March 10, 1964 H. J. McDERMOTT 3,123,858

HEATED FILAMENT SPINNING PACK

Filed Feb. 21, 1961

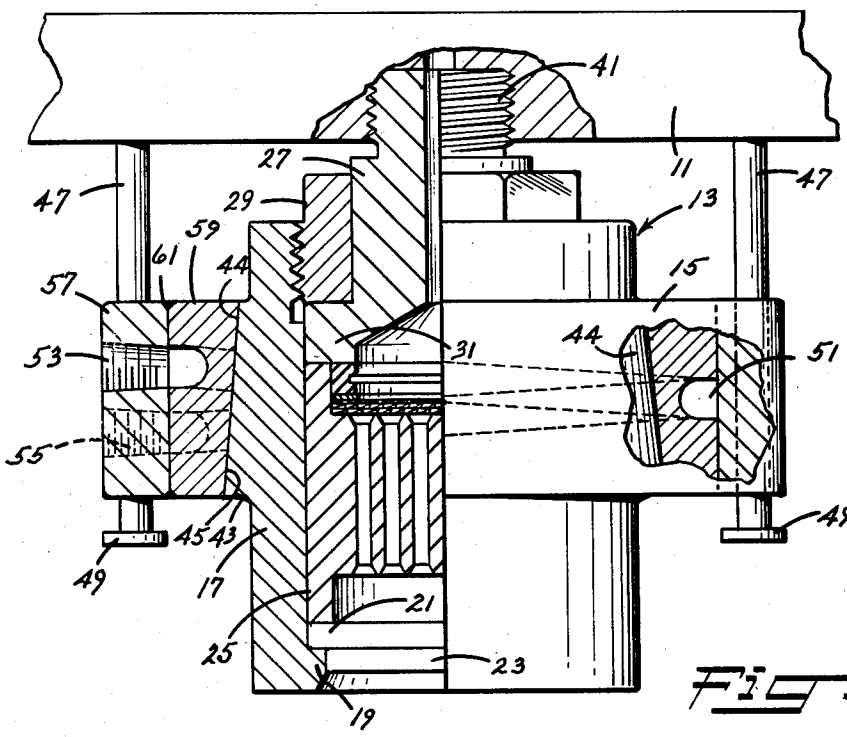

Fig. 1

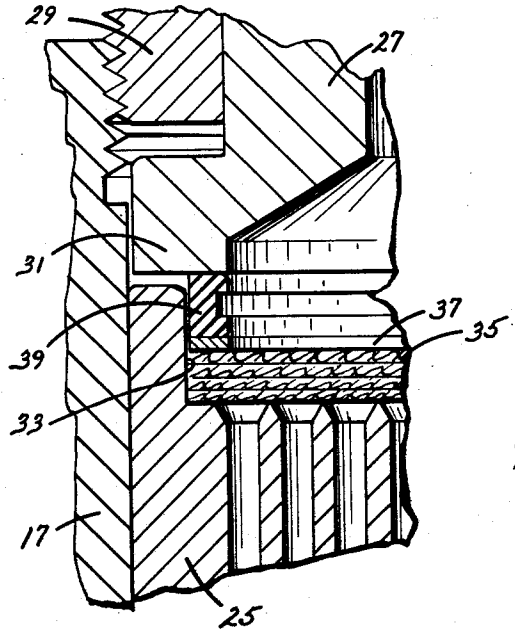

Fig. 2

United States Patent Office 3,123,858 Patented Mar. 10, 1964

3,123,858

HEATED FILAMENT SPINNING PACK

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Filed Feb. 21, 1961, Ser. No. 90,683
3 Claims. (Cl. 18—8)

The present invention relates to the extrusion of artificial filaments, and particularly to apparatus for melt spinning of thermoplastic filament-forming materials.

In the conventional melt extrusion processes, comminuted thermoplastic material, as for example in the form of flakes, granules of powders, is delivered into a heated cylinder fitted with a screw conveyor. Within the cylinder the thermoplastic material is advanced and compressed or densified by the action of the screw conveyor as it is progressively heated to a molten or highly plastic state. From the screw conveyor the molten material is delivered into a jet or spinning pack which comprises filters, auxiliary devices such as melt distribution plates and a spinneret through which the melt is extruded and shaped into filaments of desired size.

During the entire extrusion process, and particularly within the jet pack, the elevated temperature of the molten filament-forming material must be carefully controlled, with little variation in the temperature being permitted. Generally, this is conveniently achieved by jacketing the jet pack with an electric heater or a tubular coil through which may be circulated a heated fluid, such as high pressure steam. With these conventional melt spinning apparatus, repair and adjustment or replacement of the jet pack, as where a change in denier and/or filament count of the production is desired, is complicated by the presence of the jet pack heater. In some cases disassembly of the heater is required, while in other instances problems of alignment and adjustment are involved to avoid leakage of the heating fluid and/or to insure good heat transfer between the heating means and the jet pack itself. Accordingly, an object of the present invention is to provide a new or improved and generally more satisfactory melt spinning apparatus.

Another object is to provide a melt spinning apparatus including a jet pack and a cooperating heating ring having mating surfaces which snugly contact with each other and provide for good heat conductivity between these parts, yet permit rapid and easy removal of the jet pack without disassembling of the heating ring.

A further object of the invention is the provision of the melt spinning apparatus including a jet pack and a surrounding heating ring which have conical mating surfaces adapted for wedging with each other to provide for good heat transfer between these parts.

Still another object is to provide a melt spinning apparatus having a spinning pack releasably wedged within a heating ring, with the heating ring being slidably mounted to permit the spinning pack to be easily adjusted or replaced without removal or disassembly of the heating ring itself.

These and other objects and advantages of the invention will be apparent from the following description and accompanying drawing in which:

FIGURE 1 is a side view of the spinning pack and cooperating heating ring of the present invention, with a portion thereof being shown in section; and

FIGURE 2 is a partial vertical section of the spinning pack illustrating the assembly of a melt breaker plate and a filter assembly.

In general, the melt spinning apparatus of the present invention includes a spinning or jet pack and a surrounding heating ring through which a heated fluid may be circulated. A portion of the outer periphery of the jet pack is provided with a generally conical surface which mates with a correspondingly shaped surface provided on the internal periphery of the heating ring. These cooperating conical surfaces provide for a wedge connection between the heating ring and the jet pack and thereby assure snug contact and good heat transfer characteristics between these parts. The heating ring rests on the jet pack during extrusion operations but is slidably supported by a series of hangers which permit the ring to be lifted away from the jet pack, as when replacement or adjustment and repair of the pack is desired.

Referring to the accompanying drawing, the melt spinning apparatus of the present invention includes a supply conduit 11 through which molten filament-forming material is delivered, as from a screw conveyor, a jet pack 13, and a heating ring 15 which is engaged with the jet pack for maintaining the same at a desired elevated temperature.

The jet pack 13 includes a main body or housing 17 which is formed with an inwardly directed shoulder 19 at one end on which is supported a flange 21 of a conventional spinneret or jet 23. A breaker plate 25 is urged against the spinneret flange 21 by a coupling 27 which is in turn locked in position by a nut 29 threaded into the housing 17. The nut 29 bears against a flange 31 formed on the coupling 27 to hold the parts in assembled positions yet is slidable relative to the coupling itself to minimize twisting thereof as the nut is tightened. The upper end of the breaker plate 25 is provided with a recess as shown at 33 into which is seated, by pressing, a filter assembly 35, a spacer ring 37, and a split retainer ring 39, as more fully described hereafter. The coupling 27 is threaded as shown at 41 whereby the jet pack 13 may connect as a single unit to the supply conduit 11.

On its outer periphery, the jet pack housing 17 is provided with an annular projection 43 which is in the form of a truncated cone. The surface 44 of the projection 43 is adapted to wedge with a mating conical surface 45 forming the internal periphery of the heating ring 15. As more fully described hereafter, the heating ring 15 is slidably supported by a pair of hangers or guide rods 47 which are suspended from the supply conduit 11, or other fixed structure, and which are provided with enlarged heads or flanges 49 at their free ends. It will be noted that with the parts of the apparatus assembled as shown in FIGURE 1, the heating ring 15 is supported by the jet pack housing 17 so that its weight serves to urge the conical surfaces 44 and 45 snugly together and thereby assists in providing for good heat transfer between these parts.

The heating ring 15 is provided with a spiral passage 51 having inlet and outlet openings 53 and 55 respectively at its opposite ends. Steam or other heat transfer fluid is delivered into and removed from the passage 51 by flexible hoses, not shown, which permit the heating ring 15 to be moved relative to its hangers 47 without any obstruction. The fluid inlet and outlet openings 53 and 55 of the ring 15 are preferably located approximately 15° from each other and at substantially 90° to the hangers 47, as measured along a circle concentric with the ring axis, to facilitate easy access to the hose connections yet minimize any tendency for the ring 15 to bind as it is moved along the hangers 47. From the standpoint of economy and ease of manufacture, the heating ring 15 is preferably formed of two separate ring elements 57 and 59 which are welded or otherwise connected, as shown at 61, after they have been individually machine. It will of course be understood that the ring 15 may be provided with electrical heating means, in lieu of or in combination with the fluid circulating passage, without departing from the spirit and scope of the present invention.

The jet pack 13 is completely assembled outside of the melt spinning apparatus thus minimizing the shut-down period of the apparatus during jet pack replacement. The jet pack assembly operation is rather simple and merely involves the positioning of the spinneret 23 and breaker plate 25 within the housing 17 as shown in FIGURE 1, after which the filter assembly 35, which includes a plurality of individual filters, the spacer ring 37 and the split retaining ring 39 are placed in the breaker plate recess 33, as shown in FIGURE 2. The coupling 27 is then inserted into the housing 17 and is pressed into contact with the upper edge of the breaker plate 25, as by the use of an arbor press. During this pressing operation the retaining ring 39 is urged completely into the breaker plate recess 33, compressing the edges of the filters of the assembly 35 into a somewhat solid mass which prevents leakage of filament-forming material at this area. While the above noted parts are pressed together, the nut 29 is threaded into the housing 17 to lock the parts of the pack in fixed positions. As heretofore mentioned, the turning movement of the nut 29 is not imparted to the coupling 27 so that damage or distortion of the filter assembly 35 is avoided.

During the operation of the melt spinning apparatus, the jet pack 13 and heating ring 15 are wedged together as shown in FIGURE 1. A heated fluid medium is circulated through the spiral passage 51 in the ring 15 and, by conduction, maintains the jet pack at a desired elevated temperature. The molten filament-forming material passes from the supply conduit 11 and through the coupling 27, filter assembly 35, and breaker plate 25 where it is divided into separate streams before passing through the jet 23.

When it is desired to replace a jet pack 13, the flow of molten filament-forming material through the conduit 11 is stopped, after which the heating ring 15 is tapped lightly to release the same from the conical projection 43 of the jet pack housing. Once loosened, the ring 15 is merely lifted along the hangers 47 while the threaded portion 41 of the jet pack 13 is unscrewed from the conduit 11. With the jet pack removed, the heating ring 15 may be then released and comes to rest on the flanged portions 49 of the hangers 47. A new jet pack 13 is installed merely by passing the same upwardly through the heating ring 15, whereby the mating surfaces 44 and 45 wedge with each other and the ring is lifted from the hanger flanges 49. The threaded end 41 of the jet pack coupling 27 is then screwed into the conduit 11 and the apparatus is again in condition for extrusion operations.

The simple and rapid jet pack replacement procedure requires that the spinning apparatus be shut-down for only a short period of time. Equally important is the fact that the operator is required to perform a minimum

of manipulative operations on the hot and rather compact spinning apparatus. Further, it will be noted that the heating ring 15 is not disassembled during this replacement procedure, and that it adjusts itself by gravity to the mating surface of new jet pack to provide for snug contact and good heat transfer between these parts.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A melt spinning apparatus including a spinning pack having a spinneret for shaping filament-forming material as it is extruded therethrough, heating means encircling said spinning pack and engaging therewith with a wedging action to maintain the same at a desired elevated temperature, and means supporting said heating means for slidable movement in an axial direction to permit removal of said spinning pack.

2. A melt spinning apparatus including a spinning pack having a housing and a spinneret for shaping filament-forming material as it is extruded therethrough, said housing having an annular portion of generally conical configuration projecting from its outer periphery, a heating ring encircling said spinning pack for maintaining the same at a desired elevated temperature, said heating ring having an internal peripheral surface corresponding with said annular portion of said spinning pack and engaging therewith with a wedging action, and means supporting said heating ring for sliding movement in an axial direction to permit removal of said spinning pack.

3. Apparatus as defined in claim 2 wherein said annular projecting portion of said housing is in the form of a truncated cone and wherein said heating ring supporting means includes a plurality of fixed guide rods along which said ring is slidable, said rods being enlarged at their free ends for supporting said ring when said spinning pack is removed.

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