

Feb. 3, 1959

R. H. SPEAKMAN  
MELT SPINNING APPARATUS

2,871,511

Filed Aug. 24, 1954

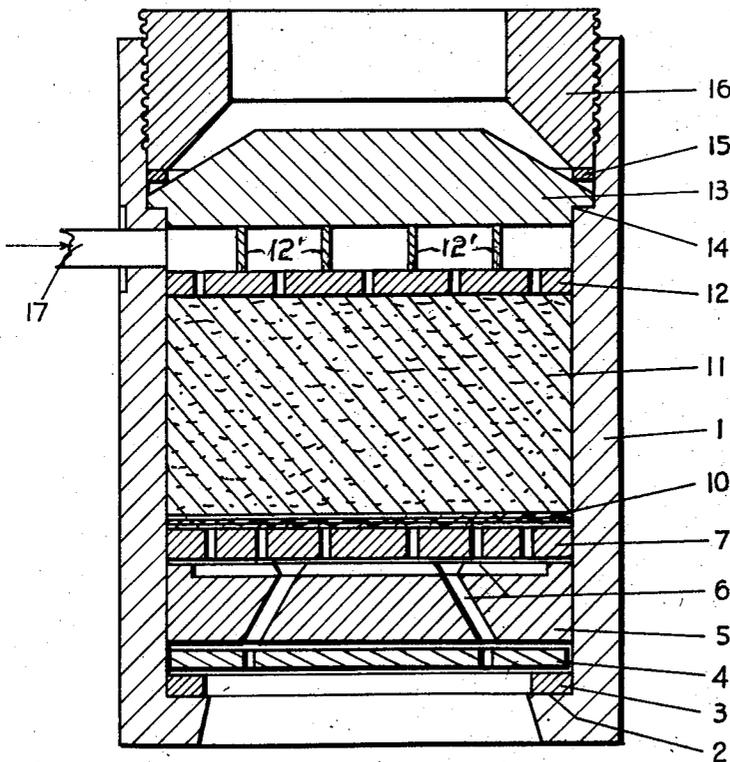


FIG. 1

INVENTOR:

*Raymond Holden Speakman,*  
BY *Cushman, Harley & Cushman*  
ATTORNEYS.

1

2,871,511

MELT SPINNING APPARATUS

Raymond Holden Speakman, Harpenden, England, assignor to Imperial Chemical Industries Limited, London, England, a corporation of Great Britain

Application August 24, 1954, Serial No. 451,865

Claims priority, application Great Britain August 28, 1953

5 Claims. (Cl. 18—8)

This invention provides an improved method and apparatus for melt-spinning artificial filaments, particularly for melt-spinning linear condensation polymers such as highly polymeric polymethylene terephthalates and polyamides.

In the melt-spinning of artificial filaments the fibre-forming viscous melt is pumped at a high pressure through a spinning pack comprising filters, auxiliary devices such as melt distribution plates, gauzes, supporting plates and the spinneret through which the melt is extruded, all housed in a container, usually of cylindrical section.

Pressures which are used in melt-spinning are very high, being of the order of 2000 lb. per square inch. This pressure is generated either by a screw or, more usually, a gear metering pump which feeds the melt to the spinning pack. As spinning proceeds the hydraulic pressure inside the pack increases. Under these high pressures leaks of the melt are liable to develop between the components of the spinning pack, the hydraulic pressure of the melt tending to force the components apart. This tendency to leak is aggravated by the tendency of gasket material to creep under mechanical stress.

I now provide a method of melt-spinning using a spinning pack assembly wherein these undesirable leaks of the melt are virtually eliminated, even during prolonged use and which has the added advantage that the spinning pack can be dismantled and reassembled easily and quickly.

According to my invention I provide an improved method of melt-spinning utilising a spinning pack wherein the hydraulic pressure of the melt inside the pack acts to seal some or all the joints between the components of the pack.

My invention also provides an improved melt-spinning apparatus comprising a spinning pack, some or all of the components of said spinning pack being capable of limited relative movement under pressure, so that the hydraulic pressure within the spinning pack acts to close some or all the joints between the components of the spinning pack, and means for feeding molten material to said spinning pack, under pressure.

The spinning pack components offer a large internal surface to the viscous melt inside the spinning pack assembly and are subjected to a high hydraulic pressure. The pressure is transmitted to the gaskets or similar jointing devices between the various components and is proportionally magnified when the area of the joints is small compared with the area of the surface of the component in contact with the melt, so that the gaskets or similar jointing devices are compressed further with rising pressure.

The drawing illustrates but does not limit the scope of our invention.

Fig. 1 is a diagrammatic section through a spinning pack.

The spinning pack assembly comprises the cylindrical

2

container 1 of circular section which is provided with a shoulder 2 at its lower end. The shoulder 2 supports a gasket 3 (shown uncompressed), a spinneret 4, a bridge plate 5 with channels 6, distribution plate 7, gauzes 10, sand pack 11 and upper distributor plate 12. The distributor plate 12 is attached by legs 12' to a pack lid 13, which rests on a flange 14, beneath a gasket 15 (shown uncompressed) under a thread lock ring 16. The parts of the pack are fitted into the barrel in the order listed and the lock ring 16 tightened on the lid 13.

During melt-spinning, the melt is pumped by a gear pump (not shown) into the pack via the entry port 17. The pressure of the melt tends to lift the lid 13 against the gasket, thereby compressing it against the ring 16. The melt flows through the pack from the plate 12 to the spinneret 4 and the components are all forced by the hydraulic pressure against the spinneret 4, which compresses the gasket 3. Thus, the hydraulic pressure acts to seal the joints where melt might escape from the pack. The build-up of hydraulic pressure during spinning compresses the gaskets further and seals the joints more tightly.

To clean the pack when spinning is completed and the hydraulic pressure released by stopping the pump, the ring 16 is unscrewed and the components removed from the barrel. Thus, the process of dismantling and refitting is essentially quick and simple.

In the drawing a cylindrical container of circular section is illustrated. Such a shaped container is preferred because of its symmetry, ease of manufacture and cleaning, and the fact that the various other components of the spinning pack can easily be made and fitted into such a container. Containers of other shapes may be used, if desired.

It is preferred that that part of the container which encloses the other components of the spinning pack, should be in one piece to obtain the full advantage of our invention. If desired, however, this need not be so and the flange 2 for example, could be bolted, threaded or otherwise attached to a cylindrical tube. In such a case care must be taken to avoid leakage round the joint.

The pack illustrated is one in which entrance of the melt is from the side. This enables both the gasket 15 at the top of the pack and the gasket 4 at the bottom of the pack to be subjected to pressure by the movable components. With certain spinning apparatus a side entry for the melt may not be possible, the melt coming vertically downwards into the pack, through the pack lid 13. In this case it is preferred that the pack lid should not be movable but should be rigidly fixed in position before spinning starts. Care must be taken to ensure that this rigid joint does not leak under the high melt pressures involved.

The flat circular gaskets shown in the drawing may be replaced by gaskets of different section e. g. triangular section, if this assists the sealing of the mating surfaces. Any heat resistant material may be used for the gaskets, which does not tend to disintegrate under heat and pressure.

Using the method and apparatus of my invention the nuisance of leakage due to gasket creep is minimised because the pressure on all jointing devices is continuously maintained by the hydraulic pressure of the melt, however thin the gasket becomes. Owing to the simplified design no clamping bolts are necessary to hold the components together and a larger filter bed area becomes available for a given outside diameter of the spinning pack container. The packs of my invention can be put together and dismantled very easily and any wear or damage to sealing surfaces is compensated for by the

3

continuously increasing hydraulic pressure during spinning.

What I claim is:

1. An improved melt-spinning apparatus wherein all the pressure-resistant joints are sealed by the hydraulic pressure of the melt comprising a spinning pack and a duct for transmitting melt thereto and connected therewith, said spinning pack comprising a vertical container having an inner wall and an annular flange at its lower end projecting inwardly, an annular gasket of relatively small cross-sectional area supported on said flange, at least one other component of the spinning pack being loosely mounted in operative position in said container and resting on said gasket, said one other component being of relatively great cross-sectional area and extending substantially across the inner diameter of the pack, said inner wall being unbroken from said gasket to said duct and a pack lid closing the upper end of said container.

2. The apparatus of claim 1, in which the gasket is directly below a spinneret, said spinneret being a component of said spinning pack.

3. An apparatus according to claim 1, wherein the duct enters the container horizontally below the pack lid, and the pack lid is capable of limited vertical movement against a gasket, mounted above the pack lid and between it and a rigid structure, whereby the vertical movement of the pack lid is caused by the hydraulic pressure of the melt.

4. A spinning pack assembly for melt spinning including a tubular housing opened at at least one end, closure means engaged to the other end of said housing for sealing this end, a radially inwardly directed annular flange means joined to said housing adjacent said one end thereof, internal removable components including a spinneret assembly loosely mounted in operative position in said housing intermediate said closure means and said flange means for axial movement therein, an annular compress-

4

sible seal sandwiched in between said flange means and said spinneret assembly, and means including a duct for introducing a melt under pressure into said housing intermediate said closure means and said spinneret assembly so that the pressure of the melt will operate to effect relative movement of said spinneret assembly toward said flange means thereby compressing said seal.

5. The structure defined in claim 4 wherein said closure means includes: an annular, radially inwardly directed member joined to said housing, a radially inwardly directed flange on said housing disposed adjacent to and axially inwardly of said member, a disc-like element loosely disposed in said housing intermediate said member and said last-named flange for axial movement therein, and an annular compressible seal intermediate said element and said member.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

1,504,547	Egerton	Aug. 12, 1924
1,983,330	Welch	Dec. 4, 1934
2,253,073	Hayes	Aug. 19, 1941
2,266,363	Graves	Dec. 16, 1941
2,266,368	Hull et al.	Dec. 16, 1941
2,528,260	Cademartori	Oct. 31, 1950
2,571,486	Reynolds	Oct. 16, 1951
2,589,870	Sale et al.	Mar. 18, 1952
2,803,851	Braunlich et al.	Aug. 27, 1957

##### FOREIGN PATENTS

863,841	Germany	Jan. 19, 1953
---------	---------	---------------

##### OTHER REFERENCES

"Rayon & Textile Monthly," February 1936 (page 52 (92)) relied on.