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ROTARY REGENERATOR SEAL POSITIONING MEANS

Filed March 21, 1962

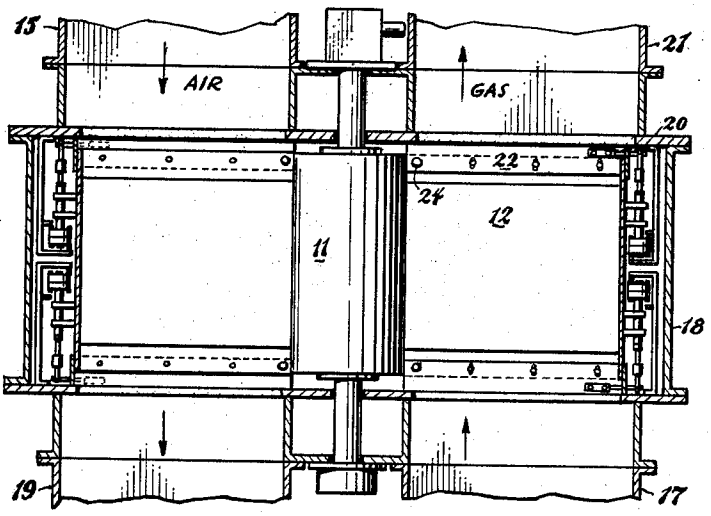

Fig. 1

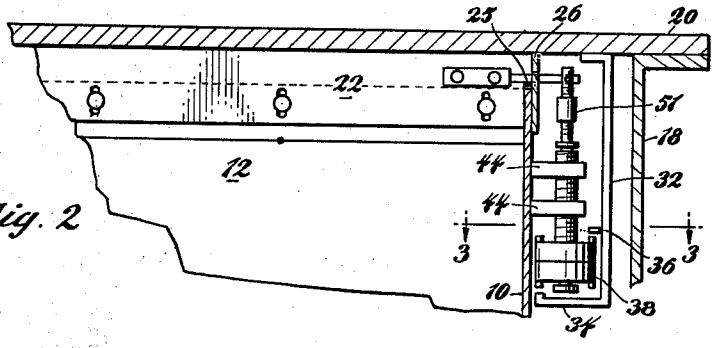

Fig. 2

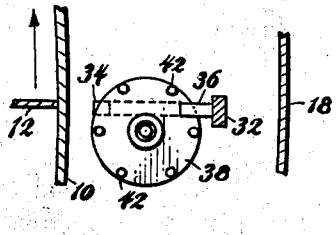

Fig. 3

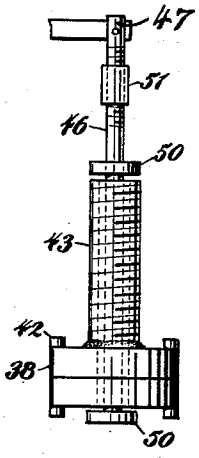

Fig. 4

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ROTARY REGENERATOR SEAL POSITIONING MEANS

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2 Claims. (Cl. 165—9)

This invention relates to rotary regenerative air preheaters or the like and especially to an improved sealing arrangement that continuously maintains a preferred sealing relationship between relatively rotatable parts thereof regardless of relative distortion between its rotatable parts.

In rotary regenerative heat exchange apparatus a cylindrical rotor having compartments carrying heat absorbent material is mounted to rotate between spaced ducts through which flow a heating fluid and a fluid to be heated. The rotor is surrounded by a housing having end plates formed with openings that attach to the spaced ducts. In order to preclude the flow of heating fluid or the fluid to be heated through the clearance space between the rotor and rotor housing without first passing over the heat absorbent material carried by the rotor, it is customary to provide the rotor with circumferential and radial sealing means that close the space between the rotor and its surrounding housing.

Heat exchange apparatus of this type is frequently subjected to continuously changing extremes of structural and thermal stress that cause the rotor and surrounding housing to shift their space relationship and thus vary the clearance space therebetween. Thus a sealing relationship that is satisfactory at one time for one set of conditions may vary and be entirely unsatisfactory when there is an increase or decrease in temperature of the gas or air and the related structure of the surrounding heat exchanger.

This invention is therefore directed to a sealing arrangement that includes a novel seal positioning means that continuously acts to maintain the sealing means in a predetermined position intermediate the rotor and its surrounding housing regardless of deformation conditions within the heat exchanger.

The invention will be best understood upon consideration of the following detailed description of an illustrative embodiment thereof when read in conjunction with the following drawings in which:

FIGURE 1 is a sectional elevation of a rotary regenerative heat exchanger having seal positioning means according to the invention.

FIGURE 2 is an enlarged view showing the details of the sealing arrangement.

FIGURE 3 is an enlarged view of a portion of the apparatus seen from line 3—3 of FIGURE 2.

FIGURE 4 is an enlarged view of the combined sensing and actuating means.

In the drawing a rotor having a cylindrical shell **10** is joined to a rotor post **11** by radial partitions **12** to form a series of sectorial compartments that are adapted to carry a mass of heat absorbent material through which a heating fluid and a fluid to be heated are alternately directed. A housing **18** surrounds the rotor and is provided at opposite ends with end plates **20** having imperforate sections between spaced apertures that are connected to inlet ducts **15** and **17**, and outlet ducts **19** and **21** for the heating fluid and the fluid to be heated.

A sealing means that includes a radial arm **22** is pivoted to the end of each radial partition **12** at a point **24** adjacent the rotor post in order that the outboard end of the arm **22** may be moved axially to a predetermined clearance relationship between the rotor and its surrounding

housing. The outboard end of each radial arm **22** penetrates a slot **25** in the rotor shell and is joined on its end edge to an annular circumferential seal **26** that surrounds the end of the rotor. The axially remote edge of the circumferential seal is aligned with the adjacent edge of the radial arm **22** while the annular inner surface of the circumferential seal is adapted to slidably abut the radial outer surface of the rotor shell **10**. The outboard end of radial arm **22** is formed to cooperate with the notch **25** in the edge of the rotor shell and form a slip joint therebetween that is covered on its annular periphery by the circumferential seal **26** to preclude fluid flow therethrough.

The seal positioning means comprises essentially a series of support members **32** that are arcuately spaced about the end edge of the end plates and arranged to extend axially into the space between the rotor and rotor housing. Each support member carries a pair of axially spaced limit indicators **34** and **36**, the end indicator **34** extending radially inward into a closely spaced relation with the rotor shell while the axially spaced indicator **36** extends radially inward a lesser distance, to provide a space therebetween for a rotatable sensing means **38**.

The sensing means comprises a disk **38** having a series of arcuately spaced pins **42** that extend axially from the periphery of its spaced plane surfaces. A threaded tube **43** rotatably carried by support means **44** which depend from the rotor shell outboard from the ends of each radial partition is axially connected to the center of the sensing means. The support means **44** are provided with internally threaded apertures adapted to receive the threaded tube **43** in order that rotation of the member **38** and the integral tube **43** will effect an axial movement of the tube and its connected sensing means. A rod **46** directed loosely through the tube **43** is provided closely adjacent the ends of the latter with thrust members **50** that provide spaced surfaces through which axial movement of the tube **43** may be transmitted to the rod **46** when the tube **43** is rotated about its vertical axis. The end of the rod **46** adjacent the end plate is pivotally connected at **47** to the sealing assembly **22–26**. The rod **46** preferably includes a turnbuckle arrangement **51** by which the effective length of the rod may be readily varied to change the position of the sealing assembly connected thereto.

When the sealing assembly **22–26** is positioned in a preferred relationship between the rotor and adjacent surface of the end plate, the sensing means **38**, tube **43** and rod **46** actuated thereby lie in an inactive position with the ends of the pins **42** on both plane faces of the disk **38** passing out-of-contact with the ends of the limit indicators **34** and **36** as the rotor is rotated about its axis.

Soul a shift in the axial relationship between the rotor and adjacent housing occur, the sensing means **38** would be moved axially with respect to the limit indicators **34** and **36** and contact would occur upon rotation of the rotor. Considering rotation of the rotor in the direction illustrated in FIGURE 3, an upward shift of the rotor with respect to the rotor housing would produce a contact between the upper limit indicator **36** and the pins **42** on the upper side of disk **38**. Continued contact would produce a clockwise rotation of the disk **38** and threaded tube **43** (as viewed from above) which would screw the tube axially downward and carry with it the rod **46** and sealing assembly attached thereto. Conversely a downward movement of the rotor would open a clearance space between the sealing assembly and end plates and move the pins **42** on the lower side of disk **38** into contact with the limit indicator **34** to induce a counter-clockwise rotation of the disk and tube **43** which would then effectively move the sealing assembly back to its preferred relationship between the rotor and rotor housing.

Thus movement of the rotor toward or away from the

adjacent surface of the end plate will automatically effect a readjustment of the sealing means. It will be apparent that sealing means at the top and bottom of the rotor will be reversely acting, for as the rotor moves toward or away from its adjacent end plate at one end of the rotor, the exact opposite movement will occur at the axially spaced end of the rotor. Therefore, seal positioning apparatus of the type herein disclosed would operate in the same manner irrespective of location within the heat exchanger.

While this invention has been described with reference to the embodiment illustrated in the drawing it is evident that various changes might be made without departing from the spirit of the invention, and it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. Rotary regenerative heat exchange apparatus having a rotor shell, a central rotor post, radial partitions extending from the rotor post to the rotor shell to provide a series of sectorial compartments therebetween, a mass of heat absorbent material carried by each compartment of the rotor, a cylindrical rotor housing having apertured end plates at opposite ends thereof adapted to enclose the rotor and provide an annular space therebetween, a sealing assembly intermediate the rotor and adjacent end plate including radial sealing means pivotally attached to each radial partition, seal positioning means for moving the sealing assembly into a preferred relationship between the rotor and rotor housing comprising axially spaced limit indicators carried by the housing in the annular space between the rotor and rotor housing, bracket means secured to the rotor outboard from the radial partitions having an internally threaded aperture, tubular means having a threaded exterior surface carried by the threaded aperture of said bracket means, sensing means secured to said tubular means axially intermediate the limit indicators whereby said sensing means will be moved into contact with one of said limit indicators when the rotor is moved axially with respect to the housing, means for rotating the rotor about its axis, means responsive to rotation of the rotor for moving the sensing about its axis to thus actuate the tubular means axially within its bracket, and seal actuating means carried by said tubular means arranged to transmit axial movement of said tubular means to said sealing assembly.

2. Rotary regenerative heat exchange apparatus having a rotor including a rotor shell, a central rotor post, radial partitions extending from the rotor post to the rotor shell to provide a series of sectorial compartments therebetween, a mass of heat absorbent material carried by each compartment of the rotor, a cylindrical rotor housing enclosing the rotor in spaced relation to provide an annular space therebetween, end plates at opposite ends of said cylindrical housing having apertures that direct a heating fluid and a fluid to be heated through the rotor, a sealing assembly having a preferred position intermediate the rotor and said end plates adapted to preclude fluid flow therebteween, seal positioning means for maintaining said sealing assembly in its preferred position comprising axially spaced limit indicators carried by the rotor housing in said annular space, a rotatable disk carried by the rotor in said annular space lying intermediate the limit indicators, means for rotating said disk when it is moved axially into contact with one of said limit indicators, and means actuated by said rotating disk effecting axial movement of said sealing assembly.

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