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SPINNERET PACK ASSEMBLY

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FIG. 2

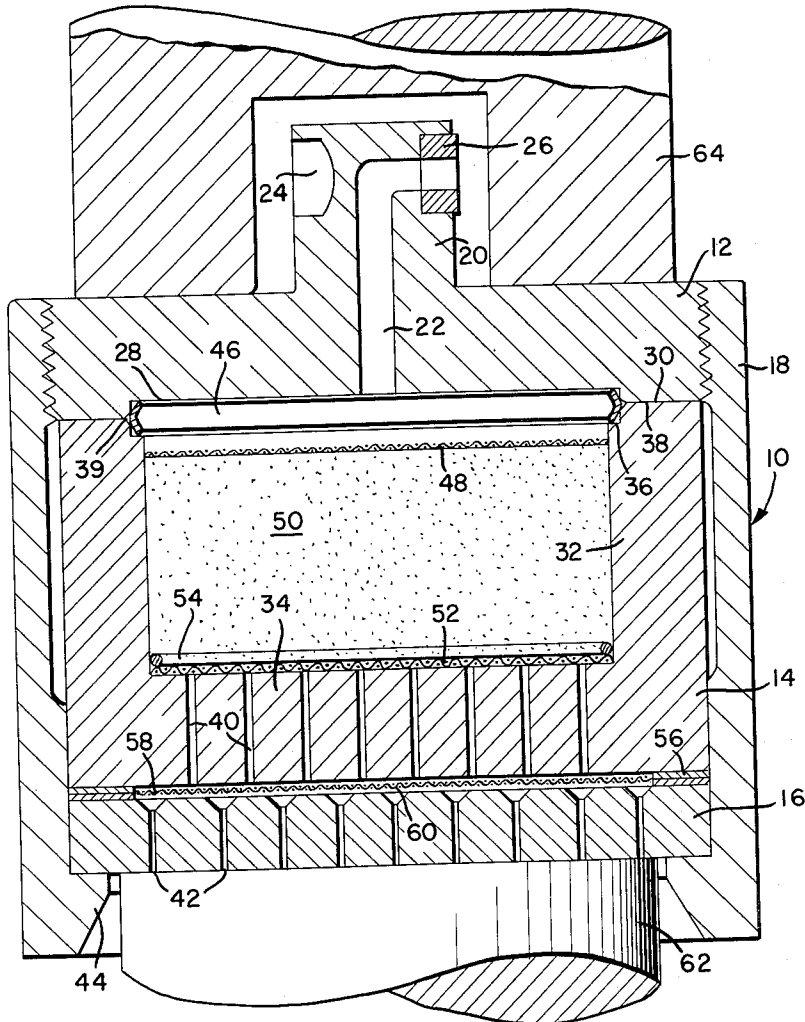


FIG. 1

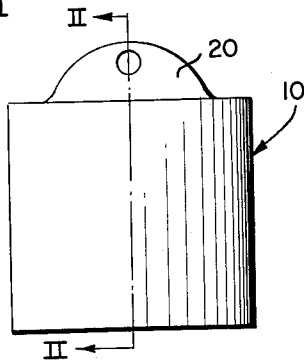
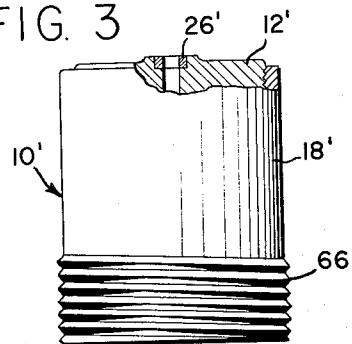


FIG. 3



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## SPINNERET PACK ASSEMBLY

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6 Claims. (Cl. 18—8)

This invention relates generally to the spinning of filaments and the like from liquid organic compositions and, more particularly, to improvements in the filtration and extrusion apparatus which is employed in the spinning process.

In the production of filaments from polymeric materials such as polyhexamethylene adipamide, polyethylene terephthalate, polyacrylonitrile and the like, it is customary to feed the liquid polymer through a filter medium to an extrusion device or spinneret. As the spinning process is continued, it is apparent that filtered material will accumulate and that there will be a progressive decline in the efficiency of the filtering medium. With this efficiency decline, it becomes impossible to maintain the required quality and uniformity of the spun filaments. These conditions lead to an excess number of broken filaments and a high incidence of filament wraps on the draw roll. Eventually, individual spinneret orifices may either spin in an intermittent fashion or become blocked. These and other filament defects are an indication that the process must be interrupted until the defective equipment has been serviced or replaced. In order to minimize the time lost by these interruptions, it has become the general practice to assemble the filter and spinneret elements loosely in the form of a pack which may be preheated and attached to the spinning machine. Pack assemblies of this type have been shown and described by Graves in U.S. Pat. No. 2,266,363 and by Hull et al. in U.S. Pat. No. 2,266,368. These prior art packs have served a very useful purpose in reducing the time lost during a spinning interruption.

Experience has shown that, aside from the accumulation of filtered material, one of the major causes of spinning interruptions has been the occurrence of leaks at one or more of the high pressure joints in the pack assembly. The general objective of the present invention is to provide an improved pack assembly which, in view of important structural features and relationships, minimizes the occurrence of pack leaks and therefore reduces the frequency of spinning interruptions.

The most important object of the present invention is the provision of a spinneret pack assembly in which the sealed joints have gaskets which are accurately and uniformly seated and loaded during assembly of the pack.

Another important object of the present invention is to provide a preassembled pack in which the security of the preloaded joints is improved with increases in the operating pressure of the pack.

A further object is the provision of a preassembled and preloaded spinneret pack which may be quickly and easily attached as a unit to the spinning machine to thus further reduce the time lost during a spinning interruption.

With these and other objects in view, the spinneret pack assembly of the present invention comprises generally superimposed spinneret, filter and lid elements, gaskets at the joints between these elements, and a locking collar surrounding the elements and engaging the spinneret and lid elements in such a manner as to hold all the elements properly assembled with the gaskets under compression. Additional, more minor objects of the present invention will become apparent as the following specification pro-

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gresses, reference being had to the accompanying drawing, wherein:

FIGURE 1 is a side elevational view of a preferred embodiment of the spinneret pack assembly of the present invention;

FIG. 2 is an enlarged vertical section taken on the line II—II of FIG. 1 and illustrating also certain portions of a press which is used in assembling the pack; and

FIG. 3 is an elevational view of an alternate embodiment, parts having been broken away and shown in section to reveal details of construction.

Referring now to the drawing, wherein a preferred embodiment is illustrated in FIGS. 1 and 2, the preloaded spinneret pack assembly of the present invention is designated broadly by the numeral 10 and includes, as the major elements thereof, a lid 12, a filter container or sand holder 14, a spinneret plate 16, and a locking nut or collar 18.

The lid 12 is provided with an upstanding web 20 which has an L-shaped flow passage 22 extending through the lid. Opposite passage 22, web 20 has a depression 24 which accommodates a bolt or clamping lug on the spinning machine (not shown) by means of which the assembly 10 is supported and the passage 22, with its associated metallic gasket 26, is held against a mating port of the manifold through which liquid polymer flows to the assembly 10. On the lower side thereof, lid 12 has a circular recess 28 and an annular surface 30, the inner rim of which is chamfered for a purpose which will be described more fully hereinafter.

Container 14 has a cylindrical side wall 32 and an integral bottom wall 34. Side wall 32 has an internal annular recess which forms a ledge 36 and terminates in a surface 38 complementary to surface 30 on lid 12. The inner rim of surface 38 is chamfered so as to form a V-shaped groove with the similar formation on lid 12 when the surfaces 30, 38 are engaged. Bottom wall 34 has a plurality of distribution passages 40 extending therethrough.

Spinneret plate 16 is provided with orifices 42 through which liquid polymer is extruded in filament form. As shown in FIG. 2, the collar 18 is cylindrically shaped and provided at one end with an turned flange 44 which engages spinneret plate 16 peripherally. At its opposite end, collar 18 is internally threaded for engagement with threads provided externally on lid 12.

The joint between surfaces 30, 38 is sealed by a band-shaped metallic gasket 46 which is seated between ledge 36 and lid 12 and has a convex surface engaging the chamfered edges of groove 39. Within the container 14, a screen 48 functions to contain and isolate a body 50 of an inert filtering medium such as sand. The filtering medium 50 is supported and contained by a fine screen 52 which is held in place by a deformable metallic ring 54. Bottom wall 34 is spaced from plate 16 by a pair of flat annular metallic gaskets 56 between which is sandwiched a screen 58. In addition to sealing the joint between plate 16 and container 14, the gaskets 56 also present a distribution space 60 for liquid polymer passing from passages 40 to orifices 42.

The pack 10 is assembled by superimposing the various elements including the spinneret plate 16, gaskets 56 with the screen 58 therebetween, container 14 with its contents in place and with its exterior carefully cleaned, gasket 46 and lid 12 on the platen 62 of a suitable hydraulic press. The press ram 64 is then lowered to engage lid 12 and the pack is loaded with the proper force to seal the gaskets 46 and 56. The locking nut 18 is screwed up by hand on the lid 12 until the flange 44 is tight against spinneret plate 16, to thus seal the assembly with a proper and uniform compression load upon all

gaskets. For purposes of aligning the various elements, collar 18 may be engaged with lid 12 before application of the press load and then reset before the press load is released.

The distance between ledge 36 and recess 28 is such that there is metal-to-metal contact when the appropriate load has been placed on gasket 46, i.e., this self-sealing gasket should be loaded sufficiently to seal low pressures and to prevent early leakage. As the flow increases and the pressure builds up, gasket 46 is further deformed into a tight sealing engagement with the edges of V-shaped groove 39, as set forth more fully in the copending application of Gill and Hildebrand, Ser. No. 681,328, filed August 30, 1957, now Patent Number 2,980,204.

The magnitude of the press load placed on flat gaskets 56 depends on the material chosen which, in turn, depends on the anticipated operating pressure within the pack. The press force will vary from a maximum in those high pressure assemblies in which stiff metallic gaskets 56 are employed to a minimum in those low pressure assemblies where soft gaskets are employed.

The pack assembly of FIGS. 1 and 2 has utility in a high throughput, high pressure, melt-spinning system. As noted previously, one of the major causes of spinning interruptions in known pack assemblies has been the occurrence of leaks at one or more of the high pressure joints in the assembly. One explanation of these leaks is that, with the application of high internal pressures (up to 10,000 pounds per square inch), the assembly tends to elongate in the direction of polymer flow, with the result that the gasketed joints separate and lose their sealing effect. With reference to FIG. 2, it is noted that any elongation of locking nut 18 will have no adverse effect on the sealing capacity of gaskets 56; rather, the increasing internal pressure acts on container 14 in such a manner as to improve the seal despite the fact that the assembly expands. The band-shaped self-sealing gasket 46, which is initially deformed by the relatively light limited compression thereof between lid 12 and ledge 36, is subsequently further deformed by the pressure of the polymeric material and the joint between surfaces 30, 38 is ultimately sealed solely by the pressure and the resultant deformation of the gasket. As the pressure within the assembly builds up and it begins to elongate, surfaces 30, 38 are partially separated. However, the seal is retained by the tendency of gasket 46 to spring back to its initial configuration, i.e., to remain in sealing engagement with lid 12 and ledge 36. At higher pressures, the gasket 46 is deformed into engagement with the edges of the V-shaped groove and becomes self-sealing, i.e., higher pressures result in a permanent deformation of the gasket.

Since the outer surface of wall 34 has a greater area than its inner surface and there is a pressure drop between these two areas, in low pressure operation, e.g., during start-up, when this pressure drop is low, there is a slight upward force on container 14 and some expansion of gaskets 56. The compression of gaskets 56 in the assembly procedure is sufficient to absorb expansion without effect on the sealing capacity of the joint. As the operating pressures increase, this pressure drop increases and functions to overcome the effect of the area differential.

In addition to those leaks which occur as a result of pack elongation, another cause has been the uneven compression of gaskets in packs of the type shown by Hull et al., which are installed and sealed simultaneously by tightening a plurality of attaching bolts. These difficulties have been overcome in the pack assembly of the present invention by the use of an assembly press 62, 64 providing proper and uniform seating and loading of all gaskets and by providing locking means 18 for retaining the uniform load applied by the press prior to removal of the press load.

In FIG. 3, another embodiment of the pack assembly of this invention is illustrated which differs from the preferred embodiment primarily in the means for attach-

ing the pack to a spinning machine. In place of web 20, the locking nut 18' is provided externally with threads 66 by means of which the gasket 26' is compressed and pack 10' is attached to a spinning machine. This embodiment is designed for a low through-put high pressure service in which heat transfer between the pack and the spinning machine is a major factor. The use of a threaded fastener, as shown in FIG. 3, provides a considerably greater percentage of area contact and, by comparison with the pack of FIG. 2, facilitates adequate heat transfer from the spinning machine. Internally, this embodiment is in all respects similar to that shown in FIG. 2. The same may be said for the assembly procedure.

It is apparent that many changes and modifications may be made in the pack assembly of the present invention without departing from the spirit thereof and it is, therefore, intended to be limited only by the scope of the appended claims.

I claim:

1. A preloaded spinneret pack assembly comprising: a circular spinneret plate; a filter container having a cylindrical side wall and a bottom wall with distribution passages therethrough; annular gasket means between said bottom wall and the plate, presenting a distribution space therebetween; a lid closing said container and forming a joint with said side wall, there being a ledge formed on the inner face of said side wall adjacent the joint; an annular band-shaped gasket held between said ledge and the lid in sealing engagement with both the lid and said side wall at said joint; and a locking nut engaging both the plate and the lid through the periphery thereof for holding the assembly clamped under compression, said lid having means thereon adapted for connection to a source of liquid polymer and a flow passage discharging to the interior of said container.

2. A preloaded spinneret pack assembly comprising: superimposed spinneret, filter container and lid elements having a flow passage therethrough for a liquid polymer; at least one flat peripherally extending gasket between said spinneret and container elements; an annular band-shaped gasket in bearing engagement with the lid and said container at the joint therebetween within said assembly; and a locking collar circumscribing said elements, said collar having means thereon engaging both said lid and said spinneret for holding the elements together with said flat gasket under compression.

3. The pack assembly of claim 2 wherein said elements are circular and said means comprises a continuous intumed flange engaging said spinneret and a threaded section engaging said lid.

4. A preloaded spinneret pack assembly comprising: superimposed circular spinneret, filter container and lid elements having a flow passage therethrough for a molten polymer, said container having a cylindrical side wall and an annular ledge formed on the inner face thereof, said lid having a surface mating with said side wall to form a joint; a band-shaped metallic gasket held between the lid and said ledge in sealing relationship to said joint; at least one flat annular gasket between said container and spinneret elements; and a locking collar surrounding said elements, said collar having an intumed flange bearing against said spinneret and being in threaded engagement with said lid for holding the elements clamped together with said gaskets under compression.

5. The pack assembly of claim 4 wherein said side wall and the mating surface of said lid are chamfered along the inner rims thereof to present a V-shaped groove, said band-shaped gasket being initially deformed into engagement with the groove edges and subject to further deformation responsive to the pressure of polymer flowing through the assembly.

6. A preloaded spinneret pack assembly comprising: superimposed spinneret, filter container and lid elements having a flow passage therethrough for a liquid polymer,

said container having an upstanding side wall provided with a ledge on the inner face thereof, said lid having a surface mating with said wall to form a joint; a band-shaped metallic gasket held between the lid and said ledge in sealing relationship to said joint; at least one flat gasket between said container and spinneret elements; and a locking means engaging both said lid and said spinneret for holding the elements together with said gaskets under compression.

## References Cited in the file of this patent

## UNITED STATES PATENTS

|           |                   |               |
|-----------|-------------------|---------------|
| 2,266,368 | Hull et al. ----- | Dec. 16, 1941 |
| 2,871,511 | Speakman -----    | Feb. 3, 1959  |
| 2,879,543 | McDermott -----   | Mar. 31, 1959 |

## FOREIGN PATENTS

|         |                     |              |
|---------|---------------------|--------------|
| 780,743 | Great Britain ----- | Aug. 7, 1957 |
|---------|---------------------|--------------|