Oct. 16, 1956 E. P. HORN 2,766,970

HIGH PRESSURE CIRCUMFERENTIAL SEAL

Filed Sept. 21, 1953

Fig. 1

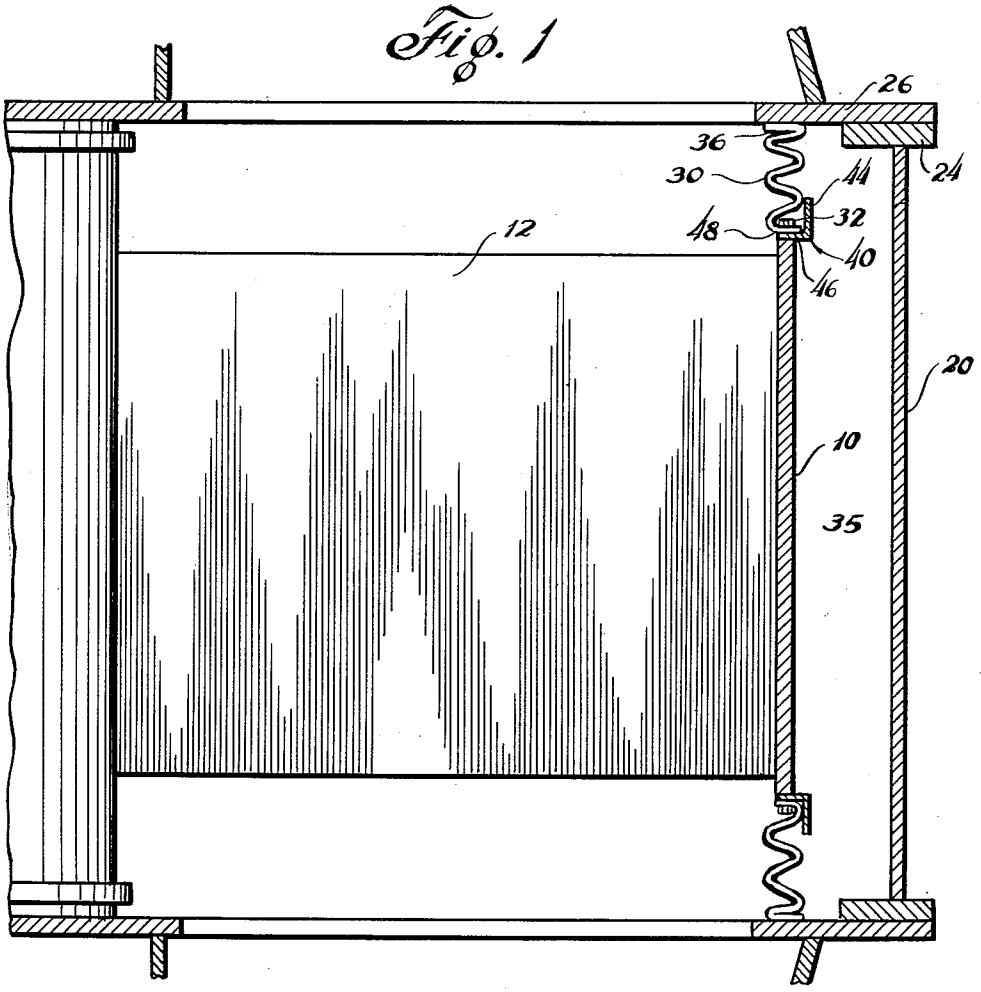


Fig. 2

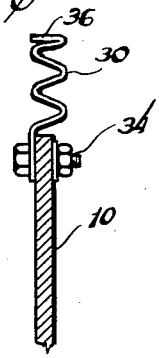
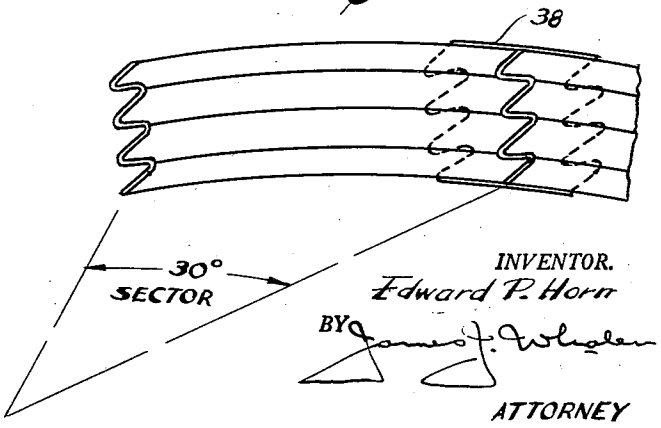


Fig. 3



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HIGH PRESSURE CIRCUMFERENTIAL SEAL

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6 Claims. (Cl. 257—6)

The present invention relates to heat exchangers and particularly to an improved circumferential seal for use between a rotor and an enclosing housing of a rotary regenerative preheater or like apparatus.

In a rotary regenerative heater a cylindrical rotor has compartments carrying metallic heat transfer plates which as the rotor turns are first exposed to the heating gases and then disposed in the air passage to impart the absorbed heat to the incoming air. The rotor is surrounded by a housing having end plates formed with openings to provide for the flow of gas and air over the heat transfer plates. In order to preclude the flow of gas or air through the clearance space between the rotor and the housing without passing over the heat transfer material, it is customary to provide the rotor with circumferential seals that bear against the sector plates or other stationary parts.

The present invention contemplates improved circumferential sealing devices of novel form and will best be understood upon consideration of the following detailed description of several illustrative embodiments thereof when read in conjunction with the accompanying drawings in which:

Figure 1 is a sectional elevation showing the flexible circumferential seal of this invention as attached to the annular rotor shell.

Figure 2 is a sectional elevation of a modified seal mounting shown with reference to the housing and end plate flange.

Figure 3 is a perspective drawing of the corrugated seal of this invention showing a splice plate used to join abutting sections of the corrugated sealing element.

In the drawings the numeral **10** designates the cylindrical shell of a rotor which, as it rotates, carries a mass of heat exchange material **12** from hot to cold sides of the heat exchanger in well known fashion. Surrounding the rotor is the housing **20**, having an annular flange **24** secured to its circumferential edge and lying in engagement with the annular flange **26** of the "connecting plate" which forms one end plate for the housing and to which the gas and air ducts are connected. Extending circumferentially with respect to the peripheral edge of the rotor shell **10** and bridging the space between said peripheral edge and the flange **26** of the connecting plate is the circumferential seal **30** which embodies this invention.

Seal **30** is a contact seal mounted on and firmly attached to the rotor shell **10** by means such as pins **32** (Figure 1) or bolts **34** (Figure 2). The seal rotates with the rotor and presses against the inner surface of flange **26** of the connecting plate to preclude leakage of gas or air through the annular space **35** between the rotor shell **10** and the housing **20**.

The sealing member **30** comprises a plurality of arcuately formed sectorial sections forming a complete circle around the peripheral edge of the rotor shell. Each section is formed from a metallic sheet corrugated longitudinally in order to provide a member compressible in a

direction axial of the rotor in its location between the rotor shell and the connecting plate flange.

In order to provide a circumferential sealing member that reduces leakage to a minimum between adjacent or contiguous sections thereof, a splice plate **38** (Figure 3) having corrugations mating with those of each corrugated seal section may be fitted at each joint. A splice plate **38** is preferably tack welded to one end of each corrugated sealing section prior to its final assembly with other similar sections into a composite annular sealing member on the edge of the rotor shell **10**. Besides serving as a barrier to the passing gases, the corrugated splice plates **38** serve as stiffeners to assist bracing the edge of the sealing members **30** against the inner face of the connecting plate flange. That portion of the sealing member which is held against the inner face of the end plate flange **26** is reinforced at **36** with a material of such hardness that it will not cause excessive wear of the connecting plate flange but will itself take the wear.

Figure 1 shows the seal mounting as including an annular angle member **40** that is welded to the end edge of the rotor shell, preferably through its extent. The vertical portion **44** of the angle member **40** provides a supporting backing for seal **30**, while the horizontal portion **46** thereof provides a base for mounting a plurality of circumferentially spaced driving pins **44**. The pins **44** are spaced apart at intervals which provide a minimum of two spaced driving pins for each corrugated sealing section **30**. Each section **30** of the corrugated sealing member has openings **48** in its lower corrugation spaced to coincide with the intervals of pins **44** in the base **46** of angle member **40**.

In assembling a seal of this type, individual sections thereof are inserted into the preheater housing through the air or gas openings in the connecting plate. Prior to its insertion, each corrugated sealing section is laterally compressed sufficient to enable it to enter the space between the pins **44** and the end plate flange **26**, and on clearing the pins in a position above the latter with the apertures **48** alined with the pins **32**, the sealing members are permitted to expand, thereby forcing the apertured corrugation into engagement with the pins **44** and the extreme corrugation at the opposite end against the inner face of the end plate flange **26**. Corrugated sealing sections are placed in continuing arrangement until they collectively form a composite circular sealing ring around the peripheral edge of the rotor shell **10**.

In assembling the individual arcuate sealing section **30** into an annular seal around the edge of the rotor shell, each section is inserted through the gas or air opening in the connecting plate, then placed in position on the rotor shell and fixed thereto by bolts. The sealing segments are sized so that they must be slightly compressed before fitting into the space between the end edge of the rotor shell and the connecting plate flange, whereby each seal will be capable of expanding, as well as contracting, to compensate for variations in spacing between said members as may be caused by thermal distortion of the rotor and its surrounding housing.

When it is deemed desirable to remove a single corrugated sealing section which appears to have worn, one follows the reverse of the assembly procedure described in the preceding paragraphs.

The annular circumferential seals of the type herein disclosed find application at either end of the rotor shell, since the spring action inherent in each corrugated member maintains a corrugated fold thereof at all times in contact with its adjacent end plate flange, whether standing in an upright position on the upper edge of the rotor shell **10** or in an inverted or dependent position from its lower edge.

The novel sealing arrangement herein described pro-

vides an efficient sealing device for use between rotors and rotor housings of apparatus subject to substantial amounts of thermal distortion. Because the flexible sealing sectors **30** are not fixed together but overlap freely they are at all times free to enlarge or contract to accommodate changes in rotor diameter, and to expand or compress with axial movement of the rotor, both types of change in the rotor being due to thermal expansion and contraction when the rotor is in service. The sealing sections are self-adjusting and automatically attain the position in which they effect the best seal. The sealing sections may be readily removed and replaced through the air and gas openings in the end plates, and replacement of a single sealing section will in no way affect the continuity of the composite sealing member.

What I claim is:

1. A sealing means for precluding fluid flow between relatively rotatable members of an apparatus, said sealing means comprising a series of longitudinally corrugated segments of arcuate form collectively comprising an annular sealing member bridging the space between said relatively rotatable members.

2. A circumferential seal as defined in claim 1 wherein each corrugated sealing segment has fixed to an end portion thereof a corrugated reinforcing member extending beyond said end portion to overlap the adjacent end portion of an adjoining corrugated sealing segment.

3. A circumferential seal as defined in claim 1 wherein each corrugated sealing segment has fixed to its radially outer face adjacent an end portion thereof a corrugated reinforcing member extending beyond said end portion

to overlap the adjacent end portion of an adjoining corrugated sealing segment.

4. Circumferential sealing apparatus as defined in claim 1 wherein each sealing segment is engaged by axially disposed pins located in the peripheral end edge of one of the relatively rotatable members.

5. Circumferential sealing apparatus as defined in claim 1 wherein each sealing segment is positioned on axially disposed pins located in the peripheral end edge of one of the relatively rotatable members.

6. Sealing means adapted to preclude fluid flow between axially spaced fixed and relatively rotatable housing members comprising an annular angle member fixed to the rotatable member and disposed axially thereof in the space between said housing members with a leg portion of said angle member extending toward said fixed housing member; a plurality of pin-like protuberances integral with the other leg of said angle member in axial alignment with said rotatable member; and a compressible sealing member apertured to fit over the pins and arranged to bridge the space between the base of said angle member and said fixed member.

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