on the end or sector plate 16 in axial alignment with the end edge of the cylindrical shell of rotor 10. An annular sealing means 22 is positioned in the space between the end edge of the rotor shell 10 and the annular base member and is adapted to be moved axially into engagement with the edge of the rotor by compression springs 24. To provide for a fluid tight expansion wall between the annular base member 20 and the annular sealing means 22, a pair of concentric backing rings 26 are first secured to opposite sides of the base member to provide therewith an annular U-shaped channel. Then, to enclose completely the annular space between the sealing member 22 and the base member 20, a pair of concentric walls 32 are secured to opposite sides of the sealing member 22 and adapted to extend axially into lateral abutment with the inner walls of rings 26. The backing rings 26 are constructed of material having sufficient body and strength to be substantially inflexible while the cooperating rings 32 are comparably thin and flexible in order that they may be laterally flexed into abutment with the adjacent surface of the backing rings 26 by a slight excess of pressure within the enclosure. Such an excess of pressure within the annular enclosure 28 is obtained by admitting high pressure fluid through an opening 34 in that portion of the inner wall of the enclosure lying adjacent and in communication with the duct 17 for the high pressure fluid.

The axial force of the biasing springs 24 (FIGURE 2) is varied by the adjustment of screws 36 that are mounted through the sector plate 16 and the annular base member 20. These screws may be readily adjusted at any time even though the apparatus is in operation.

A locking lug 38 intermediate the annular sealing member 22 and the wear surface 25 prevents relative rotational movement therebetween. Similarly, a series of driving pins 42 secured circumferentially around the backing plate 26 in alignment with slots 43 in the adjacent flexible wall 32 preclude relative rotational movement therebetween while permitting a limited degree of axial movement to compensate for axial distortion of the rotor or housing structure and abrasion of the sealing surface.

To compensate for excessive wear, the sealing member 22 is provided with a wear surface 25 having predetermined characteristics that enhance its wear resistance and sealing ability. When conditions warrant, the thickness of the surface may be greatly increased as at 25A of FIGURE 3 to permit long periods of service without the necessity of suspending operation for the renewal of the wear surface. A further modification illustrated in FIGURE 3 relates to mounting the biasing spring 24A for the annular sealing member outside the housing on a bracket 27 whereby the force of an externally mounted spring 24A may be directed against the axially disposed rod 29 and the edge of the annular sealing member 22A.

While this invention has been described with reference to the embodiments illustrated in the drawing it is evident that numerous changes may be made without departing from the spirit of the invention, and it is intended that all matter contained in the accompanying drawings shall be interpreted as illustrative only and not in a limiting sense.

What I claim is:

1. Regenerative heat exchange apparatus or the like including a rotor having a cylindrical rotor shell; a housing surrounding the rotor provided at opposite ends with sector plates having spaced apertures that direct high and low pressure fluids through spaced portions of the rotor; circumferential sealing means at opposite ends of the rotor; adapted to preclude fluid flow between the rotor and rotor housing, said sealing means comprising an annular base member aligned with the rotor shell and fixed to the sector plate; an annular sealing shoe intermediate the annular base member and rotor shell; means adapted to bias the annular sealing shoe into contacting relationship with the end edge of the rotor shell, concentric backing rings fixed to opposite sides of the annular base to provide an annular channel therebetween; concentric flexible walls secured to opposite sides of the sealing shoe adapted to laterally abut the inner walls of the annular channel to provide an annular enclosure, said enclosure having an opening in one wall thereof adapted to admit high pressure fluid to the enclosure to actuate the flexible walls into continuous contact with the backing members.

2. Regenerative heat exchange apparatus or the like including a rotor having a cylindrical rotor shell; a housing surrounding the rotor provided at opposite ends with sector plates having spaced apertures to direct high and low pressure fluids through spaced portions of the rotor; circumferential sealing means at opposite ends of the rotor adapted to preclude fluid flow between the rotor and rotor housing, said sealing means comprising an annular base aligned with the rotor shell and secured to the sector plate; an annular sealing member intermediate the annular base and the rotor shell; concentric backing rings fixed to opposite sides of the annular base to provide an annular channel therebetween; concentric walls fixed to opposite sides of said annular sealing member adapted to extend axially thereof into lateral abutment with the inner sides of said channel to form therewith an annular enclosure; spring means adapted to bias the annular sealing member into axial abutment with the end edge of the rotor shell; and means in an inner wall of said enclosure admitting high pressure fluid thereto to effect lateral contact between the concentric walls and backing rings.

3. Regenerative heat exchange apparatus or the like including a rotor having a cylindrical rotor shell; a housing surrounding the rotor provided at opposite ends with sector plates having spaced apertures that direct high and low pressure fluids through spaced portions of the rotor; circumferential sealing means at opposite ends of the rotor adapted to preclude fluid flow between the rotor and rotor housing, said sealing means comprising an annular base aligned with the rotor shell and secured to the sector plate; an annular sealing member intermediate the annular base and the rotor shell; concentric backing rings fixed to opposite sides of the annular base to form therewith an annular channel; concentric walls

fixed to opposite sides of the annular sealing member adapted to extend axially thereof into lateral abutment with the inner walls of the annular channel to form therewith an annular enclosure, the walls of said annular enclosure having an opening therethrough permitting the ingress of high pressure fluid to effect a lateral contact the concentric walls and the backing rings; spring means arranged to bias the annular sealing member into axial abutment with the end edge of the rotor shell and driving means extending between laterally abutting walls adapted to permit relative axial movement therebetween while precluding relative rotational movement about the rotor axis.

4. Regenerative heat exchange apparatus or the like including a rotor having a cylindrical rotor shell; a housing surrounding the rotor provided at opposite ends with spaced apertures that direct high and low pressure fluids through spaced portions of the rotor; circumferential sealing means at opposite ends of the rotor adapted to preclude fluid flow between the rotor and rotor housing, said sealing means comprising an annular base aligned with the rotor shell and secured to the sector plate; an annular sealing shoe intermediate the annular base and the end edge of the rotor shell; concentric backing rings fixed to opposite sides of the annular base to form therewith an annular channel; concentric walls fixed to opposite sides of said annular sealing shoe and adapted to extend axially thereof into lateral abutment with the annular channel to form a completely enclosed annular enclosure, one of said walls having an opening to permit the flow of high pressure into the enclosure; driving means extending between laterally abutting walls adapted to permit relative axial movement therebetween while precluding relative rotational movement about the rotor axis; and spring means arranged to bias the annular sealing member into axial abutment with the end edge of said rotor shell.

5. Regenerative heat exchange apparatus as defined in claim 4 wherein the spring means biasing the sealing shoe into contact with the end edge of the rotor is positioned within the confines of said annular enclosure.

6. Regenerative heat exchange apparatus as defined in claim 4 wherein the axial force of the spring means is transmitted to the sealing shoe by a driving rod slidably mounted in the annular base.

7. Regenerative heat exchange apparatus as defined in claim 4 wherein the backing rings are laterally rigid and the adjacent concentric walls are relatively flexible to permit their lateral conformity.

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