Oct. 2, 1956 W. P. S. PERSSON ET AL 2,765,150

AIR PREHEATER SEALING

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Fig. 3.

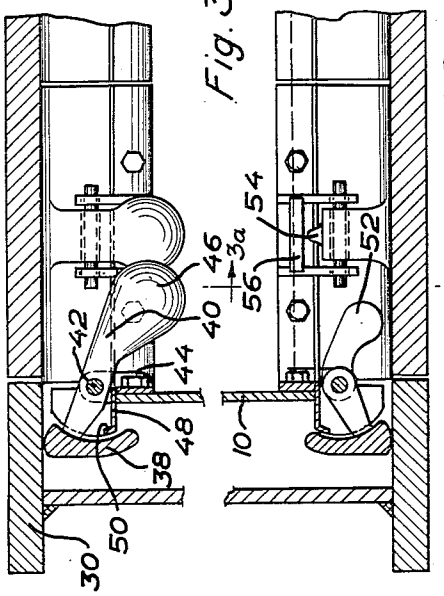

Fig. 3A

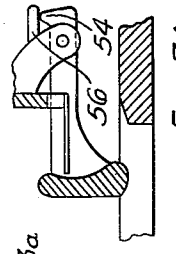

Fig. 4

Fig. 1.

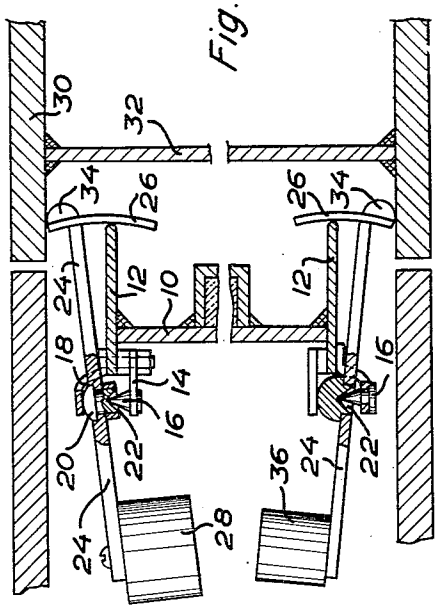

Fig. 2.

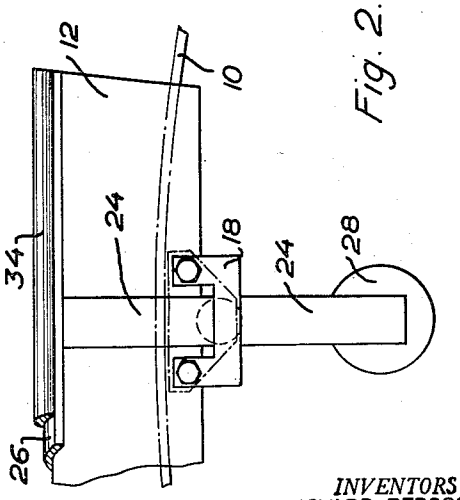

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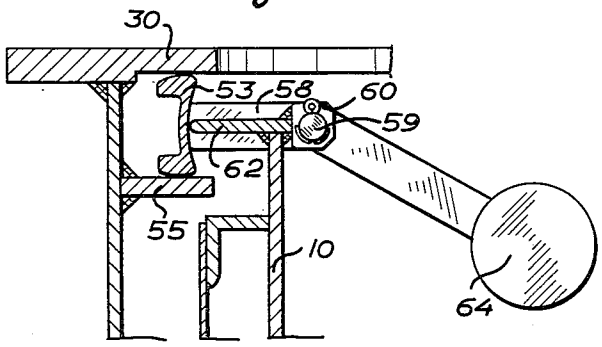
Fig. 5



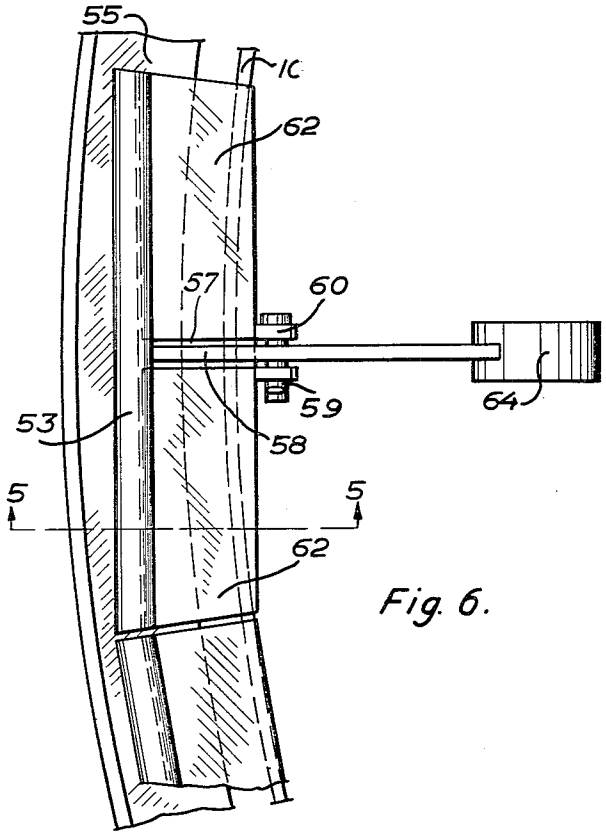


Fig. 6.

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AIR PREHEATER SEALING

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9 Claims. (Cl. 257—6)

The present invention relates to regenerative heat exchangers, especially of the so-called Ljungstrom type, and has particular reference to the seals of such apparatus.

Heat exchangers of the kind under consideration comprise two principal component parts, one of which consists of a stationary casing structure providing channels for flow of gaseous media between which heat is exchanged and the other of which consists of a rotor carrying regenerative mass and mounted to rotate so that the regenerative mass passes alternately through the gas channels to effect the desired heat exchange in well known manner. The rotor ordinarily comprises a cylindrical shell concentric with the axis of rotation of the rotor, the interior of the rotor being divided by a plurality of radially extending plates into a number of sector like compartments in which the regenerative mass is mounted. The casing structure also ordinarily comprises a cylindrical casing part concentric with and enclosing the rotor shell and located between end plates situated adjacent to the ends of the rotor and providing the ports through which the gases are conducted to and from the apparatus.

Typical examples of such apparatus are disclosed in U. S. Patents No. 1,586,816 and No. 1,654,294, and it is characteristic of such apparatus that seals must be provided, both peripherally at the ends of the rotor and radially along the sector plates thereof, to prevent leakage of gas from one to the other of the channels through which the heat exchanging gaseous media flow. Such seals, to be effective, must be of the contact variety and since the apparatus may be and usually is quite large, the frictional resistance by the seals to movement of the rotor may be considerable. This is particularly true when the nature of the seals is such that the contact pressure thereof is affected by the difference in pressure between the two gaseous media separated by the seals. Such pressure difference usually exists in practice and may not only affect power consumption and wear but also the sealing pressure, since the differential gas pressure acting on a given sealing element may alternately increase and decrease the sealing pressure as the position of the element changes.

The general object of the present invention is therefore the provision of new and improved sealing means of the kind under discussion which will be substantially independent of gas pressures and which will enable constant contact pressures of desired value to be maintained. The manner in which the above and other and more detailed objects are attained will best be understood from the ensuing portion of this specification, which in conjunction with the accompanying drawings, discloses by way of example but without limitation, suitable forms of apparatus for carrying the invention into effect.

In the drawings:

Fig. 1 is a fragmentary vertical section showing portions of a regenerative heat exchanger provided with seals embodying the invention;

Fig. 2 is a fragmentary top plan view of the upper seal shown in Fig. 1;

Fig. 3 is a view similar to Fig. 1 of another form of seal embodying the invention;

Fig. 3*a* is a fragmentary view taken on the line 3*a*—3*a* of Fig. 3;

Fig. 4 is a view similar to Fig. 2 of the apparatus shown in Fig. 3;

Fig. 5 is a view similar to Fig. 1 showing still another form of seal embodying the invention; and

Fig. 6 is a top plan view of the seal shown in Fig. 5.

In Figs. 1 and 2, upper and lower peripheral seals are shown, mounted on rectangular sealing plates 12 welded to the end portions of the rotor shell 10, the short sides of the sealing plates being cut off radially for connection to adjacent sealing plates. At the inner portion of each sealing plate located inside the periphery of the rotor shell is a holder including two carrier arms bolted to the sealing plate. The lower one of these arms is made in the form of a projecting plate 14 supporting a conical pin 16 and the upper one consists of a bracket 18 the middle portion of which is located at such a height over the conical pin that an arm 24 pivotally mounted on the conical pin by means of a bearing button 20 fastened to the arm and provided with a conical recess 22 for the conical pin, is permitted to move freely on the pin 16, but is prevented from jumping off the same. The outer portion of the arm 24 carries a cylindrically bent plate 26 running along the outer edge of the sealing plate with appropriate clearance. The radius of the bent plate 26 has its center on an axis passing through the conical pin 16. The inner portion of the arm 24 is provided with a counterweight 28 which is adjusted to effect the desired contact pressure along the line of contact between the plate 26 and the lower face of the inner flange 30 of the upper end plate of the stationary casing housing. At the contact edge, the plate 26 is provided with a sealing strip 34 fastened by welding and formed of material resistant to wear against the flange 30.

The sealing member disposed at the lower end portion of the rotor, is constructed in the same general way as the upper one, the sealing pressure, however, being provided by the weight of the parts located on the arm 24 and to the right of the conical pin as viewed in Fig. 1. The weight of these parts is partially balanced in part by a weight 36 for effecting the desired contact pressure. As will be noted from Fig. 1, the weight 36 is shown as being of lesser magnitude than that of the weight 28, since weight 36 acts merely as a partial balancing weight for the weight of the lower sealing member lying to the right of the pivot point in determining contact pressure of the lower seal, whereas the weight 28 must not only counterbalance that part of the sealing member lying to the right of its pivot point but additionally provides sufficient excess weight to produce the desired sealing pressure.

In accordance with the well known principles of operation of heat exchangers of the kind under consideration, one gaseous fluid at one pressure may fill the annular space between rotor shell 10 and the surrounding wall 32 of the stationary casing, while a different gas at a different pressure is passing through the interior of the rotor, to the right of the rotor shell 10 as viewed in Fig. 1. The function of the sealing member 26 is to prevent leakage in radial direction between the annular space around the rotor and the interior of the rotor, and by forming the pivotally mounted sealing plates 26 as parts or sectors of a cylindrical shell the longitudinal axis of which passes through the point of support of the arm 24, the resultant of the forces due to the pressures of the gases acting on the opposite sides of each of the plates 26 will pass through the point of support. With the resultant of the forces due to gas pressures passing through the point of support, the pressures of the gases have no effect or influence upon the bearing pressure exerted by the sealing

members on the bearing surface. With such an arrangement a predetermined and substantially constant bearing pressure can be obtained through the proper selection and distribution of the weights of the pivotally mounted parts, and such predetermined pressure will not be influenced or varied by variations in gas pressure or variations in relative pressure between bodies of gases acting simultaneously on opposite sides of a sealing member.

The pivotal point support of the arm **24** also provides the advantage of enabling the sealing plate **26** to freely adjust itself to follow small irregularities or variations in the contact surface of the element **30**, which may for example become slightly warped at times due to heat stresses in the casing structure.

Figs. 3 and 4 show radial as well as peripheral seals embodying the invention. The straight peripheral sealing element bearing against the lower side of the flange **30** and having substantially concentric outer and inner faces, is denoted by **38** and is carried by an arm **40** journalled on a shaft **42**, which is mounted in a holder **44** mounted on the rotor shell **10**. For partially balancing element **38** to obtain a suitable contact pressure against the flange **30**, the arm **40** is formed with a bulge **46** increasing the weight of the end portion of the arm. A sealing plate **48** is bolted to the rotor shell and forms a sealing slot between its outer upbent edge **50** and the inner face of the sealing element **38**. At the lower peripheral seal the desired contact pressure is usually provided by the weight of the sealing member, but if this would be too heavy it may be balanced by a counterweight **52**.

As shown in these figures, sealing elements similar to those just described may be used to provide seals extending radially along the bottoms and tops of the radial plates which characteristically divide the rotors of structures of the kind under consideration into sector-like compartments. As shown in these figures the sealing elements are mounted in substantially the same way as those above described, to bear against the top and bottom plate of the stationary casing structure. In the case of the radially extending sealing elements, however, they are advantageously provided with stops such as that indicated at **54**, located to coact with a stop **56** on the mounting structure, to limit the pivotal movement of the sealing elements. These stops are provided so as to limit the movement of the sealing elements when the radial rotor plates upon which they are mounted pass over the openings or ports in the end plates of the stationary casing structure through which the gases flow to or from the interior of the rotor.

In Figs. 5 and 6 another form of the invention is shown, consisting of a straight sealing element **53** which, as will be evident from Fig. 5, has a channel-like cross section having suitably rounded flange portions. The sealing element is pivotally mounted between the lower face of the flange **30** and an annular flange **55** welded to the inner face of the stationary casing, and is carried by an arm **58** disposed in a slot **57** of the rotor shell **10**. This arm is pivotally mounted on a pin **59** in a holder **60** fastened to the rotor shell between two straight sealing plates **62** welded to the rotor shell on both sides of the arm **58**. The outer edges of these sealing plates form a suitable sealing clearance with the inner face of the sealing element. The position of the arm between the sealing plates brings about a definite guiding, so that the bearing pin of the arm is relieved in part as to radial forces acting on the sealing member.

According to the invention the outer and inner faces of the sealing element **53** are cylindrical and concentric and have their central axis coinciding with the pin **59**. For adjusting the contact pressure of the sealing element against its slide-face a counterweight **64** may be provided on the arm **58** at the opposite side of the pin **59**.

The invention is not restricted to the embodiments shown and described herein but may be varied in many different aspects within the scope of the invention. For example, the sealing forces resulting from counterweights and the weight of the parts may be replaced by the force of springs for providing a desired contact pressure of the sealing member.

What is claimed:

1. A regenerative heat exchanger having two relatively rotatable main components comprising a rotor and a housing structure encircling the rotor, and means providing a seal between said components comprising a sealing surface formed on one of said components, a plurality of sealing members, means for pivotally supporting said members on the other of said components each of said members having a portion located to engage said surface in sealing relation, means for yieldably biasing said members to bring said portions into contact with said surface, each of said members further being provided with an arcuate surface concentric with respect to the place of support of the member, and sealing means forming a fixed part of said other component located closely adjacent to said arcuate surfaces.

2. Apparatus as defined in claim 1, in which said arcuate surfaces are cylindrical.

3. Apparatus as defined in claim 1, in which said members are pivotally supported on said rotor.

4. Apparatus as defined in claim 3, in which said rotor comprises an outer cylindrical shell and said sealing means comprises sealing plates extending radially outwardly from said shell into sealing relation with said arcuate surfaces.

5. Apparatus as defined in claim 1, in which the means for supporting said members provides point type supports permitting universal pivotal movement of the members about their respective places of support.

6. Apparatus as defined in claim 1, in which the means for supporting said members comprises a pivot pin extending through a portion of each of said sealing members providing for pivotal movement of the members about fixed axes.

7. Apparatus as defined in claim 3 in which the rotor includes a plurality of radially extending partitions and a plurality of sealing members pivotally carried by said partitions.

8. Apparatus as defined in claim 7 including stops for limiting the pivotal movement toward the housing structure of the sealing members carried by said partitions.

9. A regenerative heat exchanger having two relatively rotatable main components comprising a rotor and a housing structure encircling the rotor, and means providing a seal between said components comprising two spaced confronting sealing surfaces formed on one of said components, a plurality of sealing members, means for pivotally supporting said sealing members on the other of said components, each of said sealing members having two opposed sealing portions located to respectively engage said spaced sealing surfaces, means for yieldably biasing said members to bring said opposed sealing portions into contact with said spaced sealing surfaces, each of said members further being provided with an arcuate surface concentric with respect to the place of support of the member, the arcuate surfaces of said members being located between said opposed sealing portions, and sealing means forming a fixed part of said other component located closely adjacent to said arcuate surfaces.

References Cited in the file of this patent

UNITED STATES PATENTS

1,602,819	Jakowsky	Oct. 12, 1926
2,471,995	Yerrick et al.	May 31, 1949
2,571,817	Armstrong	Oct. 16, 1951

FOREIGN PATENTS

543,093	Great Britain	Feb. 10, 1942