

[54] ROTOR FOR EXCHANGERS OF THE
THERMODYNAMIC CHARACTERISTICS
OF TWO GAS CURRENTS

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[52] U.S. Cl. 165/8, 55/390, 165/10

[51] Int. Cl. F28d 19/04

[58] Field of Search..... 165/8, 9, 10; 55/390, 78, 34

[56] References Cited

UNITED STATES PATENTS

3,267,562	8/1966	Chiang et al.	165/8 X
3,596,709	8/1971	Drauniks	165/10 X
2,818,934	1/1958	Pennington	165/10 X
3,391,727	7/1968	Topouzian	165/10 X

FOREIGN PATENTS OR APPLICATIONS

865,625	2/1953	Germany	165/10
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682,278	11/1952	Great Britain	165/10
503,857	4/1939	Great Britain	165/10
1,045,974	10/1966	Great Britain	165/8

Primary Examiner—Albert W. Davis, Jr.
Attorney, Agent, or Firm—Munson & Fiddler

[57] ABSTRACT

A rotor for exchangers in which the thermodynamic characteristics of two gas currents are transferred from one current to the other while they are being passed through the exchanger insert in zones separated from one another, said rotor being formed with sector spaces defined by the outer surface of an inner hub, an outer envelope and radial spokes interconnecting said hub with said envelope, which sector spaces are filled with a moisture and/or heat transferring insert formed as prefabricated units having the shape of the sector spaces.

2 Claims, 3 Drawing Figures

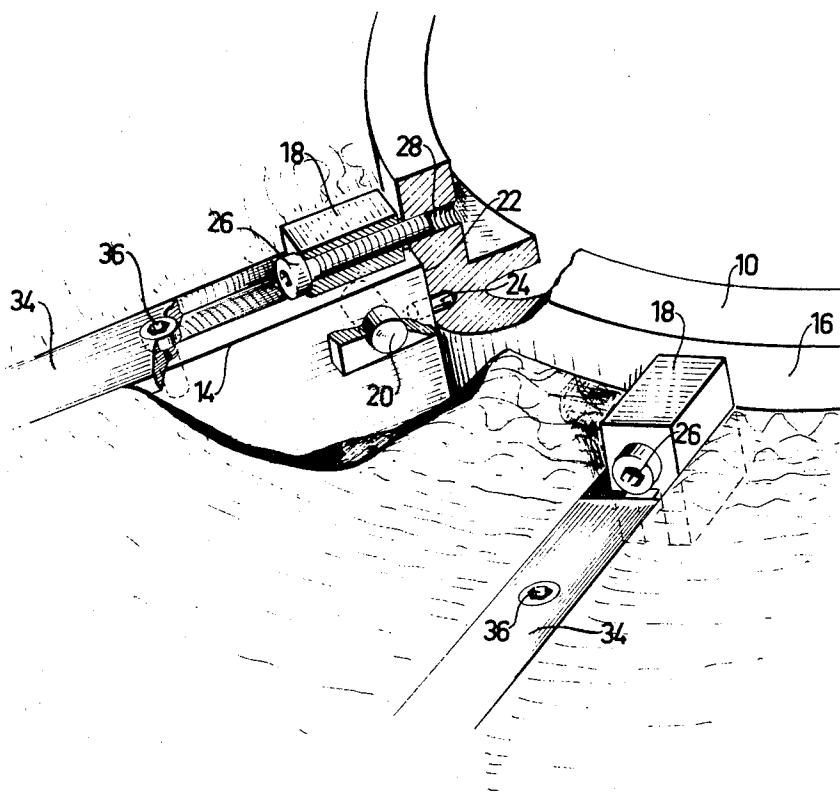


Fig. 1

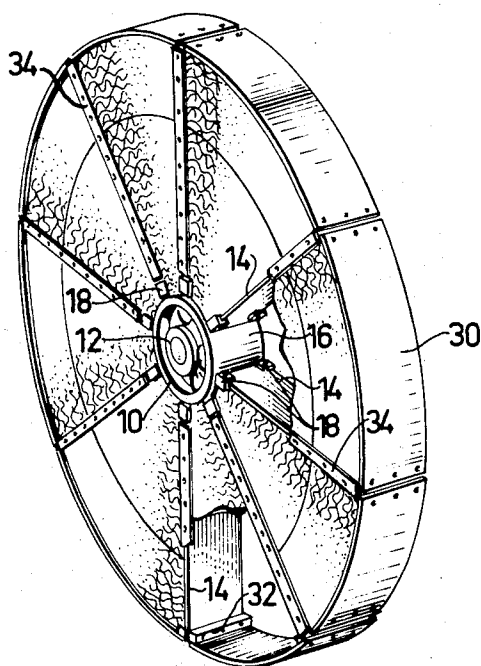
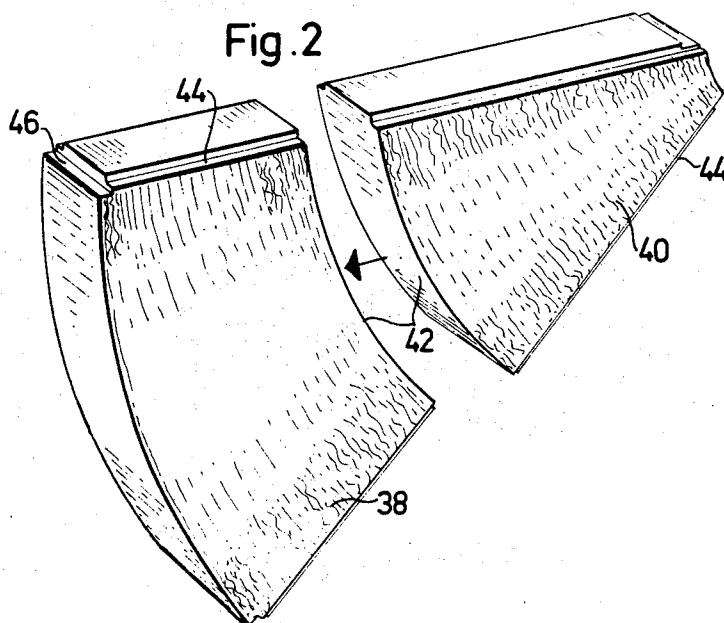
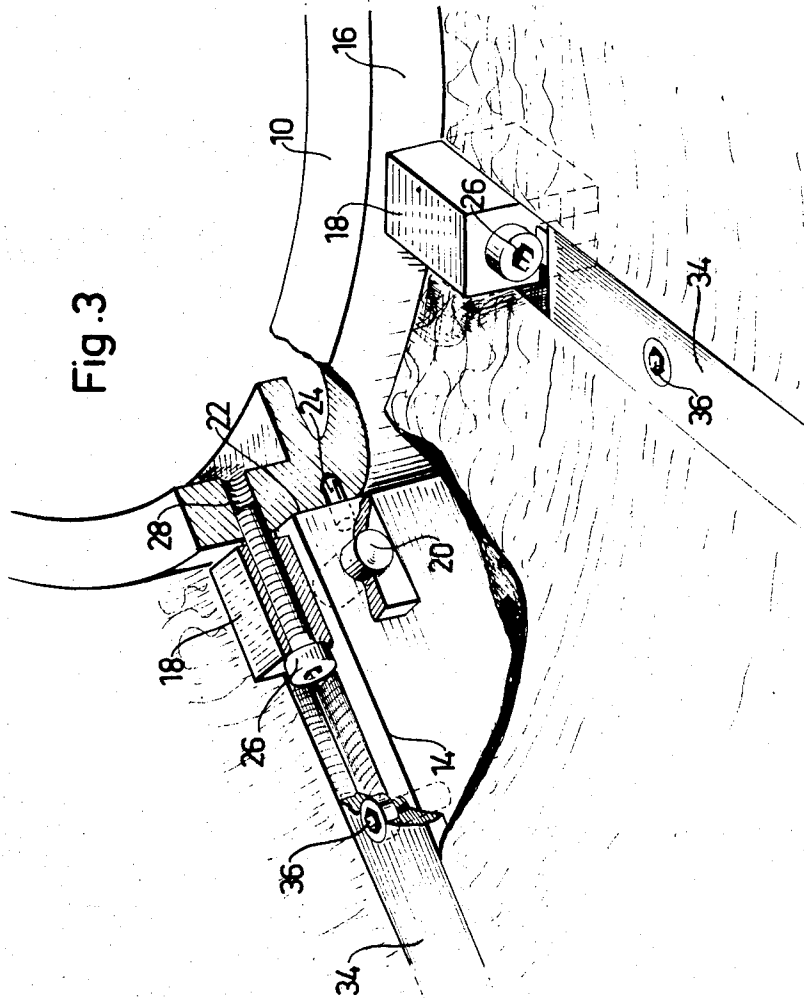


Fig. 2



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ROTOR FOR EXCHANGERS OF THE THERMODYNAMIC CHARACTERISTICS OF TWO GAS CURRENTS

BACKGROUND OF THE INVENTION

This invention relates to rotor exchangers of the thermodynamic characteristics of two gas currents, by which moisture and/or heat are exchanged between said gas currents, said rotor comprising an inner hub, an outer envelope and radial spokes interconnecting said parts and together with said parts defining sector spaces, which are filled with a moisture and/or heat exchanging or transferring mass or insert of thin, mutually parallel layers or sheets, which subdivide the sector interspace into a great number of fine channels or passageways extending axially from end to end. The layers mass or insert of the rotor is preferably composed of alternately plane and corrugated sheets of asbestos paper as is disclosed e.g. in the U.S. Pat. No. 3,231,409.

OBJECTS OF THE INVENTION

One main object of the invention is to provide a rotor of the kind in consideration having great dimensions, such as up to a diameter of 4 meters and more, and which is manufactured with great exactness so that leakage at the sealings between the passages or the gas currents exchanging moisture and/or heat within the rotor is reduced to a minimum.

Another object of the invention is to provide a rotor permitting individual parts of the layer mass or insert to be replaced without disassembling or replacing the whole rotor.

Still an object of the invention is to provide a rotor which can be transported to the place of erection in the shape of easily transportable minor elements which on assembly take predetermined exact positions.

SHORT DESCRIPTION OF THE DRAWINGS

Further objects and advantages of the invention will become apparent from the following description, considered in connection with the attached drawings, which form part of this specification and of which:

FIG. 1 is a perspective view of one embodiment of a rotor manufactured according to the invention with parts assumed cut off for obtaining greater clearness;

FIG. 2 is a perspective view of a layer unit composed of two parts; and

FIG. 3 is a perspective view in a larger scale of a portion of a hub and two spokes.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The rotor shown in the drawings is formed with a hub 10 that contains bearings 12 for a shaft (not shown) supporting the rotor in the casing of the exchanger. A plurality of spokes 14 extend radially and evenly distributed about the circumference of the hub. The spokes 14 are made of plane strips of sheet plate having relatively great thickness such as 8 to 10 millimeters and are positioned axially. They are fixed to the cylindrical outer surface 16 of the hub 10 by means of U-shaped retainer members 18 forced on the spoke plate on each lateral edge of the same. The retainer member 18 will thus with its shanks tightly clasp the spoke to which it is locked by means of a suitably cylindrical peg 20 introduced into matching holes in the retainer member and in the plate. The inner end surfaces 22 of the

plates 14 are exactly worked in relation to the cylindrical surface 16 of the hub so as to cause the spokes to extend with their lateral edges exactly vertically to the axis of rotation of the hub within very narrow tolerances. Holes are formed in the hub 10 and the end edges of the spoke plates, into which holes pins 24 are introduced, which exactly localize the position of the spokes relative to the hub. Locking screws 26 are screwed down into the central web portion of the retainer members 18, which screws in addition are introduced into threaded holes 28 formed in the hub. The retainer members 18 are not in contact with the hub 10 and when driving home the screws 26, the spokes are forced into rigid narrow abutment against the hub.

The spokes 14 are connected to the external portion of the rotor by means of a rim having the shape of plate straps 30, each having the same peripheral extension as one sector curve. The connection between the spokes and sheet plate straps 30, which latter together form a cylindric surface having the axis line of the hub as center line, can be brought about by means of screws engaging the brackets 32. Straight flat straps 34 having larger breadth than the spokes, are disposed along the radial lateral edges of the spokes 14 and secured to them by means of screws 36 provided in a row along each spoke. On each side of the rotor the outwardly facing surfaces of the straight straps 34 are located with very small deviations in one and the same plane extending transversally to the axis of rotation of the hub.

The spaces defined by the hub 10, the spokes 14 and the sheet plate straps 30 are according to the invention completely filled with prefabricated units composed of thin layers of e.g. asbestos or cellulose paper. In this connection, the layers are preferably formed of one plane sheet and one corrugated sheet which together are wound up helically to a cylindrical blank. When the winding is effected the corrugations are located to extend axially. The spaces between the smooth sheets is preferably less than 3 millimeters, such as 1 to 2 millimeters, which thus is the dimension of the top height of the corrugations in the interpositioned sheets. Suitable substances are supplied to the sheets in a manner disclosed in e.g. the patent referred to above so that required mechanical strength of the individual sheets and uniting between them is obtained. In case that the rotor is intended to serve for transfer of moisture or as a dryer, the porous paper sheets are also impregnated with a hygroscopic substance, such as lithium chloride. After having been wound up, the motor mass is worked by cutting and grinding to sector shape so that its inlet and outlet sides for the gas streams are given exactly parallel planes and that the lateral surfaces exactly match the sector-shaped spaces in the rotor frame. For especially large rotors the sheet sector can be subdivided into a plurality of portions, as is seen in FIG. 2, where a subdivision into two portions 38, 40 is shown, the contact surfaces 42 between them extending cylindrically along the turn of a winding. The layer sectors are formed with recesses 44, the height of which corresponds to the thickness of the straight straps 34 and also with recesses 46 for making room for the rods 32.

The layer sectors can be positioned into the spoke frame one after the other, the envelope sheet plates 30 and the straight straps 34 being secured to the spoke frame in succession to fix by clamping the layer sectors both axially and radially in their final position, in which the lateral surfaces of the layer sectors have to be lo-

cated in the same plane as the external surfaces of the straight straps 34. When disassembling individual sectors the pertaining envelope sheet plates and covering straps can be released without this measure having any influence on the other sectors.

The rotor is intended to be inserted into a casing of the type described in the co-pending U.S. Pat. application Ser. No. 745,431, filed July 17, 1968 by P.G. Norbäck now U.S. Pat. No. 3,587,725, said casing having connecting sockets so that a portion of the circumference of the rotor is passed by a current of gas or air and another portion by another current of gas or air, which currents during rotation of the rotor shall exchange their content of moisture and/or heat. It is easily understood that the required sealings, which shall prevent non-desired leakage from one gas current to another, can be mounted in exact positions in relation to the lateral faces of the rotor due to the fact that these are located in the same plane both with respect to the layer mass or insert and the straight straps 34.

Regarding the thickness of the spoke sheet plate straps it is of importance that they in addition to the property of a mechanical strength sufficient to take up the load of the weight of the rotor mass and the pressure exerted by the gas currents during their passage through the rotor, must have such structure that no great temperature gradients can be produced in the spokes viewed in direction of the gas flow. Great temperature gradients are adapted to produce a bending of the spokes, so that the rotor becomes domed or curved or warped. The temperature gradient through the spokes is to be substantially less than that prevailing in the zone of maximum temperature difference between the inlet and the outlet for the gases. This is attained by giving the spokes a great thickness in relationship to the depth or transverse extension in the direction of the gas flows. An advantage inherent to the arrangement described for the spokes with covering straps 34 is that under the covering straps in close vicinity to the spokes a layer of the rotor mass a portion provided which is not passed by gas, but acts as a heat insulation. This layer has favourable effect by equalizing the temperature gradient in the spokes.

The sectors may be composed of parallel, straight elongated layers instead of layers wound cylindrically. In such cases, the layers are preferably orientated so as to extend from one spoke to an adjacent spoke.

While one more or less specific embodiment of the invention has been shown and described, it is to be understood that this is for purpose of illustration only, and that the invention is not limited thereby, but its scope

is to be determined by the appended claims.

What is claimed is:

1. A rotary transferer of thermodynamic characteristics of two gas streams passing through the transfer in thermodynamic exchange relationship comprising:
 - a. a wheel-like member having a hub, and a rim, said hub having an outer cylindrical surface;
 - b. a plurality of radial spokes interconnecting said hub and said rim defining therebetween a plurality of sector units filled with a packing of gas permeable material;
 - c. said packing comprising a spirally wound web composed of one plane sheet and one corrugated sheet;
 - d. said spokes being composed of self-sustaining sheet material and having removable means for securing the spokes in axial and radial position on said hub;
 - e. said spokes having inner end surfaces contoured to the cylindrical surface of said hub, and
 - f. screw means for retaining said spokes radially on said hub with said surfaces in firm contact with one another.
2. A rotary transferer of thermodynamic characteristics of two gas streams passing through the transfer in thermodynamic exchange relationship and having selectively replaceable parts comprising:
 - a. a wheel-like member having a hub and a rim;
 - b. a plurality of radial spokes extending between said hub and said rim defining therebetween a plurality of sectors units filled with a packing of gas permeable material;
 - c. a retainer member removably engaging the hub end of each of said spokes;
 - d. a pin engaging the hub end of each of said spokes and adapted to be inserted into holes spaced about the periphery of the hub to localize the position of the spokes relative to the hub;
 - e. a screw member engaging said retainer member and adapted for engagement in screw-threaded holes in said hub to secure said spokes into engagement with the hub;
 - f. a strap mounted on the radially extending lateral edge of each of said spokes for retaining the packing unit sectors in their axial position, the outer surfaces of said straps being substantially level with the outer surfaces of said packing unit sectors;
 - g. said rim comprising a plurality of segments corresponding to the arc of said packing unit sectors and being adapted for connection to said spokes.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,789,916 Dated February 5, 1974

Inventor(s) SVEN H. B. LINDAHL

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Claim 1, Paragraph c. is corrected to read:

"said packing comprising alternately plane and corrugated sheets;"

Signed and sealed this 30th day of July 1974.

(SEAL)
Attest:

McCOY M. GIBSON, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents