Feb. 13, 1962 M. CHARPENTIER ET AL 3,020,586

APPARATUS FOR PRODUCING FIBERS

Filed June 11, 1958

2 Sheets-Sheet 1

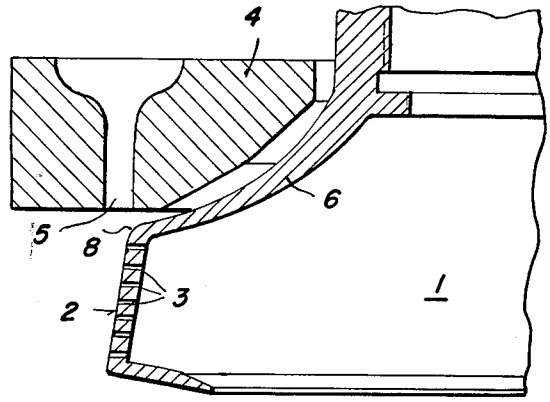


FIG. 1

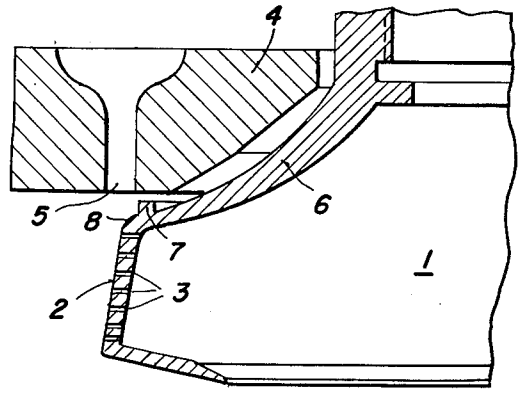


FIG. 2

FIG. 3

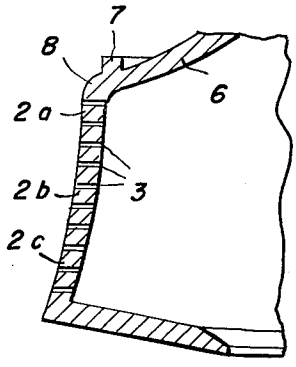
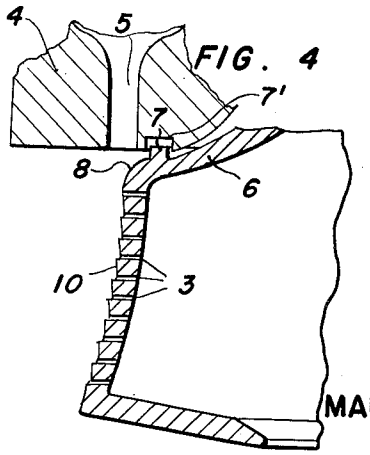


FIG. 4



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2 Sheets-Sheet 2

FIG. 5

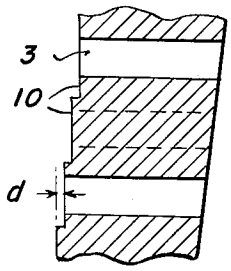


FIG. 6

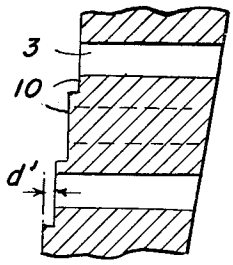


FIG. 7

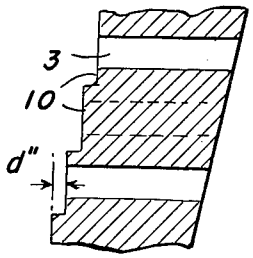


FIG. 8

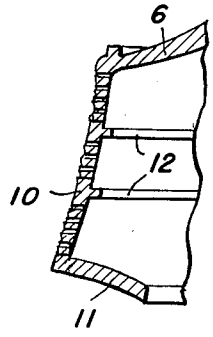


FIG. 9

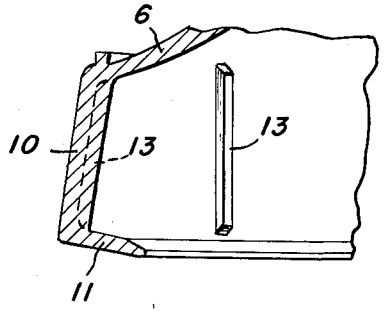
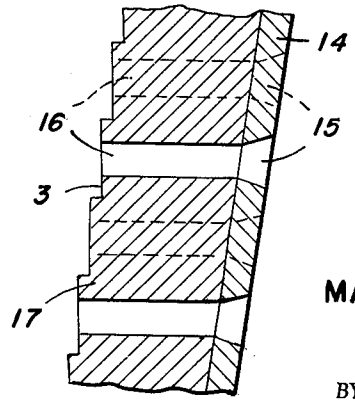


FIG. 10



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3,020,586

APPARATUS FOR PRODUCING FIBERS

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Claims priority, application France June 17, 1957
12 Claims. (Cl. 18—2.5)

The present invention relates to the manufacture of fibers from thermoplastic material in the viscous state, and in particular to the manufacture of glass fibers.

The invention relates more especially to the production of such fibers according to which the melted material is conducted into the interior of a hollow body, at the periphery of which is provided a band or wall having orifices arranged in several rows. The hollow body is rotatably driven at high speed about its axis and under the action of centrifugal force, the molten material is projected through the orifices in the form of threads, which then undergo a drawing-out effect which transforms them into fibers.

It is already known, that in order to produce very fine fibers, the threads thus obtained should be subjected to the action of flames or currents of hot gases upon leaving the projection orifices.

In accordance with the invention, the upper part of the peripheral band or wall is placed over the path of the current of flames or hot gases which are spread on contact with the said band, and this upper part of the peripheral band is given a shape such that the part of the flames or hot gases which strike it are directed toward the main current of flames or hot gases by limiting as much as possible its deflection toward the upper part of the centrifuge.

The invention provides, in particular, a truncated or rounded shape for the upper part of the peripheral band which is placed in the current of the flames or hot gases. Such a disposition allows at the same time the production of fine fibers of extremely uniform diameter, as well as a highly satisfactoriiy long period of utilization of the centrifuge. This arrangement permits, in fact, the ease of maintenance of the whole periphery of the peripheral band at an even temperature, and to maintain this homogeneity of temperature during the entire operation of the centrifuge.

The invention likewise provides for placing, above the centrifuge and in the vicinity of the peripheral wall, an obstacle designed to prevent the flames or hot gases being deflected toward the upper part of the centrifuge. Particularly, an annular shoulder limiting the space between the rotating body and the wall of the combustion chamber or burner surrounding the centrifuge can be provided on the upper part of the centrifuge, this shoulder being capable of penetrating to the interior of a groove made in this wall. The annular shoulder can moreover be integral, not with the centrifuge, but with the combustion chamber or burner.

As has already been proposed, the peripheral wall may be bell-shaped or widened towards the bottom in such a way that the flames or hot gases flow along it without the possibility of separation therefrom.

It has been established, and this constitutes another feature of the inveniton, that it is advantageous to give the peripheral wall a variable conic or tapered shape whose angle at the top increases toward the bottom of said wall.

The invention provides, in particular, for imparting to the peripheral wall the shape of several superposed truncated surfaces, the angle of which at the top increases from the upper part towards the lower part.

This conformation allows the realization of a peripheral band or wall which presents good resistance to the stresses to which it is subjected at working temperatures. This resistance prevents the deformation of the band, and hence results in the maintainance of homogeneity of temperature over its entire surface. In fact, the peripheral wall usually tends to undergo a change of form by producing a swelling in the median or upper part which, in turn, tends to prevent suitable heating of the lower part of the band. It should be noted that the deformation, once started, has a tendency to accelerate itself, because the heating of the band is no longer homogeneous, and eventually the band is rendered obsolete and useless.

The present invention also contemplates, for the purpose of increasing the wear-resistance of the peripheral wall, furnishing this peripheral wall with suitably placed ribs, these ribs being annular or horizontal or directed according to a generatrix.

The mechanical resistance of the band may be increased further by suitably profiling of the lower part of the centrifuge. It has already been proposed to provide an orifice in this lower part of the centrifuge covering practically the whole lower surface of this body. The invention contemplates the shaping of the portion of the centrifuge adjacent to the band with an inclination of the order of 10° to the horizontal, and a profiling practically identical to that of the upper part of the centrifuge.

In order to facilitate the contact of the flames or hot gases over the entire height of the peripheral band, it can be provided, and this constitutes another characteristic of the invention, that projection orifices are not made in a smooth peripheral surface, but rather in a peripheral surface having rough places or protuberances, so as to increase the friction of the hot gases on the band, or to realize an adherence of the flames thereto. The invention provides particularly for the realization of a peripheral band with an exterior surface in the form of steps, each step having one or several rows of projection orifices. The offset between these steps may be constant. It may, preferably, be varied with the slope of the peripheral band, and, if desired, may increase with it.

Other characteristics and advantages of the invention will appear from the following description in conjunction with the accompanying drawings showing illustrative embodiments, wherein:

FIG. 1 is a partial sectional view of a centrifuge with a surrounding combustion chamber, illustrating one embodiment of the invention;

FIG. 2 is a view corresponding to FIG. 1 illustrating a second embodiment of the invention;

FIG. 3 is a sectional view of a portion of the centrifuge illustrating a curved peripheral wall or one composed of portions of different angularities;

FIG. 4 illustrates a variation of the peripheral wall shown in FIG. 3 provided with steps therealong;

FIG. 5 is an enlarged view of the peripheral wall shown in FIG. 4 at the upper portion thereof;

FIG. 6 is an enlarged view of the peripheral wall shown in FIG. 4 at the intermediate portion thereof;

FIG. 7 is an enlarged view of the peripheral wall shown in FIG. 4 at the lower portion thereof;

FIG. 8 is a vertical sectional view of a modified arrangement of a centrifuge provided with a reinforced bottom wall as well as horizontal reinforcing ribs;

FIG. 9 is a partial sectional view of a centrifuge provided with vertical reinforcing ribs; and

FIG. 10 is a vertical sectional view of the peripheral wall provided with projection orifices having enlarged entry openings for the purpose of minimizing the frictional resistance to material projected therethrough.

In FIG. 1 is shown the rotating body or centrifuge 1,

of which the peripheral band or wall 2 is provided with a certain number of rows of orifices 3 for the projection therefrom of the material in the melted state which is introduced to the interior of this body. The centrifuge is surrounded by a combustion chamber 4 with an annular slot 5 concentric with the centrifuge.

The upper part 8 of the peripheral band 2 is mounted below the slot 5 within the vertical projection thereof and in the path of the hot gases escaping from the annular slot 5 of the combustion chamber, and this part 8 is rounded off so that the part of the hot gases which strike it are directed toward the current which leaves the slot, and which is conveyed over the entire height of the band which has a shape that flares toward the bottom. In general, when the operating temperature is attained, the surface of the impact zone of the hot gases on the upper part of the band is between a half and a tenth of the surface of slot 5.

In the embodiment shown in FIG. 2, there is provided in addition on the upper part 6 of the rotating body an annular shoulder 7, which serves as an obstacle to limit the space between this body and the wall of the combustion chamber. The presence of this enlargement contributes toward preventing any passage of hot gases in this space. The annular shoulder 7 may be placed adjacent to the inner boundary of the annular slot 5 to constrict the space between the upper wall of the centrifuge and the combustion chamber. If desired, the shoulder on either the centrifuge or the combustion chamber may be extended to fit within a recess in the opposite member. This is illustrated in FIG. 4 wherein the shoulder 7 on the top of the centrifuge fits within an annular recess 7' in the underside of the combustion chamber 4.

In the form of the invention shown in FIG. 3, the peripheral band has a variable conic shape and is comprised of three superposed truncated surfaces 2*a*, 2*b*, 2*c* whose angle at the top increases from the upper to the lower part. Thus, the surface 2*a* can have a 7° inclination, 2*b* a 10° inclination, and 2*c* a 13° inclination with respect to the vertical. Due to this arrangement, the friction and contact of the gas current with the peripheral wall is improved all along the wall.

As is shown in FIG. 4, the friction and area of contact of the hot gases with the peripheral band is increased over the entire height of this band, by providing steps 10, each step capable of accommodating one or several rows of projection orifices 3. As shown in detailed views illustrated in FIGS. 5 to 7, the offset or displacement between the steps may be different according to the inclination of the surface. In this example, the displacement *d* increases with the inclination to the vertical, being a minimum for the small angles at the top of the peripheral wall (FIG. 5), increasing for the larger inclination of the wall at the intermediate part thereof, as shown in FIG. 6 by *d'*, and being a maximum, as shown by *d''* in FIG. 7 at the wall portion adjacent to the bottom thereof.

FIG. 8 shows a modified form of a centrifuge whose bottom 11 is inclined to the horizontal and which presents a profiling similar to that of the upper part 6 of the rotating body, and which is characterized particularly by a concavity directed towards the bottom with a variable section increasing from the peripheral wall to its extremity. This form given to the bottom 11 increases the mechanical strength of the band. In addition, internal horizontal ribs 12 are provided for the same purpose.

In the embodiment shown in FIG. 9, the ribs 13, instead of being arranged horizontally, are placed vertically and extend over the whole height of the band from bottom 11 to the upper part 6.

In order to increase the mechanical strength of the centrifuge, the thickness of its peripheral wall may be increased. However, this increased thickness increases the length of the projection channels 3 through which the molten material must pass, and consequently the resistance to the flow of this material, which in turn gives rise to the necessity of increasing the pressure of the material being fed to these channels. In order to avoid this dependence, the invention contemplates giving these channels a flared shape toward the inside of the centrifuge. Such an arrangement is shown in FIG. 10. The peripheral wall consists of two parts, the inner part 14 having the flared entry openings 15 which merge with the passages 16 which are provided in the outer part 17 which encompass the projection orifices 3. The peripheral wall may have a variable thickness, the thickness being greater at the lower part than at its upper part.

We claim:

1. An apparatus for manufacturing fibers of thermoplastic material comprising a hollow rotary centrifuge provided with an opening to receive the heated thermoplastic material in the interior thereof, said centrifuge having a peripheral wall provided with a plurality of superposed rows of orifices therein for projecting the fibers therethrough by centrifugal force, said peripheral wall having a varied angularity with the inclination thereof with respect to the vertical, increasing constantly from the top to the bottom thereof, means including an annularly-shaped slot for directing an annular hot gaseous blast against the peripheral wall of said centrifuge and onto the fibers issuing therefrom in a direction transverse to the planes of emission thereof, the upper part of said peripheral wall being disposed below said slot within the vertical projection thereof and within the path of said gaseous blast so that the portion of the blast striking said upper part of the wall is directed towards the main part of the blast with minimal deviation thereof towards the upper part of the centrifuge.

2. An apparatus for manufacturing fibers of thermoplastic material comprising a hollow centrifuge rotatable about a vertical axis and provided with an opening to receive the heated thermoplastic material in the interior thereof, said centrifuge having a peripheral wall provided with a plurality of superposed rows of orifices therein for projecting the fibers therethrough by centrifugal force, means including an annularly-shaped slot for directing an annular hot gaseous blast against the peripheral wall of said centrifuge and onto the fibers issuing therefrom in a direction transverse to the planes of emission thereof, the upper part of said peripheral wall being disposed below said slot within the vertical projection thereof and within the path of said gaseous blast so that the portion of the blast striking said upper part of the wall is directed towards the main part of the blast with minimal deviation thereof towards the upper part of the centrifuge, and protuberances on said peripheral wall to increase the frictional resistance of the gaseous blast thereon and consequently the adherence of said blast thereto without separation therefrom.

3. An apparatus as set forth in claim 2 wherein said last-mentioned protuberances are in the form of steps with each one of the steps having at least one row of the projection orifices therein.

4. An apparatus as set forth in claim 2 wherein the peripheral wall is composed of different portions of varying inclination and the protuberances are in the form of steps having a varying displacement from each other at the several inclinations, with each one of the steps having at least one row of the projection orifices therein.

5. An apparatus as set forth in claim 4 wherein the inclination of the peripheral wall to the vertical increases from the top to the bottom thereof and the displacement between the steps correspondingly increases from the top to the bottom of the peripheral wall.

6. An apparatus as set forth in claim 3 wherein said orifices are enlarged at their inlet ends for the purpose

of reducing the friction to the passage of the molten material therethrough.

7. An apparatus as set forth in claim 2 wherein said peripheral wall is formed of two juxtaposed concentric bands, the inner one having flared openings facing the interior of the centrifuge and the outer one having the orifices therein coinciding with the constricted ends of said last-mentioned openings.

8. An apparatus as set forth in claim 7 wherein said peripheral wall is of variable thickness, being of greater thickness at the bottom than at the top thereof.

9. An apparatus for manufacturing fibers of thermoplastic material comprising a hollow rotary centrifuge provided with an opening to receive the heated thermoplastic material in the interior thereof, said centrifuge having a peripheral wall composed of a plurality of superimposed truncated surfaces the angularities of which increase from the upper to the lower part and provided with a plurality of superposed rows of orifices therein for projecting the fibers therethrough by centrifugal force, means for directing an annular hot gaseous blast against the peripheral wall of said centrifuge and onto the fibers issuing therefrom in a direction transverse to the planes of emission thereof, the upper part of said peripheral wall being disposed within the path of said gaseous blast so that the portion of the blast striking said upper part of the wall is directed towards the main part of the blast with minimal deviation thereof towards the upper part of the centrifuge.

10. An apparatus for manufacturing fibers of thermoplastic material comprising a hollow centrifuge rotatable about a vertical axis and provided with an opening to receive the heated thermoplastic material in the interior thereof, said centrifuge having a flared frustoconical peripheral wall of substantial height provided with a plurality of superposed rows of orifices therein for projecting the fibers therethrough by centrifugal force, a combustion chamber surrounding said centrifuge and provided with an annular slot for directing an annular hot gaseous blast against the peripheral wall of said centrifuge and onto the fibers issuing therefrom

in a direction transverse to the planes of emission thereof, the upper part of said peripheral wall being of rounded form and disposed below said annular slot within the vertical projection thereof and within the path of said gaseous blast so that the portion of the blast striking said upper part of the wall is directed towards the main part of the blast with minimal deviation thereof towards the upper part of the centrifuge, and an annular protuberance in the space between said combustion chamber and the upper part of said centrifuge to impede the travel of the gaseous blast thereat.

11. An apparatus as set forth in claim 10 wherein said last-mentioned protuberance is formed as an annular shoulder beyond the top of said peripheral wall and adjacent to the bottom of said combustion chamber, and an annular recess in the bottom of said combustion chamber for accommodating the free end of said annular shoulder.

12. An apparatus as set forth in claim 2 wherein said centrifuge is provided with a curved top wall extending inwardly from the top of said peripheral wall, and a curved bottom wall on said centrifuge extending inwardly from the bottom of said peripheral wall at an angle of approximately 10° to the horizontal and having an inwardly directed convex curvature substantially in conformity with that of said top wall.

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