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ROTOR CONSTRUCTION FOR CENTRIFUGAL ROTOR FIBERIZATION

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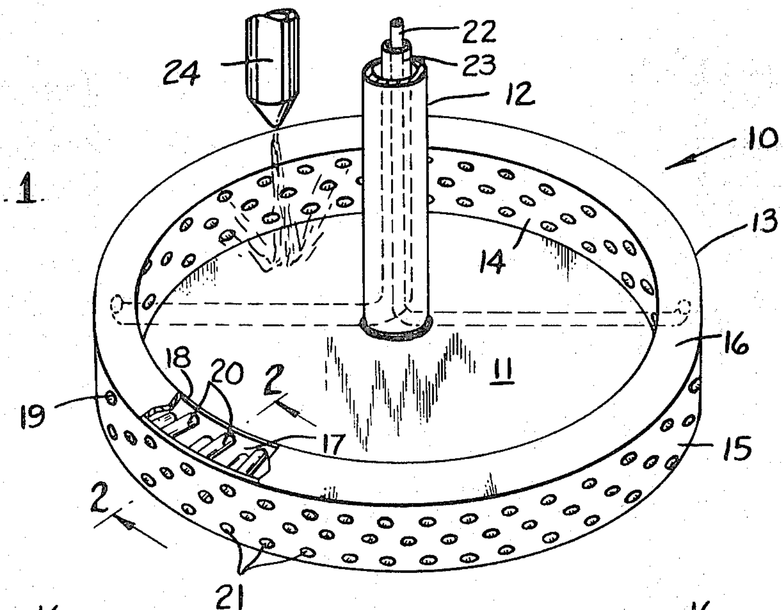

Fig. 1

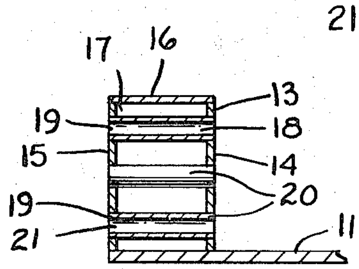

Fig. 2

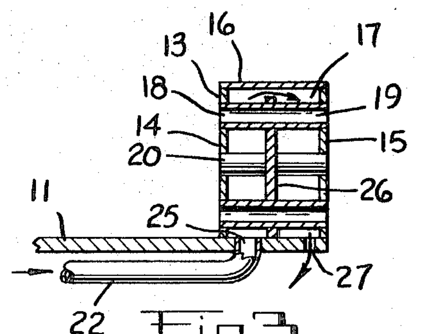

Fig. 3

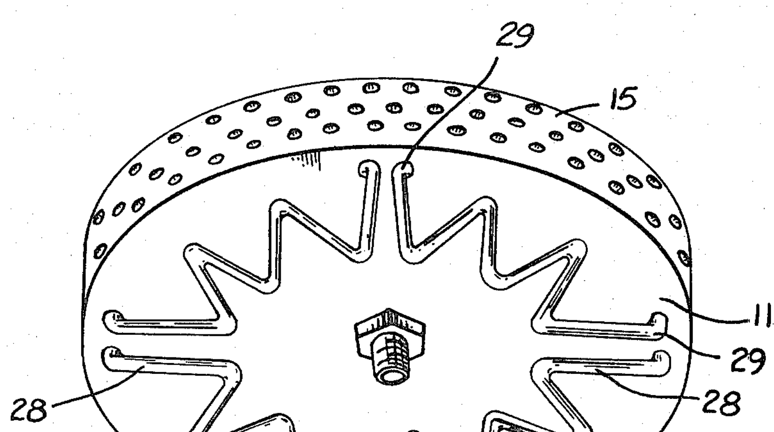

Fig. 4

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U.S. Cl. 65—15 9 Claims

ABSTRACT OF THE DISCLOSURE

An improved rotor construction for centrifugal formation of filaments of thermoplastic material in fiberization systems wherein the peripheral wall of the rotor having radial directed orifices for filament ejection is constructed as a double walled closed annular chamber for circulation of coolant.

BACKGROUND OF THE INVENTION

In centrifugal rotor fiberizing systems for the manufacture of thermoplastic fibers such as glass wherein a rotor distributes the molten material and forms and ejects primary filaments thereof radially through the orifices in the annular wall surrounding the periphery of the rotor for attenuation into fine fibers by means of an impinging gaseous blast, the diameter of the primary filaments thus formed and then attenuated constitutes a significant factor in determining the size and in turn the insulating properties, among other significant characteristics, of the resultant fibrous product. And, the diameter of the primary filaments issuing from the rotor orifices at any given viscosity of the molten material which is a function of the temperature and given revolutions per minute of the rotor creating the centrifugal force, is directly attributable to the diameter of the orifices of the forming rotor. Although the rotor wall orifices can easily be initially made to precise dimensions, continuous exposure to the very aggressive conditions of the high temperature of melts such as glass and the abrasion of the ejecting molten material passing therethrough rapidly and erratically erodes away the adjacent metal not only enlarging the size of the orifice but distorting its shape and thereby degrading the fibrous product formed and the fiberizing procedure. In addition to being detrimental to the manufacturing operation and product quality, the metal components of the rotor are warped and distorted and the apparatus is rapidly deteriorated by the high temperatures requiring uneconomical frequent replacements and loss of production, or remedial measures of the use of excessively costly metals such as platinum rotors or components like platinum orifice insert liners.

SUMMARY OF THE INVENTION

This invention comprises an improved rotor or rotor construction design wherein the annular wall about the rotor periphery constitutes a double walled, closed chamber with the rotor orifices for the formation and ejection of the primary filaments comprising conduits passing through the annular closed chamber in radial direction whereby the integrity and dimensions of the rotor wall and orifices can be maintained by a coolant circulating through the closed chamber and passing about the orifices and the conduits connected therewith.

Objects and advantages of the improved rotor or rotor construction of this invention comprise an apparatus which

will effectively endure higher temperature conditions or melts of up to about 2600° F. or greater without deterioration or distortion of its essential structure or dimensions, maintain the critical primary filament forming and ejecting orifice size and configuration by resisting erosion and wear over prolonged periods of use and contact with very high temperature melts thereby preserving the quality and consistency of the product and of the forming operation, and extensively prolongs the serve life of the apparatus.

BRIEF DESCRIPTION OF THE DRAWING

The above and other objects and advantages of the improved rotor of this invention as well as construction details will become more apparent in the hereinafter detailed description of preferred embodiments thereof and the accompanying drawings in which:

FIG. 1 is a pictorial view illustrating a rotor constructed according to this invention, with a cut away portion showing the conduits passing through the closed chamber;

FIG. 2 is a vertical sectional view of the rotor peripheral wall along lines II—II of FIG. 1 illustrating in detail the conduits traversing the closed chamber and connecting the outlet orifices within the walls of the chamber;

FIG. 3 is a vertical sectional view of the rotor peripheral wall similar to that of FIG. 2, illustrating in detail a modified cooling system; and,

FIG. 4 is a pictorial view of the underside of a rotor construction illustrating a further embodiment of a cooling system.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, the centrifugal rotor **10** is composed of circular base plate **11**, mounted on drive shaft **12** conventionally provided with suitable mounting bearings, not shown, and connected with means such as a motor to rotate the rotor at high speed. The annular wall **13** about the periphery of the base plate **11** and extending generally upwardly therefrom, is constructed of a first or inner wall **14** and a second or outer wall **15**, each fixed to the base plate **11** and generally parallel to each other. Walls **14** and **15** are provided with a top **16** to form, along with a portion of base plate **11**, an annular enclosure or closed chamber **17** for the containment and circulation of a fluid coolant.

A plurality of complemental pairs of orifices **18** and **19** are provided in the first and second walls **14** and **15** respectively and each complemental pair **18** and **19** of walls **14** and **15** is connected to each other in sealing relationship by means of conduits **20** providing radial directed outlets **21** through annular closed chamber **17**. Outlets **21**, formed by conduits **20** connecting each complemental pair of orifices **18** and **19** are preferably provided in a multiplicity of vertically arranged rows as illustrated with the diameter of outlets **21**, their number and dispersion according to conventional practice for the particular conditions to be employed.

Fluid coolant for circulation through annular closed chamber **17** surrounding outlets **21** formed by conduits **20** connecting complemental pairs of orifices **18** and **19**, is carried to and from chamber **17** by means of tubes **22** and **23** concentrically arranged one within the other and extending down through drive shaft **12** then, as shown by the broken lines, extending outwardly under rotor base **11** to the periphery thereof where they are connected with closed annular chamber **17** for the supply and return of fluid coolant circulating through chamber **17**.

Pipe **24** delivers molten material such as glass to the rotor and deposits the melt on rotor base **11** for dispersion by the rapidly rotating rotor whereupon the developed centrifugal force distributes the molten material substantially uniformly over the interior of annular wall **13** extending upwardly from base **11** and then outwardly through outlet orifices **21** in substantially continuous filaments of highly uniform diameter into the path of an appropriately directed gaseous blast not shown for attenuation as is conventional in rotor fiberization systems.

In the embodiment illustrated in FIG. 3 coolant fluid is carried into the closed chamber **17** and permitted to be discharged downwardly from under the rotor base **11** away from the area of primary filament ejection and gas blast attenuation. Referring to the drawing of FIG. 3, coolant conduit **22** extends from drive shaft **12** under rotor base **11** carrying coolant fluid to chamber **17** through opening **25** in the rotor base **11**. Closed chamber **17** is divided by baffle **26** extending up from the rotor base **11**, positioned generally intermediate and parallel to the first and second walls **14** and **15** to a height short of contact with top **16** to provide for fluid communication through the chamber **17** over baffle **26**. Fluid coolant inlet opening **25** is positioned in the rotor base **11** on one side of baffle **26** and a fluid coolant outlet opening **27** is positioned on the opposite side of baffle **26** whereby the flow of coolant from conduit **22** passes upwardly from the inlet opening **25** in chamber **17** over baffle **26** and down in chamber **17** and exits through outlet **27**, thus effectively contacting all potrions of the interior of chamber **17** and conduits **20** connecting the complemental pairs of orifices **18** and **19** which function to form and eject primary filaments, radially outwards thereby cooling and preserving the structure. The number and location of coolant carrying conduits **22** distributing the coolant fluid to chamber **17** and chamber **17** inlet and outlets **25** and **27**, or baffle arrangement **26** may of course be varied to meet the temperature conditions of any particular system.

FIG. 4 illustrates a typical apparatus for use with a molten metal coolant requiring a closed circuit system whereby circulation is achieved by rotational forces. In this embodiment a low melting material such as tin, zinc, lead, etc. fills the closed annular chamber **17** and the ducts of the closed circuit which is formed by ducts **28** fixed below rotor base **11**, preferably in a circuitous path to extend their exposure to the atmosphere and available cooling surfaces. Ducts **28** are in communication with closed annular chamber **17** through openings **29** through rotor base **11**. Chamber **17** may additionally include baffles such as **26** in FIG. 3 to prevent channeling of the coolant and achieve maximum circulation. The heat transferring and dissipating ducts **28**, fixed below rotor base **11**, may be deployed in any apt arrangement or number such as a nest of tubes to achieve efficient cooling or dissipation of the heat carried away from chamber **17** including the use of cooling fins, not shown, commonly employed to increase heat radiating surfaces, or to induce surrounding air currents passing over the cooling means.

In addition to providing baffles in closed annular chamber **17** to control or direct the circulation of coolant fluid to achieve maximum effectiveness, the chamber can be divided into segments to correspond with independent sectional coolant distributors such as a manifold coolant supply and return. Also the supply of coolant and/or its temperature can be regulated to achieve the freezing of a thin coating of the molten material being fiberized about the surface of outlets **21** including conduits **20** with orifices **18** and **19** and inner wall **14** thereby providing a protective layer on all critical surfaces with the solidified melt shielding such areas from wear. Additionally, through control of the thickness of the protective coating through regulation of the coolant the diameter of the primary filament forming orifices **21** can be adjusted, especially to offset their enlargement due to wear.

Centrifugal rotors of the construction or design of this invention may of course be fabricated from any suitable metal or alloy possessing adequate thermal resistance to meet the particular melt temperature conditions of its intended application, and with suitable metals or alloys available and known to the art the invention makes operations practical with melts ranging up to approximately 3000° F.

It will be understood that the foregoing details are given for the purpose of illustration, not restriction, and the variations within the spirit of this invention are intended to be included within the scope of the appended claims.

What I claim is:

1. In an apparatus for use in rotary systems of fiberization wherein a supply of molten material is deposited on the base of the rotor and urged by the centrifugal force of rotation through orifices in a peripheral wall of the rotor to produce filaments of the molten material for attenuation into fibers, including: (a) a circular rotor base having a peripheral wall means extending upwardly therefrom; (b) means for rotating said base about an axis extending generally perpendicular thereto; and, (c) the improvement comprising the peripheral wall means of said circular rotor base having a first and second wall forming a double wall closed annular chamber extending upwardly from the periphery of the circular rotor base, each the first and second walls extending upwardly from the base having a plurality of complemental pairs of orifices therein connected to each other in sealing relationship by means of a conduit to provide radial outlet passages thorugh the double wall closed annular chamber comprising the peripheral wall means extending upwardly from the periphery of the circular rotor base for the centrifugal formation and ejection of molten filaments and means for circulating cooling fluid through the rotary system.

2. In an apparatus of claim **1** wherein the plurality of complemental pairs of orifices in the said first and second walls and connected to each other in sealing relationship with a conduit passing through the double wall closed annular chamber providing radial outlet passages therethrough are arranged in at least two annular rows about the peripheral wall means.

3. In an apparatus of claim **1** wherein the double walled closed annular chamber extending upwardly from the periphery of the circular rotor base has at least two conduits communicating with the interior thereof to provide for the supply and return of fluid coolant circulating into and through the double walled closed annular chamber.

4. In an apparatus of claim **3** wherein the circular rotor base is supported by and rotated through a hollow dry shaft secured centrally thereto and the two conduits communicating with the interior of the wall enclosed annular chamber for the supply and return of the circulating coolant extend down through the hollow dry shaft with one concentrically positioned within the other to the underside of the rotor base.

5. In an apparatus of claim **4** wherein the plurality of complemental pairs of orifices in the first and second walls and connected to each other in sealed relationship with a conduit passing through the double walled closed annular chamber providing radial outlet passages therethrough are arranged in at least two annular rows about the peripheral wall means.

6. In an apparatus of claim **1** wherein the double wall enclosed annular chamber extending upwardly from the periphery of the circular rotor base has at least one conduit communicating with the interior thereof to provide for the supply of fluid coolant circulating into and through the double walled closed annular chamber and said chamber having at least one outlet opening in the underside thereto for the discharge of the circulating fluid coolant.

7. In an apparatus of claim **1** wherein the double walled closed annular chamber extending upward from the periphery of the circular rotor base is connected in fluid transmitting relation to a duct system fixed in position on the underside of the rotor base and forming a closed circuit with the annular chamber to provide means of dissipating from the coolant fluid the heat removed from the closed annular chamber.

8. In an apparatus of claim **7** wherein the duct system fixed in position on the underside of the rotor base in fluid transmitting relation with the closed annular chamber and forming a closed circuit therewith comprises a nest of tubes.

9. In an apparatus of claim **7** wherein the duct system fixed in position on the underside of the rotor base is provided with heat radiating vents.

References Cited

UNITED STATES PATENTS

2,587,710	3/1952	Downey	65—6
3,238,028	3/1966	Simmers	65—6

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