July 19, 1960 A. L. BURCHFIELD 2,945,681

FLOATING SECTOR SEALS

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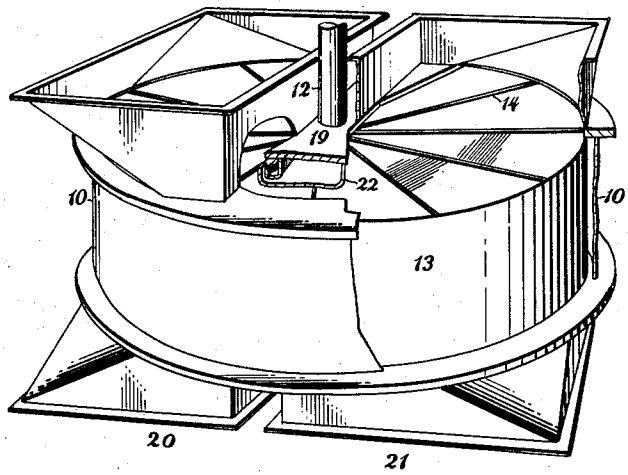


Fig. 1

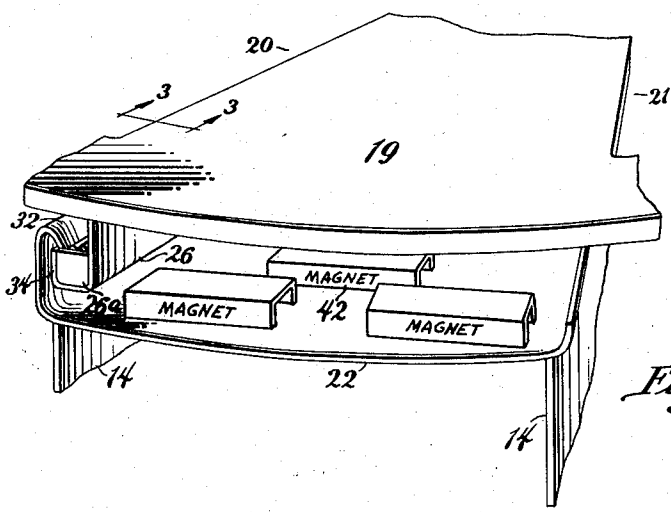


Fig. 2

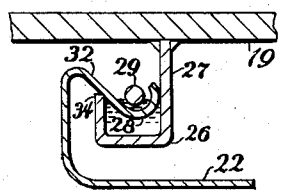


Fig. 3

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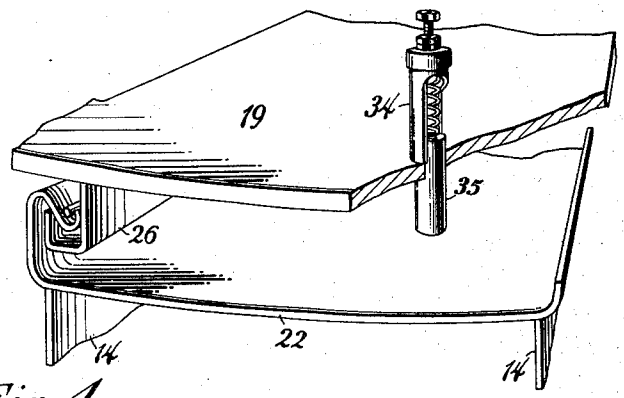


Fig. 4

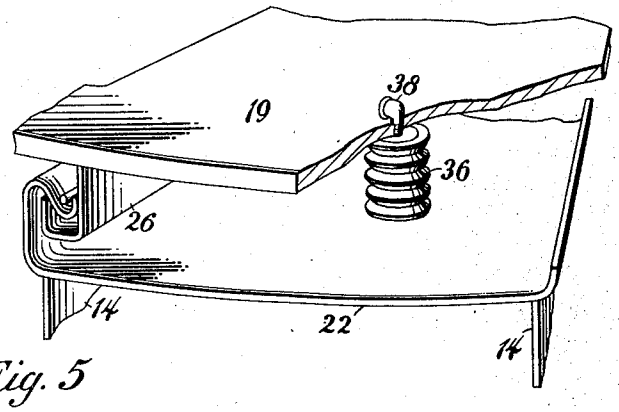


Fig. 5

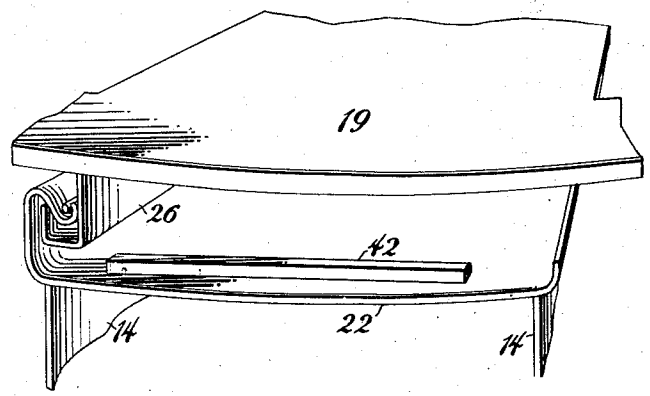


Fig. 6

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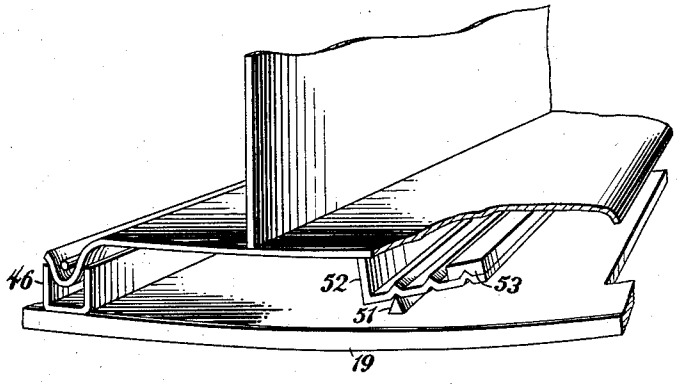


Fig. 7

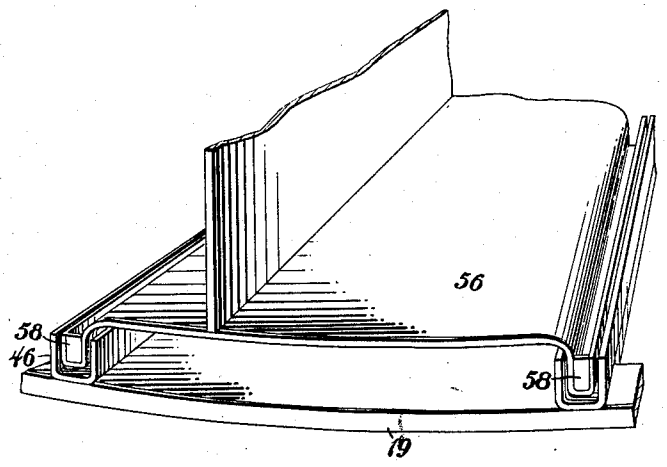


Fig. 8

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FLOATING SECTOR SEALS

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9 Claims. (Cl. 257—269)

The present invention relates to heat exchange apparatus and particularly to improved radial seals for use between a rotor and the enclosing housing of a vertical type rotary regenerative air preheater.

In a rotary regenerative air preheater or the like, a cylindrical rotor has compartments carrying heat transfer elements which as the rotor turns are first exposed to heating gases and then disposed in an air passage to impart absorbed heat to the air passing therethrough. The rotor is surrounded by a housing having end or sector plates formed with openings to permit the flow of air and gas therethrough. To pevent mingling of the two fluids radial partitions that form the rotor compartments are provided with radial seals that wipe against the imperforate portions of the end plates. In order to preclude by-passing of gas and air around the rotor through the clearance space between sides of the rotor and the housing without contacting the heat transfer material, it is customary to provide the rotor with circumferential seals that bear against a stationary part of the housing.

Usually air preheaters of the general type here referred to are subjected to a wide range of temperature variations which results in considerable thermal deformation of the preheater structure including the rotor shell and the radial partitions. Since the radial sealing members are affixed to the radial partitions it is evident that thermal distortion of these partitions imparts similar distortion to the sealing members connected thereto, and it therefore becomes an object of this invention to provide a radial sealing member mounted independent from the radial partitions and not subject to the thermal distortion thereof.

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

Figure 1 is a sectional elevation view in diagrammatic form of a rotary regenerative air preheater embodying the invention.

Figure 2 is a perspective view on an enlarged scale of the sealing assembly.

Figures 3, 4, 5 and 6 illustrate similar views of modified forms of sealing means constructed according to this invention.

Figures 7 and 8 illustrate modifications of a sealing means as used at the lower end of a rotary regenerator.

In the drawings the numeral **10** designates a cylindrical housing for the rotor of a rotary air preheater which is enclosed at both ends by end or sector plates **19** apertured at **20**, **21** (Figure 2) to provide passage for the air and gas streams therethrough. Centrally positioned within the rotor housing is a rotor post **12** supporting a rotor **13** which is divided into wedge or sector shaped compartments by partitions **14** extending radially outward from the rotor post. The rotor is turned on its axis by a motor connected thereto through suitable reduction gearing not shown. Each rotor compartment contains regenerative heat transfer material **15** in the form of spaced metallic plates which first absorb heat from the hot gases entering the preheater, and then as the rotor turns slowly about its axis, the heated plates are moved into a stream of cold air to impart heat thereto. After passing over the heated plates and absorbing heat therefrom, the heated air is directed to any predetermined point of ultimate usage. In order that the streams of gas and air do not bypass the heat transfer surface in the rotor by flowing through the space between the rotor and the adjacent end plates, novel sealing means is provided to bridge the space thereby precluding flow therebetween.

In accordance with the present invention the end plates **19** have attached to their inner imperforate surface floating wedge shaped sealing members **22** that are adapted to rub against the end edges of the radial partitions **14** as the rotor rotates about its axis. The floating sealing members are mounted to be axially movable relative to the ends of the radial partitions, and they are provided with biasing means whereby they are at all times biased into contact with the adjacent end edges of the rotating partitions **14**. To prevent fluids from flowing through the space intermediate the fixed end plate **19** and the floating sealing member **22** special pivotable or extensible connections are arranged to bridge the space in the manner illustrated in Figure 2.

In this form of the invention a channel member **26** having an elongate flange **27** fastened to the underside of fixed end plate **19** extends radially outward from the rotor post **12** to the outer periphery of the fixed end plate **19**. The floating seal is formed with a "hook" portion **28** which is adapted to be positioned in channel **26** with a shank portion **32** of hook **28** pivotable upon the edge of the flange **34** whereby the sealing member **22** is free to move axially into contact with partitions **14**.

The sealing channel **26** is closed at its ends by plates **26***a* thereby enabling it to contain a fluid to submerge the hook **28**. The particular fluid used is dependent to a large extent upon the operating temperature of the device, therefore no attempt is here made to specify any particular fluid. A stay bar **29** removably fastened to the plates **26***a* at opposite ends of the channel **26** permits easy assembly and disassembly of the sealing unit.

In order that the face of the sealing means **22** may be held in contact with the end surfaces of the rotating radial partitions special biasing means may be employed. Figure 2 illustrates a basic form of biasing means comprising one or more weights **31** on a positioning means **32**. In Figure 4 a slightly different form illustrates an adjustable spring in a housing **34** pressing against a plunger **35** acting directly against the upper surface of the floating sealing member **22**. This spring device is mounted on the imperforate portion of the end plate **19** and since the plunger projects through the latter the spring pressure may be readily adjusted during operations of the preheater.

Figure 5 illustrates another variation in which a pressure responsive device **36** fixed to the underside of sector plate **19** may be expanded against the plate **22** to place a downward force thereon. The pressure to actuate this device is applied through a port **38** connected to any predetermined source of pressure.

In Figure 6 the force biasing the floating member **22** against the end edges of partitions **14** is derived from the high intensity magnet **42** positioned on the member **22**. As the partitions **14** rotate past the underside of plate **22** the magnet is attracted to each successive partition.

Figures 7 and 8 illustrate variations in form which permit the use of these sealing devices in the space between the lower end plate and the adjacent end edges of the radial partitions. Here the channel members **46** rest

directly on the end plate **19** and the sealing means is biased upward into contact with the partitions. In Figure 7 the biasing means comprises a lever having a fixed fulcrum resting on the lower end plate and one end **52** in contact with the sealing means while the other end is adapted to receive a weight **53** adjustably mounted to be capable of varying the upward force against the sealing means. In Figure 8 the upward biasing force acting against the sealing means is applied against floats **58** formed along radially extending edges of the sealing member **56**. Here the upward force is supplied by the buoyancy of the floats **58** displacing fluid contained in channels **46**.

The use of springs, pressurized bellows or magnetic devices could readily be applied to lower sealing means of the type shown in Figures 7 and 8 without departing from the spirit of the invention, and it is intended that all matter contained in the foregoing description or shown 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 having a rotor including a cylindrical shell joined to a rotor post by radial partitions forming compartments that carry heat transfer material, a housing surrounding the rotor and provided opposite the latter with end plates formed with circumferentially spaced apertures between imperforate portions which permit the flow of heating gases and air to and through the rotor; and sectional sealing means pivotally supported along a radially extending edge thereof by the imperforate portions of the end plates adapted to preclude fluid flow between circumferentially spaced apertures.

2. Regenerative heat exchange apparatus as defined in claim 1 wherein the sealing means adjacent the upper end plate thereof is provided with variable weights disposed to bias the sealing means into contact with the end faces of adjacent radial partitions.

3. Regenerative heat exchange apparatus as defined in claim 1 wherein the sealing means is biased into contact with the end faces of the adjacent radial partitions by adjustable spring means fixed to the imperforate portion of the end plate.

4. Regenerative heat exchange apparatus as defined in claim 1 wherein the sealing means is biased into contact with the end faces of the radial partitions by means responsive to fluid pressure.

5. Regenerative heat exchange apparatus as defined in claim 1 wherein the sealing means is biased into contact with the end faces of the radial partitions by magnetic field producing means supported by the sealing means.

6. Regenerative heat exchange apparatus having a rotor including a cylindrical shell joined to a rotor post by radial partitions forming compartments that carry heat transfer material, a housing surrounding the rotor and provided opposite the latter with end plates formed with imperforate portions between circumferentially spaced apertures which permit heating gases and air to flow to and through the rotor; axially movable sealing means adapted to preclude fluid flow between the imperforate portion of the end plate and adjacent end edges of the radial partitions, said sealing means including a radially extending channel portion supported by the end plate pivotally supporting a hooked portion of a horizontal sealing plate whereby a quantity of fluid in said channel will immerse the hooked portion of the sealing plate to preclude fluid flow therebetween.

7. Regenerative heat exchange apparatus as defined in claim 6 wherein the horizontal sealing plate extends circumferentially a distance greater than the distance between adjacent radial partitions.

8. Regenerative heat exchange apparatus having a rotor including a cylindrical shell joined to a rotor post by radial partitions forming compartments that carry heat transfer material, a housing surrounding the rotor and provided opposite the latter with end plates formed with imperforate portions between circumferentially spaced apertures which permit heating gases and air to flow to and through the rotor; axially movable sealing means adapted to preclude fluid flow between the imperforate portion of the end plate and adjacent end edges of the radial partitions, said sealing means including a radially extending channel portion supported by the end plate pivotally supporting a leading edge of a horizontal sealing plate, and means adapted to bias the trailing edge of said sealing plate into contact with end edges of the radial partitions.

9. Regenerative heat exchange apparatus as defined in claim 8 wherein the means adapted to bias the sealing plate into contact with the radial partitions provides its own magnetic field.

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