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ROTATABLE BODY FOR TRANSFER OF MOISTURE OR/AND HEAT

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Fig. 1

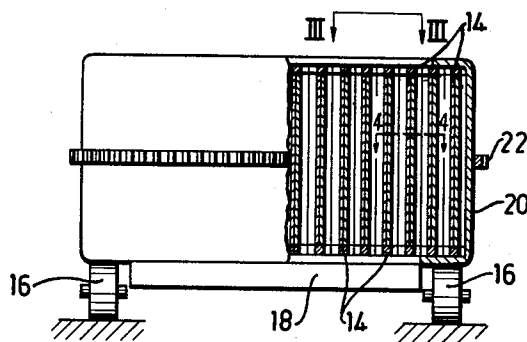


Fig. 2

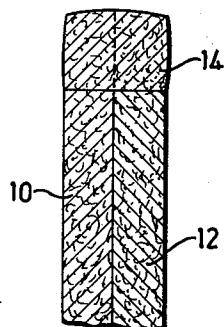


Fig. 4

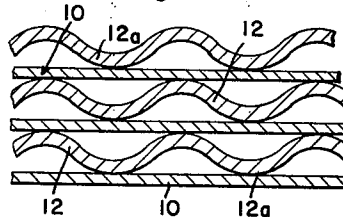
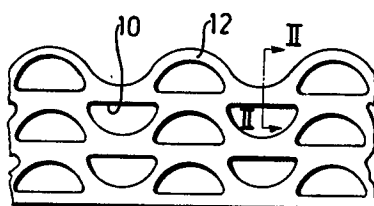


Fig. 3



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1 Claim. (Cl. 165—8)

This invention relates to a body or packing for transfer of moisture or/and heat.

More particularly this invention relates to a body or packing adapted to be passed by two gaseous media such as two air flows for the purpose of transfer of moisture and/or heat from one flow to the other.

The transfer body or transferer is composed of thin, substantially parallel sheets or layers bearing against and bonded to one another at mutually spaced places and therebetween forming channels or passage-ways for the two media extending throughout the body from one face thereof to its opposite face.

The sheets or layers preferably consist of a fibrous material, organic as well as inorganic, such as cellulose paper or asbestos paper. Alternately every second layer or sheet may be flat and every second one undulated or corrugated so as to entail to the body some kind of corrugated board structure. If moisture is to be transferred between the two air flows the layers or sheets are preferably impregnated with a hygroscopic salt such as lithium bromide or chloride, or a composition of various suitable salts.

One important field of the application for the transfer body in consideration consists in its forming part of an apparatus provided with an inlet and an outlet for each of the media so as to permit both media to transgress the body simultaneously at different regions or zones, preferably in a countercurrent. The body is preferably rotatable so that during the rotation its different parts are transgressed alternately by the one and the other of the gaseous media. In the co-pending application Serial No. 747,427, filed July 9, 1958, and now abandoned, by Carl Georg Munters, it has been proposed to cover or impregnate in transfer bodies of the type in consideration those portions of the sheets where the openings of the channels are located, with a substance making the sheets stiffer and bonding the fibres firmer to one another than without such treatment. The sheets may also be impregnated with a hygroscopic water-soluble salt. For the particulars and advantages of this treatment reference is made to the co-pending application identified hereinbefore.

One main object of the present invention is to improve transfer bodies of the type in consideration by strengthening the preferably flat faces thereof where the channels open so as to become more rigid than hitherto available and thus to make said bodies more stable in shape and also more reliable in operation in spite of relatively high temperatures and temperature variations.

Another object of the invention is to provide such transfer bodies at their faces where the channels open with a kind of lattice or framework structure possessing very great mechanical strength and moment absorbing capacity.

Still another object of the invention is to provide transfer bodies which in spite of their general structural composition of a weak material particularly when under the action of moisture, such as thin fibres of non-metallic, organic or inorganic nature, nevertheless can be manufactured with great precision and retains its structural shape extraordinarily well.

The improvement brought about by the present invention mainly consists in that the layers in the face zones where the channels open, are covered or impregnated with a substance which in addition to its stiffening the

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layers joins them together at the places of contact so as to cause said face zones to form a coherent disc which is perforated in correspondence to the channel openings.

Further objects and advantages of the invention will become apparent from the following description, considered in connection with the accompanying drawing which forms part of this specification, and of which:

FIG. 1 is a partly sectional view parallel with the shaft of a rotor or wheel made according to the invention.

FIG. 2 shows a portion of the rotor or wheel in the same section as in FIG. 1 but on a larger scale; FIG. 2 at the same time being a sectional view following line II—II of FIG. 3.

FIG. 3 is a lateral elevation of a portion of the rotor viewed according to the line III—III of FIG. 1 and in an enlarged scale.

FIG. 4 is a sectional view taken substantially on the line 4—4 of FIG. 1.

Referring to the drawing reference numeral 10 denotes plane sheets and 12 corrugated sheets which are united together along the ridges 12a of the corrugated sheets. The flat-faced rotor may here be composed of a strip composed of one plane and one corrugated sheet which strip is helically wound up to a desired diameter of the rotor. The two sheets are bonded together in known manner in a so-called single corrugated board-making machine by means of an adhesive of the water-glass type, whereas the individual windings of the composed strip need not be provided with any particular adhesive during the winding operation. The sheets are made of fibrous material which depending on the requirements determined by the temperatures to which the rotor is exposed, may be of organic or inorganic nature. The thickness of the sheets is only one or some tenths of a millimetre. The height of the waves of the corrugated sheet may be about 1 to 2 up to 3 millimetres which results in an average spacing of the sheets of an order of magnitude ranging between 0.5 and 1.5 millimetres. The channels formed by the sheets are thus narrow which ensures high coefficients of transfer for both heat and moisture, the capacity for a unit of volume becoming large at the same time. The narrow channels are mutually parallel and extend between the lateral flat-faces of the rotor formed in this helical embodiment.

The portions of the sheets adjacent the lateral flat-face are impregnated in accordance with the invention so as to obtain a surface layer as is indicated at 14 in FIGS. 1 and 2, said layer constituting a coherent perforated disc. This impregnation implies that the impregnating agent not only penetrates through the individual sheets but also in the zones of mutual contact joins them intimately together so as to form a kind of network of homogeneous strength. In this way the rotor will be composed of a softer inner core constituting the transferer proper and two thin face layers the thickness of which may be one or a few millimetres, said two layers together constituting a supporting or framework structure which has a very high resistance capacity against bending stresses of various kinds. If thus the rotor with a vertical shaft is supported by rollers 16 it will even when having a large diameter such as up to several metres retain such evenness of its lateral flat-faces as to attain excellent sealing against a sealing member 18, for example. This sealing member has for its purpose to keep separated the two passageways for the gaseous media between which the rotor is disposed. The rotor may be provided with an outer rail 20 against which the rollers 16 bear and which may have a central gear rim 22 or the like for rotation of the rotor.

The complete joining together of the end portions of the individual sheets in the zones of mutual contact is effected by means of non-shrinking synthetic resins such

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as an epoxy resin. This resin withstands temperatures up to about 100° C. It is thus of importance that the resins employed neither during their application nor a subsequent curing provoke cracks in the rotor which could result in a non-uniform distribution of the media passing through the rotor and further endanger the coherence or mechanical strength of the rotor, in particular if a crack should follow one and the same winding around the circumference.

Some phenolic resins can also be made shrinkage-free while they at the same time have a kind of welding effect by bonding together not only the individual fibres in a sheet but also two sheets at the zones of contact. A phenolic resin of this type preferably is chemically neutral. It should thus not be alkaline to an appreciable degree. The pH value is much dependent on the character of the curing process, another important factor being the stage of condensation which should be low with the shrinkage-free type.

In some cases it is suitable to pre-treat asbestos paper with substances such as resins, for example a phenolic resin, which have a good through-impregnating or stiffening effect on the fibres, but a less bonding effect. This pre-treatment may comprehend the total sheet material included in the transferrer. Thereafter the face layers are formed according to the invention by means of a substance such as a resin which thus produces a kind of welding together of the sheets or windings along the face zones of the packing. The pre-treatment entails to the asbestos sheets an improved strength in particular when in a wet state, whereas the suitability of the asbestos fibres to serve as carriers for a hygroscopic salt or a mixture of such salts remains unimpaired. By the subsequent treatment according to the invention the accent is put to accomplishing the coherent face layer which has so small depth that it will not matter that it due to this last-mentioned treatment becomes more or less inactive as transferrer of moisture.

The resins may be plasticized by addition of various substances in small quantities such as 1 percent each of lactic

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acid and glycerine. The result is a minor plasticization which reduces the danger of cracks being formed in the resin due to changes in temperature. Such changes in temperature will occur both when the finished rotor removed from a hot curing zone is cooled down to room temperature, and when the rotor is in operation which means when it alternately passes a regenerating zone and a drying zone in a drying system.

It is important that the channels are kept open in the face layer, and for removal of excess of impregnation agent air may be sucked or blown through said channels while the agent still is in liquid state.

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 to be limited thereby, but its scope is to be determined by the appended claim.

What I claim is:

A wheel-like transferrer of a thermodynamic characteristic of air comprising a plurality of pairs of thin sheets of fibrous material, at least one of the sheets of each said pairs being corrugated and engaging the other sheet at spaced intervals to mutually support each other and form a mass of adjacent peripherally enclosed tubular parallel cells open at both ends to allow moisture and gas to flow through said cells, the end portions of said cells forming flat faces at each end of said transferrer, said end portions being impregnated with a stiffening material to form said flat faces into relatively hard coherent fluted discs and which material in addition thereto bonds said sheets together along their points of engagement whereby to prevent deformation of said faces while maintaining the inner core of said transferrer relatively soft.

References Cited in the file of this patent

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