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HEAT EXCHANGER BEARING ARRANGEMENT

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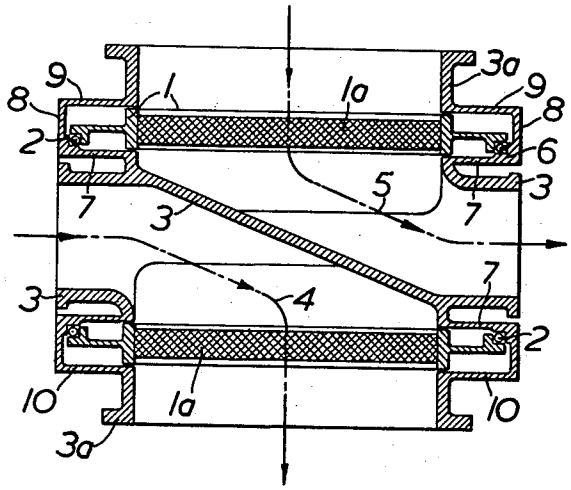


Fig. 1

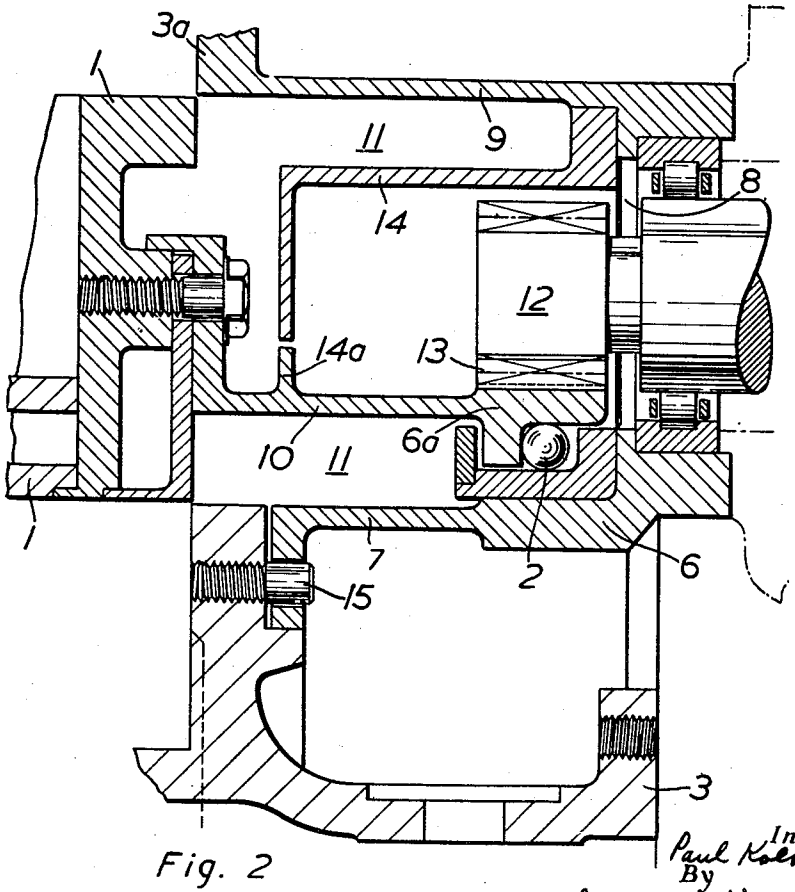


Fig. 2

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HEAT EXCHANGER BEARING ARRANGEMENT

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2 Claims. (Cl. 257—6)

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This invention relates to heat exchangers of the rotary regenerative type, that is to say of the type in which different parts of a rotary matrix are simultaneously exposed to hot and cold fluid flows so that in the course of its rotation the matrix receives heat from the one flow and imparts heat to the other. Such heat exchangers have particular application to gas turbine power plant and it is in such plant that a heat exchanger in accordance with the invention may be expected mainly to be used.

In particular the invention relates to such heat exchangers of the drum type in which the rotary matrix is of cylindrical form and the fluid flows are guided by casing structure to pass radially through the matrix, the drum being mounted at its end on the casing structure for rotation about its own axis. In that type of heat exchanger it is convenient, in order to allow axial flow of fluid through the ends of the drum, to mount the drum in a peripheral bearing support, an arrangement which enhances the difficulty, already inherent in the rotary regenerative type of exchanger, of dealing with the tendency of the bearings to overheat, and with problems arising from relative thermal expansion of different parts. An object of the present invention is to provide an improved bearing arrangement and structure for heat exchangers of the drum type referred to which will mitigate these difficulties.

Accordingly the invention proposes to provide a heat exchanger of the rotary drum type referred to having an end supporting bearing of which the relatively moving bearing parts are axially spaced away from end structure of the drum and of the stationary casing by which the boundary of the fluid flow path is defined, and are respectively connected to said structures by axially extending annular supporting structures arranged in radially spaced relation concentrically with the drum axis so that their cross-section constitutes the sole heat transmission path from the drum and casing structures to the bearing surfaces. It is intended that said cross-section should be reduced relative to adjacent structure to the maximum extent consistent with mechanical strength requirements in order to limit the input of heat to the bearing and also to provide some capacity for yielding in the radial direction to accommodate thermal stress.

In the normal type of construction the heat exchanger casing will include structure both internally and externally of the drum, and in such a case it is proposed, in further accordance with

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the invention, that the annular bearing-supporting structure associated with the casing should comprise radially spaced concentric walls united at their axially outer ends, between which walls at an intermediate radius and concentric therewith lies the annular bearing-supporting structure associated with the drum. A double-walled stationary annular supporting structure such as has just been described may be used to accommodate at one or more points about the periphery of the bearing a pinion meshing with a gear ring on the annular supporting structure associated with the drum, which pinion may transmit drive either to or from the drum or might be used for example for the distribution of oil. It will be noted also that the kind of annular supporting structure envisaged will provide virtually an annular pocket in the casing with its open side presented to the rotor, which can be arranged substantially to close the pocket; in this way ample provision is made for either a convective or a forced cooling air flow if required. The outer annulus may further be provided internally with structure forming in conjunction with the annulus associated with the drum an enclosed or more or less enclosed annular channel serving at some part of its circumference as an oil collecting chamber or reservoir.

An example of construction in accordance with the invention is illustrated in the accompanying drawings, in which Figure 1 illustrates diagrammatically the general form of a drum type heat exchanger embodying the invention, and Figure 2 is an enlarged detail section of the bearing arrangement illustrated in Figure 1 (the view corresponding to the top right-hand corner of Figure 1).

Referring now to Figure 1 of the drawings, the heat exchanger comprises a drum 1 rotatably mounted at each end on bearings 2 supported in a casing having inner and outer parts, 3, 3a which together define two gas flow paths 4, 5 intended for the flow of cold and hot gases respectively. It will be noted that each gas path includes regions of radial flow through the wall of the drum and axial flow through the ends of the drum and casing, the wall of the drum 1 for this purpose being mainly afforded by a matrix 1a which is permeable to the gas flows. Normally it will be arranged that the hot gas enters radially and emerges axially whilst the cold gas enters axially and emerges radially so that the variation of the flow path area will be in the same sense as the variation of gas volume with temperature.

The heat exchanger as so far described is broadly known and is merely intended to typify the class of apparatus to which the invention has particular application; the invention itself is concerned with the bearing arrangement used. In the example illustrated, each bearing 2 is axially spaced from the end of the main structure of the drum 1 and from the parts of the casing 3, 3a which define the boundary of the radial gas flow path. The stationary part 6 of the bearing structure is connected to and supported on the inner casing part 3 by an annulus 7 of reduced cross-section. The annulus 7 is also connected through an associated end wall 8 and an outer annulus 9 concentric with the annulus 7 to the outer casing part 3a. The movable part 6a of the bearing, on the other hand, is connected to and supported on the end wall of the drum 1 by means of an annulus 10, also of reduced cross-section, lying concentrically between the annuli 7 and 9.

The intention of this arrangement is primarily to restrict the heat flow from the hot parts of the casing and drum to the bearing and it also has the advantage of providing some capacity for radical yielding to accommodate thermal stresses. It will be noted also that the annuli 7, 9, and end wall 8 form three sides of an annular chamber or pocket 11 of substantial axial depth, the open side of which is presented to the gas flow channel but accommodates and is substantially closed by the end rim of the drum 1; the chamber 11 so provided offers ample provision for a convective or forced cooling air flow if that should be desirable or necessary. In addition, in the preferred form of the invention illustrated in Figure 2, the chamber 11 is used to accommodate at one or more positions around its circumference a pinion such as 12 meshing with a gear ring 13 provided on the bearing part 6a, which pinion may either drive or be driven by the gear ring 13. The structure also includes an angle section ring 14 forming with a rib 14a on the annulus 10 a substantially enclosed annular chamber which at its lower part acts as an oil reservoir in which a loose pinion may be arranged in order positively to pick up oil and transfer it to the gear ring 13 and thence to the bearing 2 in that region.

The walls 7, 9, by being made suitably thin, are able to accommodate relative radial expansion as between the colder inner structure 3 and the hotter outer structure 3a; in order to accommodate relative axial expansion of these parts the inner wall 7 at one end of the apparatus is supported in an axially slidable manner on studs 15 on the structure 3. The wall 7 at the other end, of course, is securely attached to the structure 3 so as to provide a fixed point from which axial expansion of the bearing structure 7, 9, can take place.

I claim:

1. In a rotary drum type regenerative heat exchanger comprising in combination a hollow rotary drum with a fluid-permeable rim having a solid portion at one end, a casing enclosing said drum, and a duct portion on said casing defining a part extending radially up to said permeable rim, of a fluid path, which path continues through said rim into the interior of the drum and axially out from the drum, the provision of inner and outer annular walls extending axially from said casing outwardly away from said fluid path concentrically with said drum, an end wall uniting the said inner and outer axially extending walls to form therewith an annular bearing chamber within said casing but screened from the hot fluid path by said solid end portion of the rim of the drum, a thin third annular wall extending axially from said solid end portion of said rim away from said fluid path and concentrically into said bearing chamber, a bearing for the drum mounted within said chamber between said inner annular wall and said third annular wall at the outer end of the latter, remote from the hot gas path, and an axial duct portion on said casing extending inside but spaced from said inner wall to define said axial part of the fluid path from the interior of the drum, thus shielding the inner and bearing-carrying wall from the hot fluid path.

2. A rotary heat exchanger according to claim 1 with driving gear for said rotary drum comprising a toothed gear rim formed around said annular wall extending from the rim of the drum and a driving pinion housed within said bearing-chamber and meshing with said toothed gear rim.

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