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FOREIGN PATENTS

458,882 8/1949 Canada 165/8

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[54] **TRANSFER WHEEL ASSEMBLY FOR AIR
 CONDITIONER**
15 Claims, 5 Drawing Figs.

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 29/156.8, 29/157.3, 165/10, 261/83, 261/92

[51] Int. Cl. F28d 19/04

[50] Field of Search 165/8—10;
 29/157.3, 156.8; 261/92, 83

[56] **References Cited**
UNITED STATES PATENTS

2,909,363 10/1959 Kolthoff, Jr. et al. 165/9
 3,391,727 7/1968 Topouzian 165/9

ABSTRACT: To hold radially extending blades of a transfer wheel in a desired orientation in the wheel notches are provided in the axially facing edges of each blade and a hub is provided which includes a pair of generally annular, axially spaced projections projecting toward each other. The radially outer ends of the blades are trimmed to length using the notches as a reference point and the hub projections fit into the blade notches. The notch and projection connection holds the blades against radial movement relative to the hub. The hub is also provided with a number of ribs spaced circumferentially with respect to each other and all arranged in radial spaced relation from the hub projections. Each blade extends between an adjacent pair of ribs for engagement by the ribs to thereby prevent angular movement of the blades.

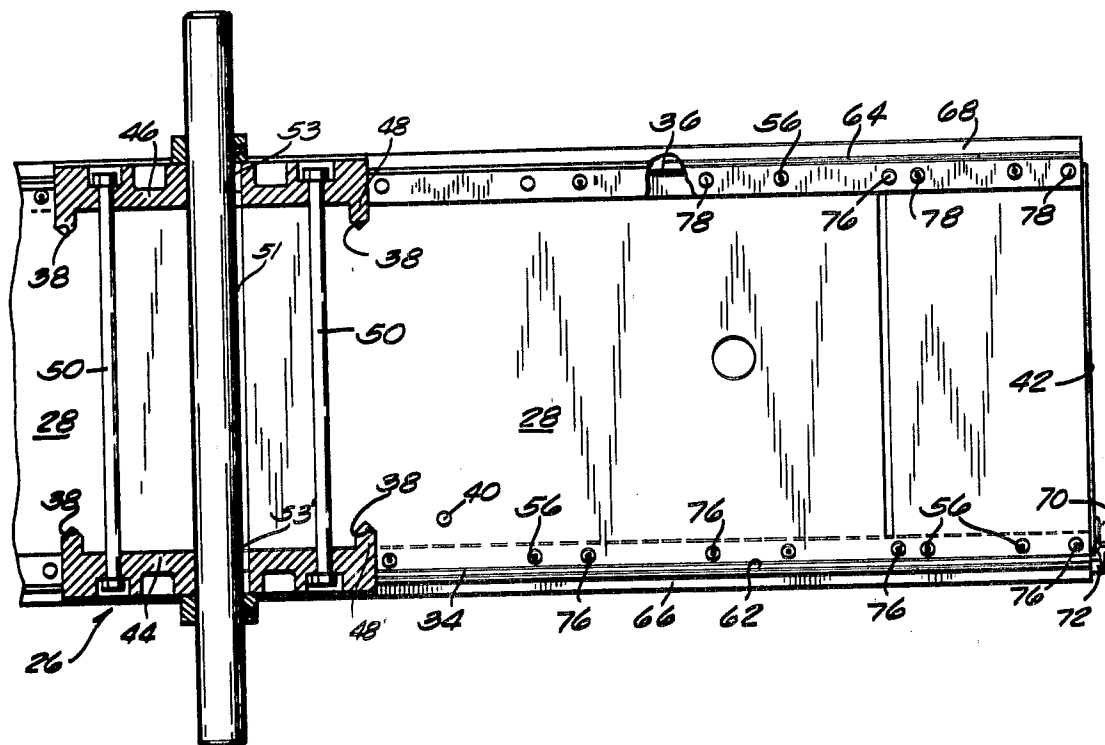


Fig. 5

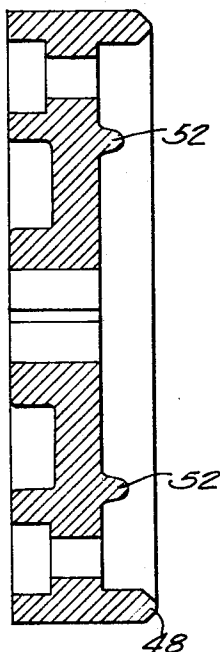


Fig. 4

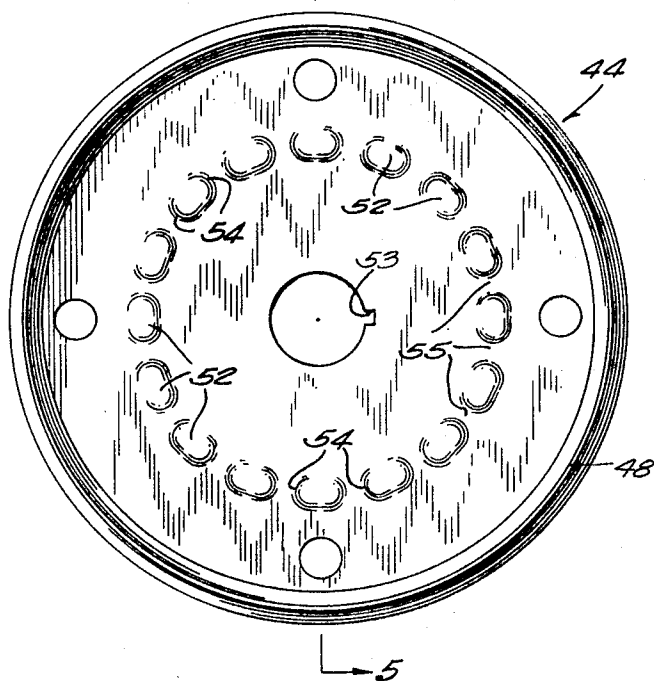
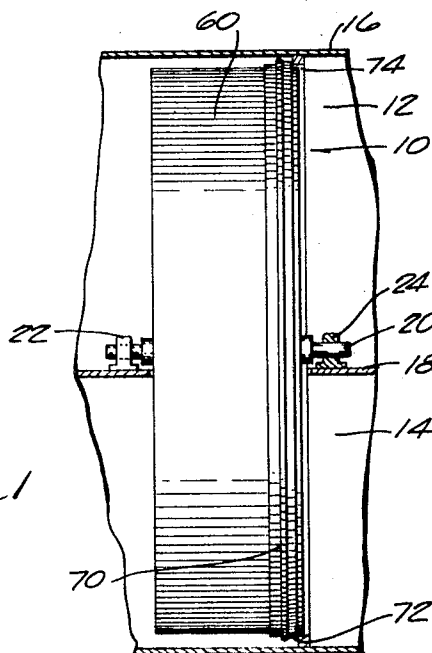
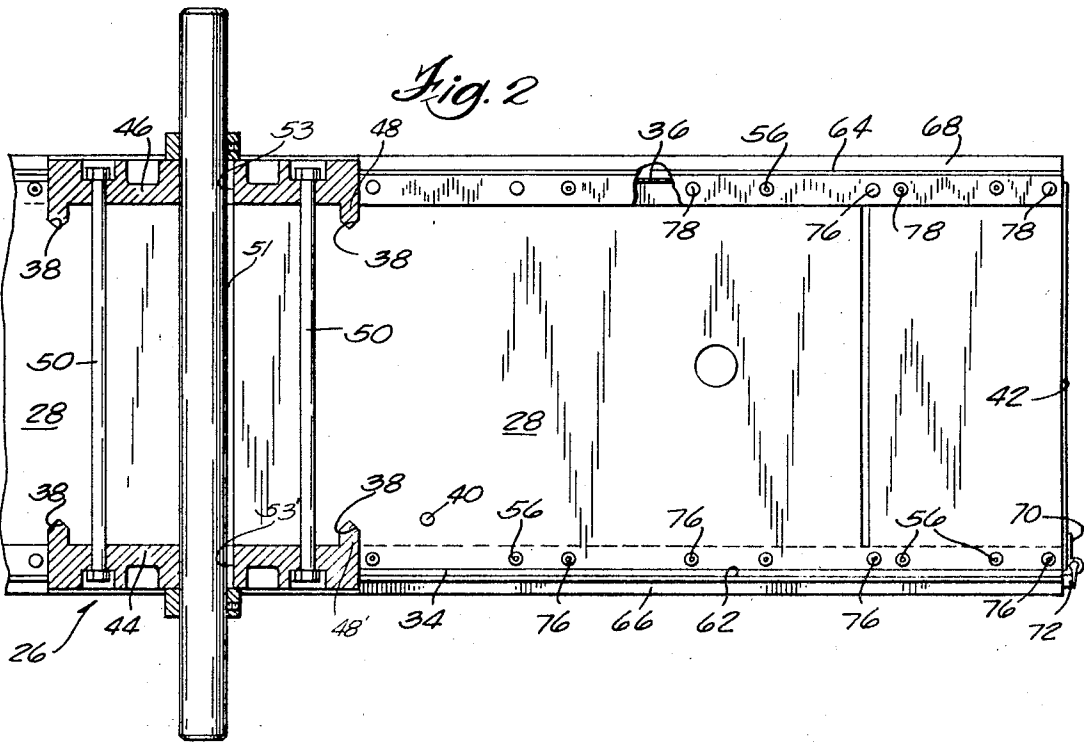
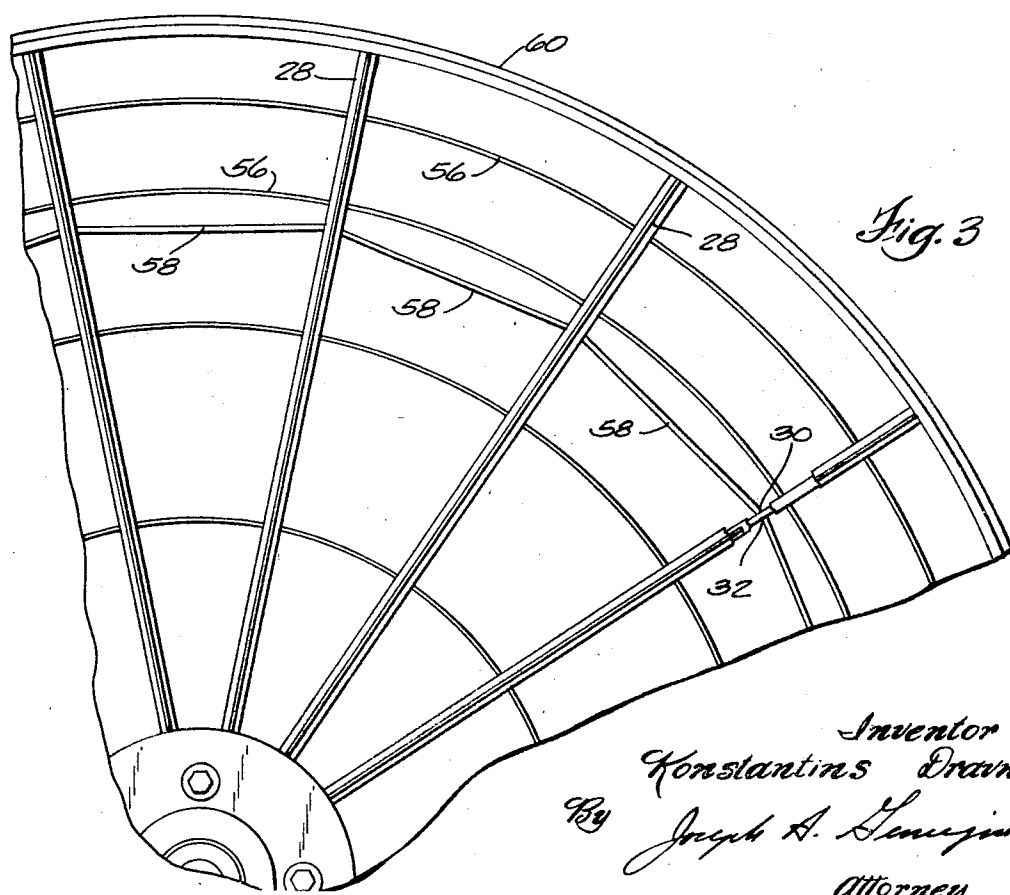


Fig. 1



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TRANSFER WHEEL ASSEMBLY FOR AIR CONDITIONER

BACKGROUND OF INVENTION

This invention relates to air conditioners and, more particularly, to transfer wheels as used in apparatus for conditioning air.

Apparatus is well known wherein a wheel is arranged to rotate through two separate air passages. The wheels include transfer media capable of conditioning the air flowing in one passage on the basis of the condition of the air flowing in the other passage. That is, the wheel can alter, for example, the temperature or humidity condition of the air flowing in one passage in accordance with the condition of the air flowing in the other passage. U.S. Pat. Nos. 2,723,837 and 3,251,402 contain examples of such units.

SUMMARY OF INVENTION

An object of this invention is to provide a connection of the blades in the wheel which will establish and effectively maintain a desired orientation of the blades in the wheel and thereby insure maintaining an effective seal in the wheel area.

For the achievement of these and other objects, this invention proposes an arrangement wherein notches are provided, preferably, in the blades to be assembled into the wheel. The notches are used as a reference in trimming the blades to length and also in making the connection of the blades to a supporting hub. The blade notches have a preselected orientation relative to the blade ends. The hub is provided with projections which have a preselected orientation with respect to the axis of rotation of the wheel. These projections fit into the notches and with the notches provide a connection effective to establish blade orientation in the wheel assembly and to maintain that orientation during wheel operation. It will be appreciated that the notches and projections may be reversed as between the blades and hub. In this regard, the hub is also provided with a number of generally radially extending surfaces spaced from the hub projections and also spaced circumferentially relative to each other. Each blade extends between an adjacent pair of these radially extending surfaces for engagement by the surfaces to afford further means for holding the blades in the desired orientation in the wheel assembly.

Preferably, in the fabrication of the wheel a longitudinal edge of each blade is selected as a reference point. From that edge as a reference point, notches are made in the blade edges. Subsequently, using the notches as a reference point, the outer radial ends of the blades are trimmed. The attachment brackets for affixing blade seals to the blades are accurately located first by using the reference edge to locate one set of attachment brackets along one blade edge and then using that set for locating the attachment brackets for the seal at the other blade edge.

DESCRIPTION OF DRAWINGS

FIG. 1 is a generally schematic illustration of a portion of an air conditioning installation containing a transfer wheel assembly constructed in accordance with this invention;

FIG. 2 is an axial section of a portion of the transfer wheel;

FIG. 3 is a front elevation of a portion of the transfer wheel;

FIG. 4 is a front elevation of a portion of the hub; and

FIG. 5 is a section view generally along line 5-5 of FIG. 4.

DESCRIPTION OF PREFERRED EMBODIMENT

With particular reference to the drawings, transfer wheel assembly 10 is illustrated in FIG. 1 as mounted for rotation through two separate airflow passages 12 and 14. The airflow passages can be defined by a circular outer housing section 16 and a common diametrically disposed wall 18. In this manner housing 16 functions as a shroud around the transfer wheel assembly insuring passage of air flow through the wheel, this flow of air flow through the wheel will be described more completely hereinafter. It should be appreciated, however,

that the actual configuration of the passages and housing is not critical so long as the airflow in the passages in channeled through the wheel assembly. For example, the housing section may be rectangular in cross section with an interior panel bearing a circular opening in which the wheel rotates. The function of the transfer wheel assembly is to alter the condition (temperature or humidity) of the air flowing in one passage, 12 or 14, in accordance with the condition (temperature or humidity) of the air flowing in the other passage. Structurally, the transfer wheel assembly includes a shaft 20 mounted in bearings 22 and 24 supported, for example, on common housing wall 18 so that the transfer wheel assembly is rotatable through both air passages 12 and 14.

The structure of the transfer wheel assembly is perhaps best illustrated in FIGS. 2 and 3. The wheel assembly includes a central hub 26, which carries shaft 20, and a number of generally imperforate blades 28 projecting radially from the hub with respect to the shaft. The blades are all of the same configuration and only one blade will be described in detail. As can be seen from FIGS. 2 and 3, the blades 28 are elongated and generally planar having opposite major faces 30 and 32 which have both a radial and axial extension. The longitudinal sides 34 and 36 of the blades are each provided with a notch 38. In fabricating the blades, one of the longitudinal sides is selected as a reference side. In this instance, side 34 is selected and is marked by a hole 40 which is punched in the blade adjacent that reference side. All of the blades are provided with a similarly located reference hole 40. Using side 34 as a reference, notches 38 are formed in the blade and subsequently, using the notches as a reference point, the outer radial ends 42 of the blades are cut to trim the blades to the proper length. In other words, the notch is used as the gauging point for accurately establishing the length of the blade.

Hub 26 includes two generally identically formed hub sections 44 and 46. Again, the hub sections are identical and only one section will be described in detail. With particular reference to FIGS. 4 and 5, hub section 44 is generally circular and includes a generally annular projection 48. The annular projection is accurately located with respect to the center or axis of the hub so that when the hub is assembled on the shaft 20 the annular projection will also be accurately located with respect to the shaft and the axis of rotation of the transfer wheel assembly, i.e. concentric. The two hub sections 44 and 46 are interconnected by bolt assemblies 50. In their assembled relationship, the hub sections, and consequently the annular projections 48 and 48' thereof, are spaced axially with respect to each other. Projections 48 and 48' extend toward each other and have configuration complimentary to that of the notches into which they fit. In this connection, other complimentary configurations can be used.

With the hub sections 44 and 46 assembled as illustrated in FIG. 2, the blades are positively held in position with respect to the shaft 20, and consequently the axis of rotation of the transfer wheel assembly, by the notch and projection connection formed by projections 48 and 48' and notches 38. The interengagement achieved by this notch and projection connection establishes a maximum, fixed radial extension of the blades from the hub or axis of rotation and also hold the blades in a desired radial orientation perpendicular to the axis of rotation of the transfer wheel assembly. The blade edges are preferably relieved in all areas except at projections 48 and 48' so that engagement occurs only in area of the projections to insure positive engagement and accurate blade location.

To further insure a precise orientation of the blades with respect to the axis of rotation and to insure maintaining that precise orientation, the hub sections 44 and 46 are provided with additional projections or ribs 52 best visible in FIGS. 4 and 5. The ribs are circumferentially spaced about the axis of rotation and are also radially spaced from hub projections 48 and 48'. Each of the ribs includes a generally radially extending surface 54 with the radially extending surfaces of adjacent ribs being in opposed relationship and defining spaces 55 therebetween. In the transfer wheel assembly, the inner radi-

ally ends of each blade extends into a space 55 between an adjacent pair of ribs 52. The opposed generally radially extending surfaces 54 of the ribs engage the opposite surfaces 30 and 32 of each of the blades. This interengagement between ribs 52 and the blade surfaces provides an additional engagement between the blade and hub to further insure proper orientation of the blades. More particularly, the ribs cooperate in holding the blades in a precise radial plane with respect to the axis of rotation.

It should also be noted that hub sections 44 and 46 are held in alignment, i.e. with ribs 52 and spaces 55 therebetween in axial alignment, by a common key 51 engaged in Keyways 53 and 53'.

As can be seen in FIG. 2, the blades are relatively spaced apart with each extending in a precise radial plane. A generally pie-shaped segment is defined in the wheel assembly between each pair of adjacent blades, each segment being isolated from an adjacent segment by the imperforate blade. These pie-shaped areas are filled with condition transferring media which is capable of transferring temperature or humidity conditions from one of the flowing air streams to the other. This transfer media can take any conventional well-known form for example, crimped metal mesh. The areas between adjacent blades are filled with this transfer media and wires 56 are provided over the axial faces of the wheel assembly to cooperate in holding the media in place. Also, stiffener members 58 can be positioned between adjacent blades to lend overall rigidity to the transfer wheel assembly.

To complete the structure of the transfer wheel, an outer imperforate, generally cylindrical ring 60 extends around the transfer wheel assembly. Ring 60 is suitably attached to the blades for example by spot welding to the outer radial ends 42 of the blades. Ring 60 cooperates to further isolate adjacent media areas. Extruded brackets 62 and 64 are attached to the longitudinal sides 34 and 36 of each of the blades. These brackets carry resilient sealing strips 66 and 68. Sealing strips 66 and 68 are positioned to engage common wall 18 as the wheel rotates to thereby maintain general isolation between air passages 12 and 14 and prevent direct flow through and between the passages.

Also, an additional bracket 70 is attached to rim 60 and carries a resilient sealing member 72. Sealing member 72 is intended to seal the periphery of the ring to prevent airflow bypassing the transfer wheel assembly. As can be seen in FIG. 1, sealing member 72 engages an annular baffle 74 to seal the upstream side of the wheel from the downstream side except for flow through the wheel assembly itself.

Also, in the fabrication of the blades, that is in addition to the procedures already discussed, the points of attachment 76 for bracket 62 are located in the blade using edge 34 as a reference point. Subsequently, the points of attachment 78 for bracket 64 are located using the attachment point 76 as a reference point. This then completes the structure of the blade and of the overall wheel assembly with the blade accurately orientated with respect to the axis of rotation and the various seals accurately located on the blade.

With this arrangement, the outer radial end of the blades are accurately located and the interconnection provided by the notch and projection connection between the blade and hub provide a maximum, fixed radial extension of the blade and also a precise radial orientation of the blade. That is, the blade is located in a precise radial plane. The interengagement between ribs 52 and the blades also cooperate in establishing this location of the blades in a precise radial plane. The hub and blade interengagement not only initially accurately locates the blade but also holds the accurate orientation during operation of the transfer wheel assembly. With this arrangement, precise alignment of sealing members 66, 68 and 72 with respect to the passage sealing surfaces which they are to engage is also maintained during operation. It has been observed that with this arrangement, a precise concentric orientation of the blades and seals with respect to the axis of rotation of the transfer wheel assembly is maintained over extended usage of the transfer wheel assembly.

I claim:

1. A transfer wheel assembly comprising, in combination, a shaft defining an axis of rotation, hub means operatively associated with said shaft for rotation about said axis, a plurality of blades projecting radially relative to said axis and having generally axially facing and oppositely directed side portions.

means defining a projection and notch connection between said hub means and blades and providing engagement between said hub means and blades at said blade side portions to hold said blades in a preselected orientation relative to said axis,

the portions of said projection and notch defining means in said blades having a preselected orientation relative to the radially outer end of each of said blades and the portions of said projection and notch defining means on said hub means having a preselected orientation relative to said shaft,

and condition transfer medium supported within said wheel and being pervious to flow of a gaseous medium and capable of providing a condition transfer between itself and the gaseous medium flowing therethrough, said condition transfer medium separated into distinct portions within said wheel by said blades with said blades isolating adjacent portions of said transfer medium so that the condition of one transfer medium portion.

2. The combination of claim 1 including a generally cylindrical member engaging and connected to said blades at the radially outer ends of said blades for rotation therewith, said cylindrical member extending around and closing the periphery of said wheel assembly as defined by said radially outer blade ends.

3. The combination of claim 1 wherein said blades are generally planar in an axial direction.

4. The combination of claim 1 wherein said hub means include a plurality of pairs of opposed generally radially extending surfaces spaced radially from said projection and notch connection,

and wherein each of said blades extend between a respective pair of said hub means radially extending surfaces for engagement of said blades by said hub means radially extending surfaces to cooperate in holding said blades in said radially projecting orientation.

5. The combination of claim 4 wherein said blades are generally planar in an axial direction and include opposite planar surfaces having both an axial and radial extension, and said opposite planar blade surfaces are engaged by said radially extending surfaces of said hub means.

6. The combination of claim 5 in combination with means defining first and second passages,

and including partition means separating said first passage from said second passage,

and wherein said wheel assembly is arranged for rotation through both said first and second passages,

and further including sealing means connected along both of the radially extending, axially facing sides of said blades and arranged for engagement with said partition means.

7. The combination of claim 6 including circular baffle means within said passages and extending generally around the periphery of said wheel assembly, and generally circular sealing means connected to and extending around said wheel assembly adjacent the outer periphery thereof and engaging said baffle means to prevent flow bypassing said wheel assembly.

8. The combination of claim 4 wherein said hub means includes first and second hub means portions arranged with said blade means therebetween and means connecting said hub means portions to each other and said blades.

9. The combination of claim 8 wherein said blades are generally planar in an axial direction and include opposite planar surfaces having both a radial and axial extension,

including means defining notches in the opposite axial facing sides of each of said blades,
 each of said hub means portions including axially extending first projections arranged with the first projections on one hub means portion extending toward the first projections on the other hub means portion,
 and said first projections engaged in said blade notches and holding said blades against radial displacement.

10. The transfer wheel assembly of claim 9 including means on each of said hub means portions defining a plurality of axially extending second projections spaced circumferentially on said hub means portions and spaced radially from said first projections, the second projections on one of said hub means portions extending toward the second projections on the other hub means portions,
 and each of said blades disposed between said first and second hub means portions and extending between a pair of adjacent ones of said second projections on each of said hub means portions, said second projections engaging and holding said blades in the desired orientation relative to said hub means.

11. The combination of claim 10 in combination with means defining first and second passages,
 and including partition means separating said first passage from said second passage,
 and wherein said wheel assembly is arranged for rotation through both said first and second passages,
 and further including sealing means connected along both of the radially extending, axially facing sides of said blades and arranged for engagement with said partition means.

12. The combination of claim 11 including circular baffle means within said passage and extending

generally around the periphery of said wheel assembly, and generally circular sealing means connected to and extending around said wheel assembly adjacent the outer periphery thereof and engaging said baffle means to prevent flow bypassing said wheel assembly.

13. The method of fabricating a transfer wheel comprising the steps of

forming a plurality of generally elongated blades, forming a notch in the opposite longitudinal sides of each of said blades,

using at least one of said notches as a reference point, trimming one of the longitudinal ends of each of said blades,

forming a hub with opposed, axially spaced first projections, assembling said blades on said hub with said first projections engaged in said notches and with said blades projecting radially from said hub with said trimmed blade ends spaced radially out from said hub,

and positioning gaseous medium pervious condition transfer material between adjacent ones of said blades.

14. The method of claim 13 including the steps of providing a plurality of axially extending, circumferential spaced second projections on said hub and spaced radially from said first projections,

and positioning each of said blades between a pair of adjacent second projections and for engagement by said second projections so that said second projections cooperate in holding said blades in said orientation projecting radially from said hub.

15. The method of claim 14 including the steps of using one of the longitudinal edges of each of said blades as a reference edge in making said notches.