March 3, 1953 I. PEYCHES 2,629,969

MANUFACTURE OF FIBERS SUCH AS GLASS FIBERS

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FIG. 1.

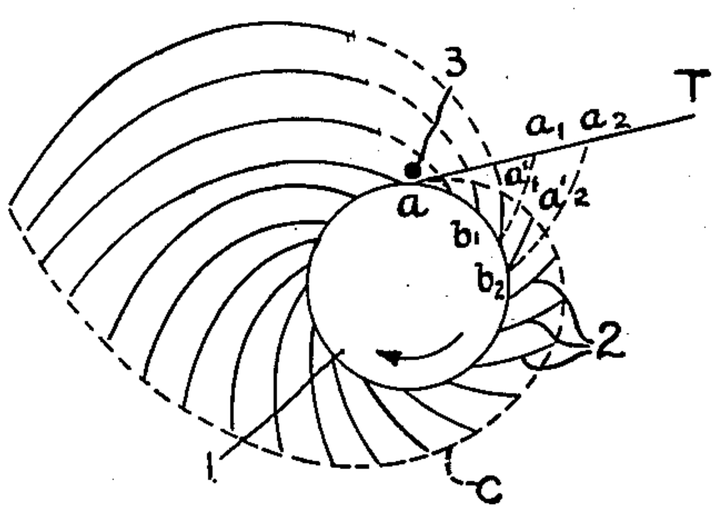


FIG. 2.

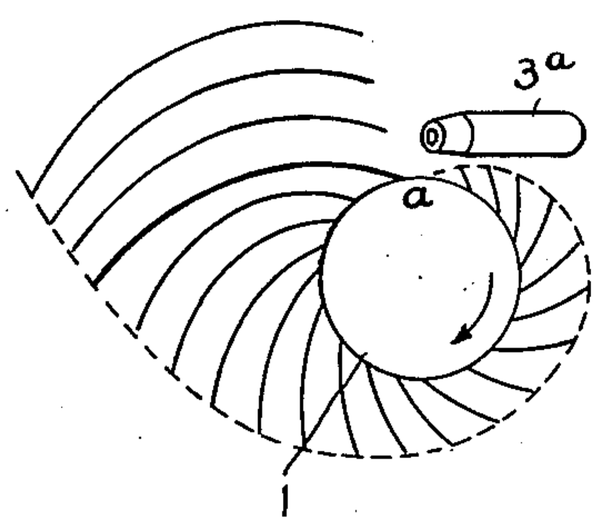


FIG. 3.

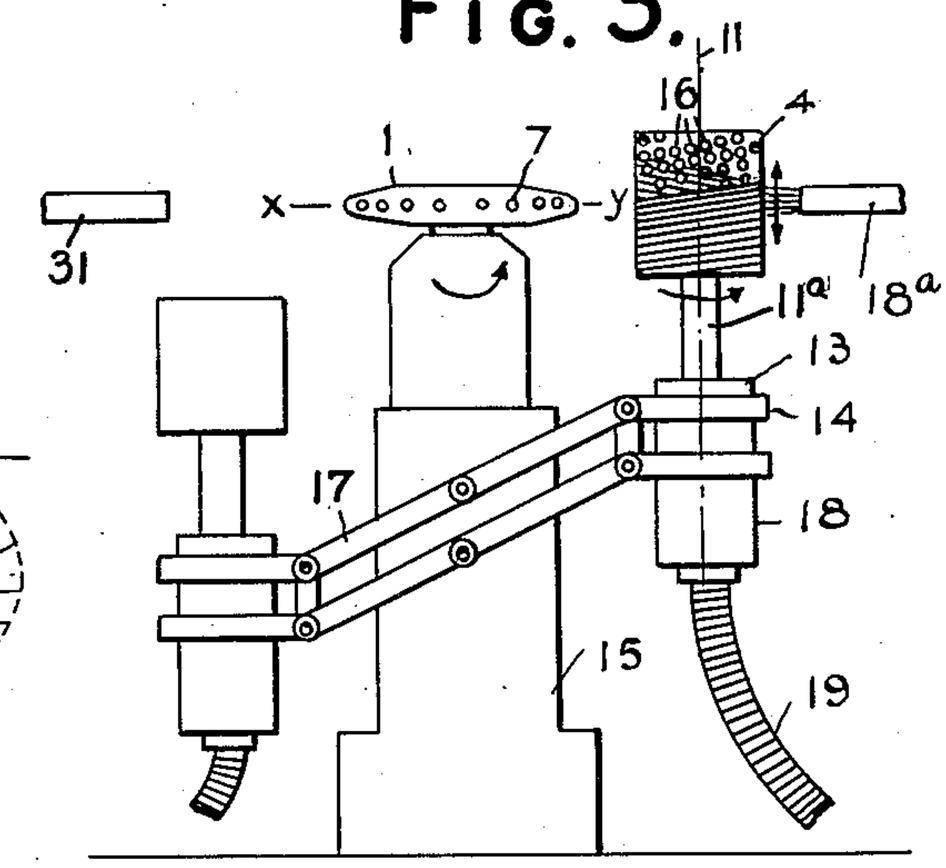


FIG. 5.

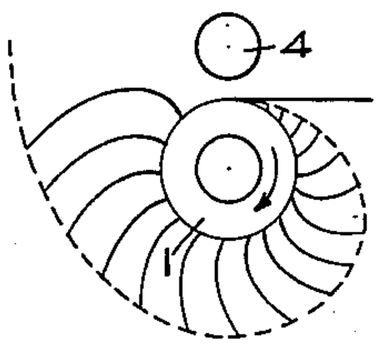
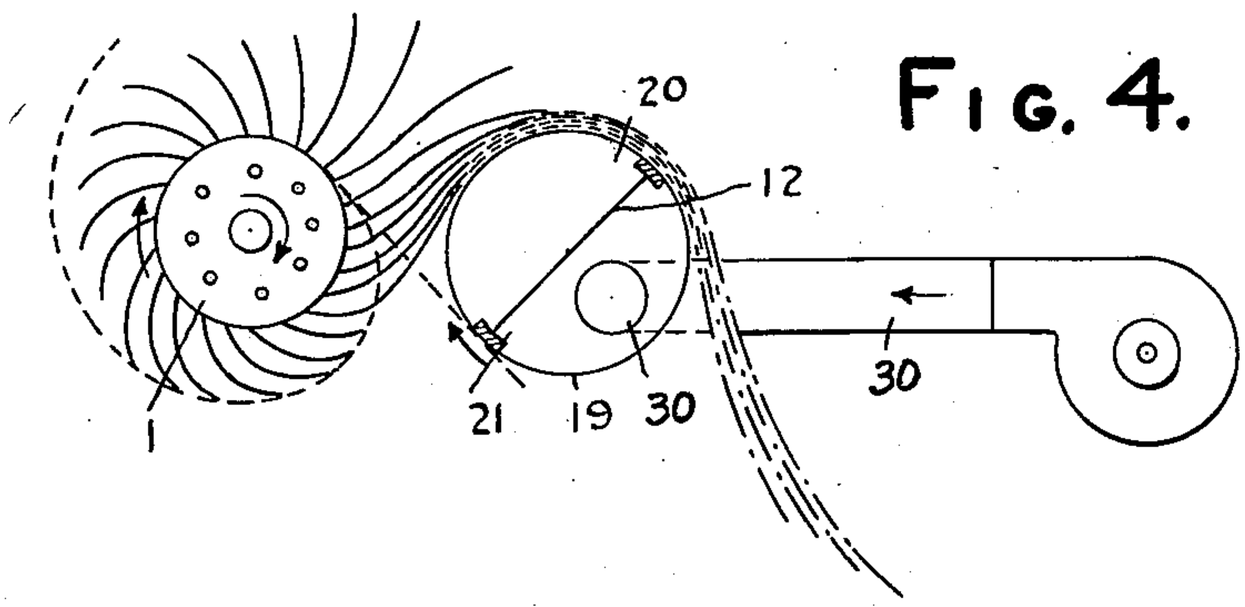


FIG. 4.



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MANUFACTURE OF FIBERS SUCH AS GLASS FIBERS

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15 Claims. (Cl. 49—1)

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My invention refers to an improvement in the production of glass fibres or fibres of other mineral or organic materials having thermoplastic properties, such fibres being formed by projecting the material under the effect of centrifugal force.

My invention may be applied to all processes for manufacturing fibres where the material to be drawn is fed to a revolving body, projected from said body under the action of the centrifugal force and drawn into fibres. The revolving body may be of different shapes, for instance it may be consituted by a hollow body at the periphery of which openings are provided and inside which the viscous material to be transformed into fibres is fed.

As shown diagrammatically in Fig. 1 of the accompanying drawings the centrifugal force caused by the rotation of the hollow body 1 projects the viscous material through the orifices, in the form of streams 2. Theoretically each of the elements of the stream (for example a) would move along the tangent T of the body 1 at the starting point of the element. Consequently the position of the glass stream to which a belongs would be represented at a_1 b_1 at time t_1, and at a_2 b_2 at time t_2. But, in fact, because of the resistance of the surrounding air, the glass viscosity and the increase of such viscosity due to the cooling of the stream in the air, the projection of each element is slackened, so that the trajectory followed by the element a, instead of being the tangent T to the body 1 at the issuing point is a curve c which is nearer the revolving body than said tangent T. Thus, when departing from the revolving body, the projected glass stream successively occupies the positions b_1 a'_1—b_2 a'_2 until it reaches a certain distance outward of the revolving body where it at least partially congeals. The plurality of fibres discharged from the openings in the revolving body then assumes a mass collection of individual fibres in the form of a crown spaced from and concentric with the revolving body.

Such crown is substantially in the projection plane of the glass streams, perpendicular to the rotation axis of the revolving body. In the known processes the crown is allowed to be formed and for making use of the produced fibres it is necessary to cut off such crown.

An object of the present invention is to collect the fibres in such a manner as to avoid the crown formation or collection of the fibres as just described and consists in providing an obstacle adjacent to the periphery of the revolving body and in the path of the fibres delivered therefrom

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in such a manner that the fibres will contact with and be ruptured by the presence of the obstacle.

The invention also contemplates a collection of the fibres on the obstacle in such a manner as to form a mat thereon. Owing to the fact that the deposit of the fibres on such an obstacle is accompanied by an abrupt interruption of the movement of the fibres driven along by the centrifuging body, the fibres are strongly applied on the obstacle. Thus the successive deposits of the fibres are pressed against one another, and this contributes to a good cohesion of the mat. This pressure upon the fibres also facilitates the retention of the mat upon the obstacle.

Moreover as the obstacle may be placed as near as desirable to the revolving body, the arrangement may be such that the fibres will meet the obstacle at a short distance from their issuing point and consequently retain sufficient plasticity for cohesion with the fibres already accumulated on the obstacle. Thus a stiff mat may be obtained without the use of a binding agent and this result is facilitated by the intimate contact and tautness of the fibres of the mat.

Another feature of the invention is the ability to obtain a determined geometrical shape of mat (plane, cylindrical, conical, etc.). This may be accomplished by using as an obstacle an element having a shape corresponding to the desired shape of the mat, such element constituting a kind of mandrel or mould. The element may be moved in such a way that all the points of its exterior surface are successively brought into the plane of the trajectories followed by the fibres. Such movement is perpendicular to the projection plane of the fibres and if effected periodically and in reverse directions will produce a mat having several superposed layers wherein the fibres of two successive layers are crossed.

Together with this displacement along its axis, another movement may be added, for instance, a rotation of the mandrel when the surface of same is engendered by rotation around an axis so that all the points of the exterior surface of the mandrel will successively come and meet the fibres in the very plane where they are projected.

In numerous cases such different movements of the mandrel help to maintain at its surface the fibres coming in contact with it. In the case where the mandrel is rotating around its axis, the fibres will wind around it and consequently they will be held on its exterior surface or on the already formed mat.

In case the shape of the mandrel itself and its

movements are not sufficient to retain the mat at the mandrel surface, grasping means may be provided on said surface for fixing the first deposited fibres and thereafter retaining the whole of the mat. The mandrel may also be provided with a perforated surface in the form of a plurality of openings communicating with a conduit or chamber wherein a minus pressure is maintained thus serving to retain the fibres on the mandrel.

According to another characteristic feature of the invention, the obstacle met by the fibres may also be devised for helping in drawing the fibres.

It has been determined that one of the main factors influencing fibre production is the relative speed of the fibre at its issuing point from the revolving body with respect to the congealed part of the fibre already projected. According to the invention said relative speed is increased by a drawing action exerted on the fibre by the obstacle in a direction opposite to that of the displacement of the issuing point.

In an embodiment of such device, the obstacle may be constituted by a drum revolving in the same direction as the revolving body. At any moment the parts of the drum and of the revolving body facing each other are thus moving at speeds in opposite directions; as a result the fibres coming in contact with the drum have their speed increased, which causes or increases their drawing before they are broken off by the obstacle constituted by the drum.

Referring to the accompanying drawings in which corresponding parts are designated by corresponding marks of reference—

Fig. 1 is a view representing the action where a filament is projected from a revolving body.

Fig. 2 is a view representing an embodiment of this invention.

Fig. 3 is an elevation of such a device where the cylinder may be moved along its axis.

Fig. 4 is a diagrammatical horizontal view of a device for drawing and subsequently rupturing the fibres and the delivery of the fibres from the collector or obstacle.

Fig. 5 is a diagrammatical horizontal view of an embodiment showing a cylinder as constituting the obstacle.

The obstacle need not be constituted by a material means. It may be formed by a jet of compressed fluid intersecting the projection plane of the fibres.

In Figs. 3 and 5 the obstacle has the shape of a cylindrical mandrel, the axis of which is substantially perpendicular to the projection plane of the fibres, two movements being imparted to said mandrel: a movement of rotation on itself and an alternative translation movement along its axis. This rotating mandrel will produce cylindrical mats of fibres.

The distance of the core **4** from the centrifuge **1** may be varied. When the core **4** is placed sufficiently close to the centrifuge hot and still plastic fibres will be deposited on or received by the core and these fibres will weld or cohere to the previously collected fibres with the result that a stiff cylindrical collection or mat of fibres will be obtained without requiring the use of a binding agent to hold the fibres in mat form. If the obstacle is placed farther from the centrifuging body, the fibres have already cooled when they are deposited and a soft cylindrical mat or element is produced.

In Fig. 3, **1** designates the centrifuging body, **1** the openings from which the glass issues and

x y the issuing plane of the fibres; **4** is the obstacle constituting a kind of mould around which the fibers are deposited; said mould is given a rotary movement around its axis **11** and also an alternative translation movement along said axis, the amplitude of the latter movement being equal to the height of the mould.

The support **13** bearing the mandrel **4** may be displaced on the framework **14** connected to the base **15** of the revolving body. The displacement of support **13** permits a varying of the distance from the mandrel to the centrifuging body. **16** shows the openings which are provided on the mandrel **4** and through which the minus pressure established inside the mandrel may be transmitted for drawing the fibres onto the mandrel surface.

To avoid interruptions in the production, the machine shown in Figure 3 comprises two identical receiving devices connected to the base **15** through an articulated parallelogram **17** to which the frameworks **14** supporting said devices are fixed.

Thus the mandrel which is covered with fibres may be taken away from the zone of formation of the mats and a fresh empty mandrel may be substituted for it.

For the sake of simplicity the drawing does not show the driving mechanism of the mandrels, which is normally placed inside the casing **18**. Vacuum may be established inside the mandrel by means of a pipe **19**, connected to the axle **11***a* of the mandrel through the casing **18**.

Finally the replacement of a mandrel by another one, i. e., the movement of the parallelogram **17** may be started as soon as the thickness of the mat on one of the mandrels has reached the desired value.

Moreover during the formation of the mat, any liquid or appropriate material may be projected on its surface either for binding the fibres with each other, or on the contrary to facilitate their mutual displacement. Such operation may be effected in particularly easy conditions owing to the fact that the mandrel is displaced during such formation of the mat. Owing to those displacements said material may be projected on the whole surface of the mat even when the projecting means for said materials are placed out of the active zone where the fibres come in contact with the mandrel or with the already formed mat. Thus the deposit of the fibres is not hindered; the distribution of the material on the whole surface of the mat is obtained when the several portions of the mat pass before the means projecting such material.

The arrangement shown in Fig. 4 provides a drum **19**, having its axis parallel to the axis of the revolving body, and rotating in the same direction as the revolving body. The fibres issuing from the orifices of the revolving body are applied on the surface of said drum, and as the parts of the revolving body and of the drum which face each other are moved at speeds in opposite directions, a drawing of the fibres is produced. Afterwards the fibres are cut off by the presence of the drum **19** which, in that respect, is acting as the obstacles considered in the preceding description. The drum may be provided with numerous openings or perforations in its peripheral surface and separated into two parts **20**—**21** by a fixed partition **12** diametrically placed in said drum. The partition will be air sealed against the inner peripheral surface of the drum and end sections of the drum if they re-

volve. Each end of the revolving surface of the drum should be sealed by end sections in aid of the differential pressures to be exerted interior of the drum and at its surface. At least one of the end sections should be maintained stationary but in sealed relation to the revolving surface so as to afford entry to the interior of the drum of the plus pressure from the air line 30. As the outer peripheral surface of the drum revolves and enters the zone or part 20 it will pick up and carry the fibres away from their area of projection by the centrifuge. When the revolving and perforated surface of the drum carrying the fibres leaves the zone or part 20 and enters the zone or part 21 of the drum, plus pressure within the part 21 will serve to expel or remove the fibres from further contact with or support by the perforated and revolving surface of the drum. As the perforated and revolving surface passes from the zone or part 21 and again enters the zone or part 20 which is not under the influence of the plus pressure in the part 21 a repetition of the above cycle occurs. The cut fibres may be collected in a container.

A suitable binding agent may be projected onto the mats as formed by the jets 18*a* and 31 to increase the cohesion thereof.

It must be understood that my invention is not limited to the embodiments which have been hereabove described, but that it may be carried out in numerous other embodiments.

What is claimed is:

1. In an apparatus for the manufacture of fibres from a thermoplastic material, a revolving body, means to feed said material to said body, means to rotate said body for projecting said material to transform it into fibres, an obstacle in the plane of projection of the fibres located to one side of and sufficiently near the periphery of the revolving body to be met by the fibres and to cause their breaking, said obstacle having its surface provided with openings, and means to establish a minus pressure inside said obstacle to retain the fibres on its surface and to cause them to accumulate into a mat.

2. In an apparatus for the manufacture of fibers from a thermoplastic material, in particular from glass, a revolving body, means to feed said material to said body, means to rotate said body for projecting said material to transform it into fibers, an obstacle in the plane of projection of the fibers located sufficiently near the periphery of the revolving body to be met by the fibers and cause their rupture, said obstacle having its surface provided with openings, means to establish an under-pressure inside said obstacle to retain the fibers on its surface and to cause them to accumulate into a mat and means to impart to said obstacle a movement enabling different points of its surface to be successively met by said fibers.

3. In an apparatus for the manufacture of fibers from a thermoplastic material, in particular from glass, a revolving body, means to feed said material to said body, means to rotate said body for projecting said material to transform it into fibers, an obstacle in the plane of projection of the fibers located sufficiently near the periphery of the revolving body to be met by the fibers and cause their rupture, said obstacle having its surface provided with openings, means to establish an under-pressure inside said obstacle to retain the fibers on its surface and to cause them to accumulate into a mat and means to impart to said obstacle a reciprocating movement at an angle to the plane of projection of the fibers enabling different points of its surface to be successively met by said fibers, to produce a mat constituted of superposed layers of fibers.

4. In an apparatus for the manufacture of fibers from a thermoplastic material, in particular from glass, a revolving body, means to feed said material to said body, means to rotate said body for projecting said material to transform it into fibers, an obstacle in the plane of projection of the fibers having a symmetrical shape with respect to an axis substantially perpendicular to the projection plane, rotating around said axis and placed sufficiently near the periphery of the rotating body to be met by the fibers to cause their rupture and to produce a complementary drawing action on the fibers after they have come in contact with said obstacle and until they are cut off, said obstacle having its surface provided with openings and means to establish an under-pressure inside said obstacle to retain the fibers on its surface and to cause them to accumulate into a mat.

5. In an apparatus for the manufacture of fibers from a thermoplastic material, in particular from glass, a revolving body, means to feed said material to said body, means to rotate said body for projecting said material to transform it into fibers, an obstacle in the plane of projection of the fibers having a symmetrical shape with respect to an axis substantially perpendicular to the projection plane, said obstacle having its surface provided with openings, means to establish an under-pressure inside said obstacle to retain the fibers on its surface and to cause them to accumulate into a mat and means to impart to said obstacle a translation movement along its axis and a rotation around said axis.

6. In an apparatus for the manufacture of fibers from a thermoplastic material, in particular from glass, a revolving hollow body with perforations in its periphery, means to feed said material to said body, means to rotate said body for projecting said material in view of transforming it into fibers, a cylindrical obstacle having its axis transverse to the plane of projection of the fibers and located sufficiently near the periphery of the revolving body to be met by the fibers and to cause their rupture, means to impart to said obstacle a rotation around its axis to produce a drawing action on the fibers after they have come in contact with said obstacle and until they are ruptured, means associated with and effective within the obstacle for maintaining differential pressures at predetermined zones through which the surface of the obstacle rotates whereby the fibers are first received and drawn by the revolving surface of the obstacle and are then positively discharged therefrom.

7. In an apparatus for the manufacture of fibers from a thermoplastic material, in particular from glass, a revolving body, means to feed said material to said body, means to rotate said body for projecting said material to transform it into fibers, an obstacle in the plane of projection of the fibers located sufficiently near the periphery of the revolving body to be met by the fibers and cause their rupture, said obstacle being adapted to retain the ruptured fibers on its surface in the form of a coherent mat which can be withdrawn from said obstacle in the form of a self sustaining mat having a shape corresponding to the shape of the obstacle on which it has been produced, and means to throw on the

fibers of the mat during or after their deposit on the obstacle a binding material.

8. The hereinbefore described method of producing a coherent mat of fibers, of a thermoplastic material which comprises projecting the material in a plastic state from a centrifuge to form fibers in air, receiving the fibers on a collector having a perforated surface rotating the collector around an axis at right angles to the plane of projection of the fibers and creating a minus pressure within such collector.

9. The hereinbefore described method of producing fibers of a thermoplastic material which comprises projecting the material in a plastic state from a centrifuge to form fibers in air, receiving the fibers on a rotating collector having a perforated surface and maintaining a greater pressure at one area of the collector than at another area.

10. The hereinbefore described method of producing a coherent mat of fibers of a thermoplastic material which consists in projecting the material in a plastic state from a revolving body to form fibers in air, rupturing said fibers by the presence of an obstacle located adjacent the revolving body and in the plane of the projected fibers, collecting the ruptured fibers on the obstacle in the form of a coherent mat conforming into the shape of the obstacle and withdrawing the mat so formed from the obstacle in the form of a self sustaining mat corresponding to the shape of the obstacle.

11. The hereinbefore described method of producing a coherent mat of fibers of a thermoplastic material, in particular glass, which comprises projecting the material in a plastic state from a centrifuge to form fibers in air, receiving the fibers on a collector located near the periphery of the rotating body rotating around an axis at right angles to the plane of projection of the fibers and adapted to retain the ruptured fibers on its surface in the form of a coherent mat which can be withdrawn from said collector in the form of a self sustaining mat having a shape corresponding to the shape of the collector on which it has been produced, imparting to said collector a translation movement along its axis enabling a proper coating of its surface and throwing on the fibers of the mat during or after their deposit on the surface a binding material.

12. In a device for manufacturing glass fibers, the combination of a hollow body provided with a plurality of openings at its outer edge for the discharge of molten glass from the interior of the body and rotatable about an axis at sufficient speed for the discharge of the glass in fiber form, an obstacle provided with a curved and perforated surface located adjacent the edge of the body and in the path of the fibers as they are projected therefrom and rotatable about an axis located beyond the edge of the body and parallel to the axis of the body and means for establishing within the obstacle while rotating a pressure differing from that of the surrounding atmosphere.

13. In a device for manufacturing glass fibers, the combination of a hollow body provided with a plurality of openings at its outer edge for the discharge of molten glass from the interior of the body and rotatable about an axis at sufficient speed for the discharge of the glass in fiber form, an obstacle provided with a curved and perforated surface located adjacent the edge of the body and in the path of the fibers as they are projected therefrom and rotatable in the same direction as the body about an axis located beyond the edge of the body and parallel to the axis of the body, and means for establishing within the obstacle while rotating a pressure differing from that of the surrounding atmosphere.

14. In a device for manufacturing glass fibers, the combination of a hollow body provided with a plurality of openings at its outer edge for the discharge of molten glass from the interior of the body and rotatable about an axis at sufficient speed for the discharge of the glass in fiber form, an obstacle provided with a curved surface located adjacent the edge of the body and in the path of the fibers as they are projected therefrom and rotatable about a fixed axis located exterior of the edge of the body and parallel to the axis of the body, said openings in the body and the curved surface of the obstacle at their points of closest approach travelling in opposite directions.

15. The hereinbefore described method of manufacturing glass fibers which includes delivering a mass of molten glass to a hollow body having openings in its periphery, rotating the body about a fixed axis at sufficient speed to discharge the glass from the openings in fiber form, providing an obstacle having a curved surface adjacent the periphery of the body and in the path of the fibers projected from the body, continuously rotating the obstacle about an axis located at a predetermined and fixed distance from the body and parallel to the axis of the body, uniformly and locally intercepting the fibers by the obstacle, collecting the fibers on the obstacle and removing the fibers from the obstacle.

IVAN PEYCHES.

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