Oct. 7, 1952 H. E. HOLCOMB 2,613,039

APPARATUS FOR DRAWING FILAMENTS

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Fig. 2.

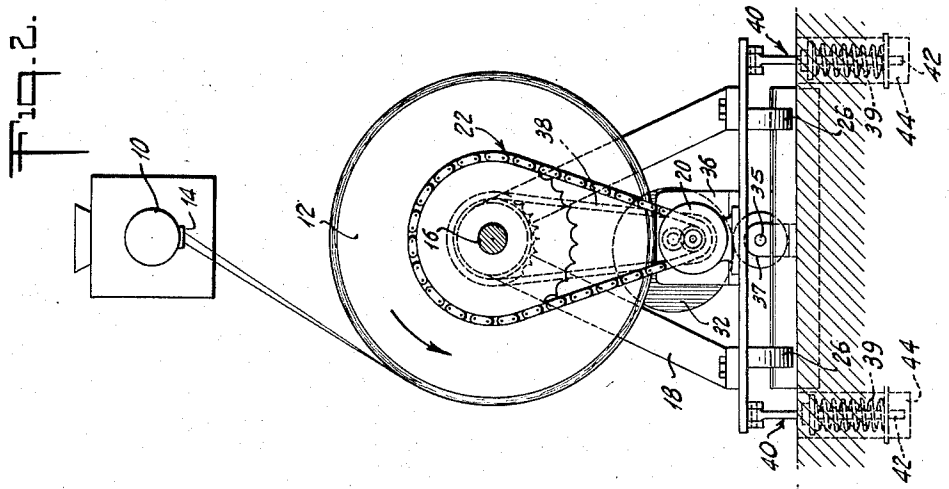
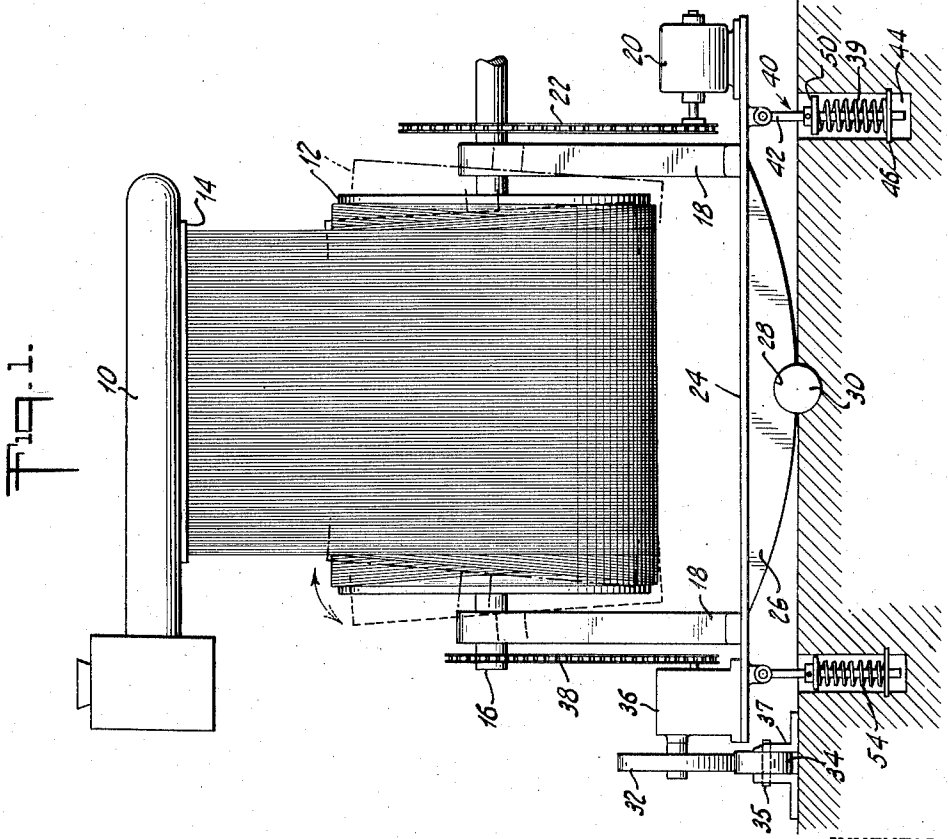


Fig. 1.



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APPARATUS FOR DRAWING FILAMENTS

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5 Claims. (Cl. 242—54)

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The instant invention relates to improved methods and apparatus for drawing filaments and accumulating them in a plurality of layers on a drum or similar collecting device. The invention is particularly adapted for the production of glass filaments from a body of molten glass, and the following discussion will be directed to such operations. It will be understood, however, that the invention is not limited thereto and that it may be employed in the production of other drawn filaments.

Heretofore a conventional method of drawing and accumulating glass filaments has employed a cylindrical drawing drum rotated at a relatively high speed. The filaments are drawn out from a plurality of orifices in a glass melting furnace, preferably located above the drum and attached to the drum and wound thereon. In order that a coherent body or mat of the filaments will be obtained which can be handled and further processed, the successive layers on the drum are laid in intercrossed relationship. This is effected in the conventional operation by reciprocating the furnace parallel to the axis of the drum during the winding operation, the rate of reciprocation relative to the rate of winding depending upon the particular angularity desired, though usually the angle between the filaments is relatively acute. The mat produced in this manner may be worked in various ways; for example, it may be stretched in a direction substantially perpendicular to the lay of the filaments whereby it is expanded or opened up, similar to that of a "lazy tongs," and the open mat then converted into products of various types.

The principal object of the invention is the provision of an improved method and apparatus for the production and collection of filaments of the type referred to which will produce a mat having the desirable characteristics of the mats made by the prior processes, but without the undesirable characteristics resulting from the mode of operation, particularly the reciprocation of the furnace.

In the prior operations, as the furnace travels from one end of the drum to the other to lay the filaments in spiral formation, there is a perceptible pause at each end of its travel to permit the change of direction. During this pause the filaments accumulate at the edges of the drum. In the period required to build up the mat to commercial thickness, usually several hours, the ends of the filamentary body on the drum become substantially thicker than the center. It has been found for example, that in the production of a

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mat ⅛" thick, the mat may reach a thickness of $\frac{3}{16}$" or greater over a distance of approximately 9" from each edge. As a result approximately 18" of the width of the mat is unusable if a product of uniform characteristics is desired. A specific object of the invention is the provision of a method and apparatus which will produce a mat of uniform, usable thickness throughout its width.

Another object of the invention is the provision of a method and apparatus of the type referred to which will increase the capacity of the equipment, reduce filament breakage, particularly through the elimination of vibration caused by the reciprocating furnace, provide a more even distribution of the filaments across the drum, produce a mat with little or no tying in of filaments and which will provide lower manufacturing costs both through permitting greater recovery of usable material and through a substantial reduction in the labor required.

The prior apparatus is inherently jerky and irregular in operation which leads to filament breakage necessitating the close attention of an operator. To replace the broken filaments he ordinarily employs a glass rod, the end of which is placed against the molten stream of glass issuing from the furnace orifice, and then lowered to string out a filament which the operator places against the mat on the drum to be picked up so that the drawing of the filament from the orifice is resumed. Due to the reciprocation of the furnace, the operator, in his attempt to contact the orifice with the glass rod, often breaks other filaments and adds to his difficulties as well as further detracting from the uniform characteristics of the mat. The jerkiness and irregularity in operation also tends to cause entanglement of the filaments on the drum, this being a primary cause of difficulties heretofore encountered in the later operation of expanding the mat.

A further object of the invention is the provision of an apparatus and method in which the above difficulties are overcome. The glass furnace is stationary and the traverse of the filaments axially of the drum is obtained through oscillation of the drum.

A further object of the invention is the provision of an apparatus including a drawing drum mounted for oscillation on an axis extending at right angles to the axial dimension of the drum and means for oscillating the drum at a controlled rate relatively to the rotation of the drum.

My invention will be more fully understood and further objects and advantages thereof will be-

come apparent when reference is made to the more detailed description of a preferred embodiment of the invention which is to follow and to the accompanying drawings in which:

Fig. 1 is a front elevational view of a filament drawing apparatus in accordance with the instant invention and for carrying out the method thereof; and,

Fig. 2 is an end elevational view of the apparatus of Fig. 1.

Referring now to the drawings, there is shown a glass melting furnace or a kiln 10 supported by suitable means (not shown) in stationary position above a filament winding or drawing drum 12. Furnace 10 is suitably of any conventional type employed in the production of continuous glass filaments and, hence will not be described in detail. It includes an orifice plate having one or more rows of orifices 14, the rows extending substantially parallel to the axis of the drum. The molten glass exudes from the orifices in fine streams, the streams being drawn out and attached to the drum whereby, upon rotation of the drum, a filament is continuously drawn from each of the orifices. Glass furnace 10 is made longer than the conventional furnace so that its orifice plate overlies the greater portion of the length of drawing drum 12. For example, where the length of the drum is such as to accommodate a mat of fibers 5' in width, the distance between the orifices at the opposite ends of the plate may be, say, 4'6''.

Drawing drum 12 is also of generally conventional type and is mounted to rotate with a shaft 16 supported for rotation in frame members 18 at opposite ends of the drum. The shaft is driven to rotate the drum in the direction indicated by the arrow (see Fig. 2) by a motor 20 and suitable drive means such as chain sprocket drive, illustrated at 22, operatively connecting the motor and shaft or through a variable speed drive, as desired.

In accordance with the instant invention drum 12 is mounted for oscillatory movement on an axis extending at substantially right angles to the axial dimension of the drum whereby successive layers of the filaments will be wound on the drum in crossing relationship to the filaments of the next previous layers. The oscillation of the drum hence serves the same function as the reciprocation of the furnace in the standard apparatus and the mat has similar desirable properties to that previously obtained. The mechanism for oscillating the drum may take different forms, one example being shown in the drawings and hereinafter described. This mechanism includes a platform 24 supporting the members 18 which carry the drum. Platform 24 is supported on a plurality of rockers 26, two being shown, the rockers including centrally located, semi-circular seats 28 for rocking movement on a pivot member 30. The latter suitably consists of a cylindrical shaft lying in a recess in the foundation or floor 31 and extending at substantially right angles to the axial dimension of the drum. Alternatively shaft 30 may be fixedly connected to rockers 26 and rock in the recess or other bearing seat.

In the illustrated embodiment platform 24 supports motor 20 and the drive means, previously mentioned, operatively connecting the motor and shaft 16. The platform also supports a rotatable cam 32 adapted for cooperation with a cam follower 34 mounted in relatively fixed position from the foundation or floor. The follower may be of any suitable type but preferably comprises a roller mounted for free rotation on shaft 35 supported in bearings in brackets 37. Cam 32 is contoured to rock the drum at a preferably uniform speed from the position shown in dot and dash lines (see Fig. 1) through the full line position to the position shown in dotted lines. The return rocking or oscillation of the drum to the position shown in dot and dash lines is caused by compression springs 39, later described in more detail, and preferably mounted to press upwardly on corners of the platform at the opposite end from the cam. The springs yieldably urge this end of the platform upwardly to hold the cam in operative contact with the follower through the complete rotation of the cam whereby the oscillatory movement of the drum in both directions is under cam control. Cam 32 is preferably also driven from motor 20 through drum shaft 16, a reduction gear box 36 and chain drive 38 connecting shaft 16 and the gear box.

Compression springs 39 are carried by mountings 40, each suitably consisting of a rod 42 pivoted to platform 24 and extending into a pit 44 in the foundation or floor. The lower end of rod 42 projects through a plate 46 anchored in the foundation. A retainer plate 50 is affixed to the rod adjacent its opposite end, plates 46 and 50 confining the compression spring 39 between them.

Springs 54, somewhat weaker than springs 39, so that they will not counter-balance the latter, are preferably provided at the opposite end of the platform from springs 39 to serve as safety anchors and to additionally cushion the operation to prevent sudden jerks or stops in either direction of oscillation of the drum. The mountings for springs 54 may be the same as those for springs 39.

In the operation of the apparatus described above and in carrying out the method of the instant invention, the filaments, say 500 or more in number and in one or more rows, are drawn from the orifice plate of the furnace and connected to the drawing drum in any conventional manner. Motor 20 is operated to drive the drum at the desired speed to secure filaments of the required diameter and, at the same time the drum is oscillated on shaft 28 through the action of cam 32 on cam follower 34. The relative rate of oscillation to drum revolution may be adjusted as desired by proper selection of the gear reduction ratio of gear box 36 to obtain a predetermined angularity of the filaments on the drum. For example, it has been found that successful operation can be obtained with the drum driven at approximately 200 R. P. M. and the cam at, say, 2 R. P. M., whereby the drum will make 100 revolutions for each complete oscillation. A mat produced in this manner will have the filaments of adjacent layers intercrossing at relatively acute angles to one another, similarly as the mats produced by the present commercial equipment.

The method and apparatus of the instant invention eliminate the difficulties of the prior operations. The furnace is stationary at all times whereby breakage of the filaments is reduced to a minimum. Furthermore, in the event of breakage, the operator can readily replace the filament with little danger of injury to adjacent filaments. The filaments are laid smoothly on the drum, the possibility of entanglement being greatly minimized as the oscillatory movement of the drum is smooth and uniform and the drum is free from vibration. There are no pauses or

dwells in the oscillatory movement and, hence, the mat is of uniform thickness throughout. Due to the fewer filament breakages and the ease of replacing the filaments which do break, the cost of operation is greatly reduced. Also, manufacturing costs per unit of usable material are lowered by reason of the fact that the entire mat is in usable condition.

Having thus described my invention in rather full detail, it will be understood that these details need not be strictly adhered to but that various changes and modifications may suggest themselves to one skilled in the art, all falling within the scope of the invention as defined by the subjoined claims.

What I claim is:

1. In a device for drawing a multiplicity of filaments lying in substantially a single plane and winding them on a drum to form successive layers, a shaft supporting said drum, first means for rotating the shaft, and second means for rocking the shaft in predetermined, timed relationship to the rotation of the shaft to wind the filaments on the drum with filaments of successive layers in intercrossed relationship.

2. In a device for drawing a multiplicity of filaments lying in substantially a single plane and winding them on a drum to form successive layers, a rockable shaft supporting the drum, means for rotating the shaft, cam means for rocking the shaft to wind the filaments on the drum with filaments of successive layers in intercrossed relationship, and means for rotating the cam in predetermined, timed relationship to the shaft.

3. In a device for drawing a multiplicity of filaments lying in substantially a single plane and winding them on a drum to form successive layers, a shaft supporting the drum, means mounting the shaft for rocking movement on an axis extending at right angles to the shaft, a cam and follower for rocking the mounting means, and means for rotating the cam in predetermined, timed relationship to the rotation of the shaft.

4. In a device for drawing a multiplicity of filaments lying in substantially a single plane and winding them on a drum to form successive layers, a shaft supporting the drum and means for mounting the shaft for rocking movement on an axis at right angles to the shaft, said means comprising a platform, means supporting the shaft from the platform, a pivotal mounting for the platform and means for rocking the platform on the pivotal mounting including a cam and follower, spring means to maintain the cam and follower in operative contact and means for rotating the cam in predetermined, timed relationship to the rotation of the shaft.

5. In a device for drawing a plurality of filaments lying in substantially a single plane and winding them on a drum to form successive layers, a shaft supporting the drum, means mounting the shaft for rocking movement on an axis at right angles to the shaft, said last-named means comprising a platform, a pivotal mounting for the platform, driving means for the drum carried by the platform, a rotatable cam mounted on the platform, a cam follower in fixed position relatively to the cam, and means for rotating the cam from the drum driving means.

HARRY E. HOLCOMB.

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