Nov. 25, 1969 P. V. M. VAN DEN BIGGELAAR 3,479,692

SPINNERET ASSEMBLY

Filed April 18, 1967 2 Sheets-Sheet 1

FIG. 1

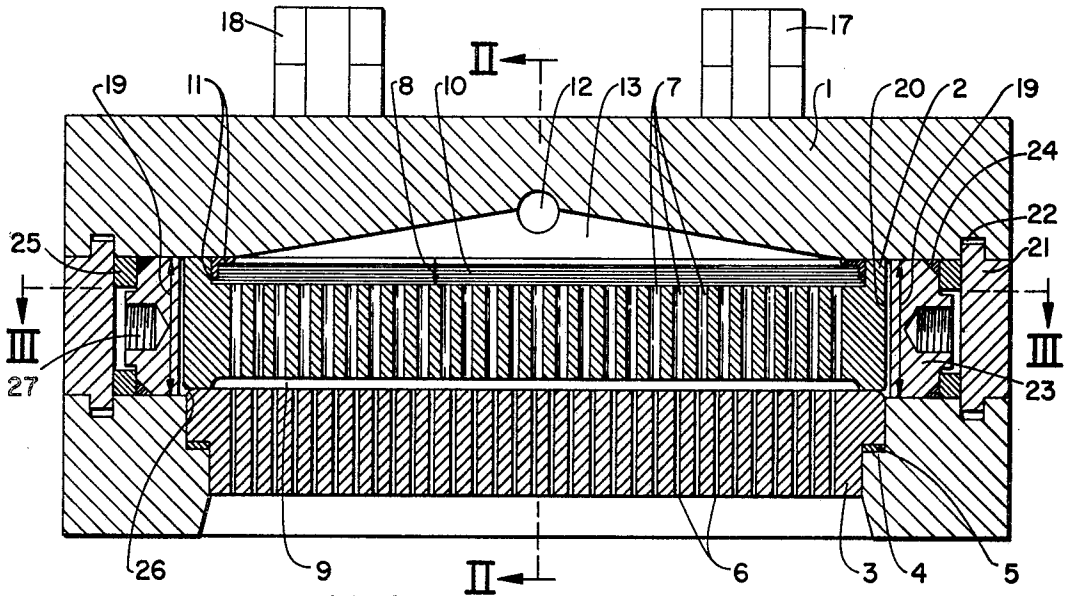
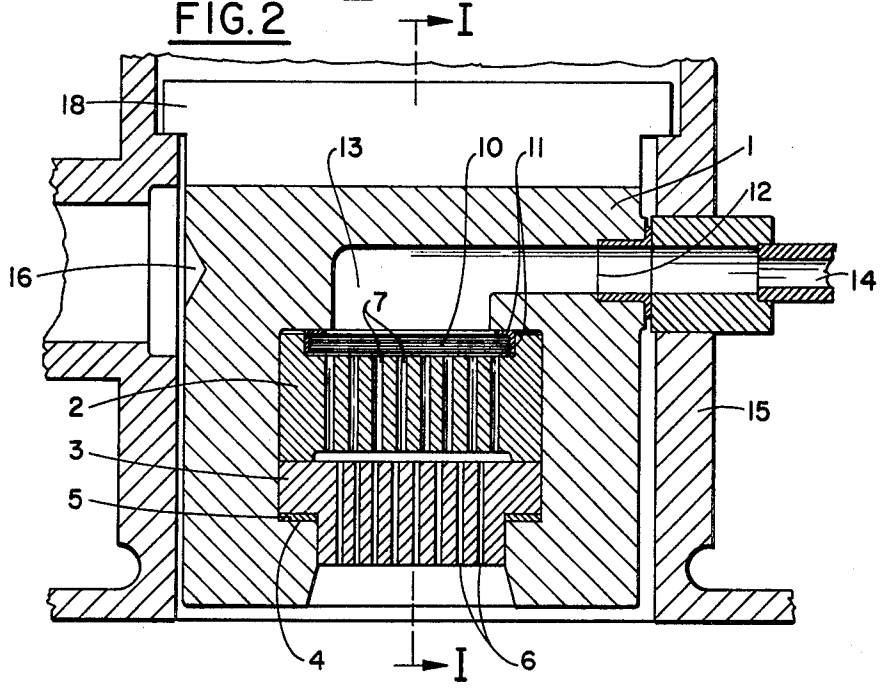


FIG. 2



INVENTOR.
PAUL V. M. VAN DEN BIGGELAAR
BY

Nov. 25, 1969 P. V. M. VAN DEN BIGGELAAR 3,479,692

SPINNERET ASSEMBLY

Filed April 18, 1967 2 Sheets-Sheet 2

FIG. 3

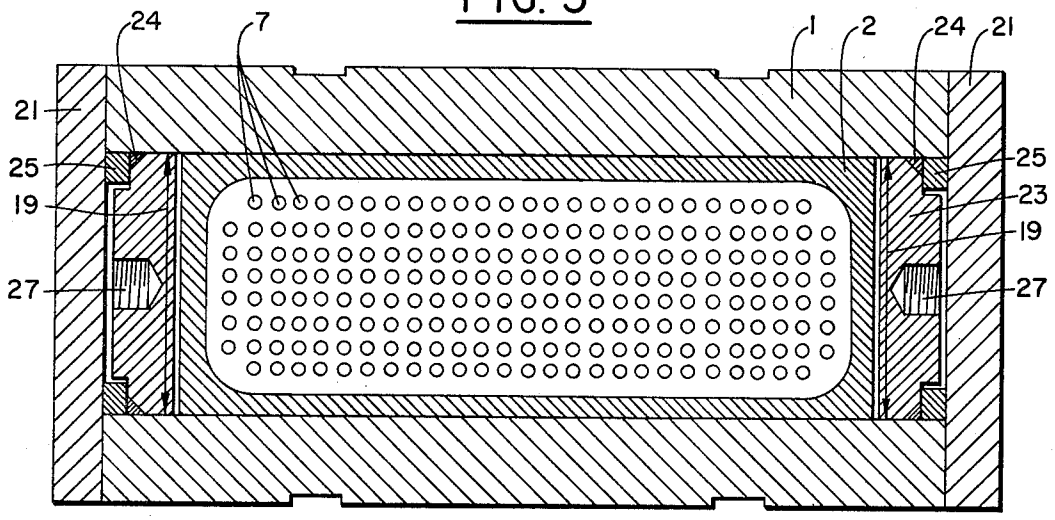
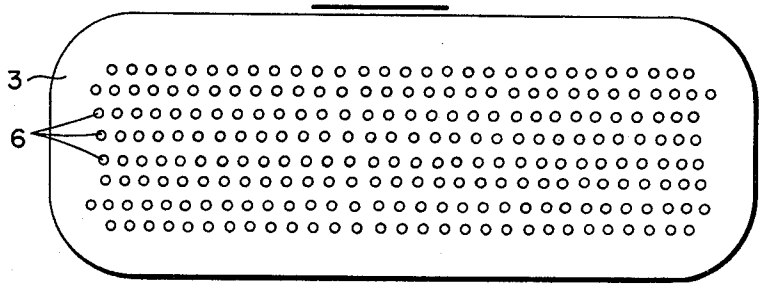


FIG. 4



INVENTOR.
PAUL V. M. VAN DEN BIGGELAAR
BY

United States Patent Office 3,479,692 Patented Nov. 25, 1969

3,479,692

SPINNERET ASSEMBLY

Paul V. M. van den Biggelaar, Huissen, Netherlands, assignor to American Enka Corporation, Enka, N.C., a corporation of Delaware

Filed Apr. 18, 1967, Ser. No. 631,815
Claims priority, application Netherlands, Apr. 28, 1966, 6605678
Int. Cl. D01d 3/00
U.S. Cl. 18—8 2 Claims

ABSTRACT OF THE DISCLOSURE

An improved spinneret apparatus for the manufacture of synthetic filaments, fibers and threads comprising a container, distribution plate and spinneret plate, each rectangular in shape, at least one opening being provided in one side of said container for installing and removing said distribution and spinneret plates, the height of said opening being equal to or slightly larger than the thickness of said plates and the length of said opening being equal to or slightly longer than the length of the smallest side of said plates, said opening being capable of being closed with a sliding locking member positioned therein, said container being self-sealing when said opening is closed and said container subjected to polymer pressure.

This invention relates to spinneret apparatus used in the melt solution spinning of filaments, threads and fibers from thermoplastic materials such as polyamides, polyesters, polyolefins, polyvinyls and glass.

It is generally known and accepted in the prior art to provide a spinneret apparatus, an assemblage of components for imparting shape to melt solutions of polymers and embraces a container which supports, in a sealed relationship, a distribution plate, a spinneret plate having one or more shape imparting orifices, filter means, etc. In this type of an arrangement of functional components, the entire apparatus, or as it is commonly called, a spinneret assembly or "pack," is detachably connected to a polymer melt feed conduit and is further provided closure or locking means, which permits access to the interior of the container for cleaning and repair of the components contained thereby.

U.S. application Ser. No. 513,464, filed Dec. 13, 1965, and commonly assigned herewith, is exemplary of this general type of apparatus.

Shaping structures such as fibers and films from melt solutions of polymers of increased viscosity have been found to present several numerous and difficult problems when using spinneret packs of this general type of construction, however. In the melt spinning of high performance filaments, fibers and yarns, there is the need to use polymers having an increased viscosity and, consequently, much higher pressures are needed to force the polymer through the assembly. Pressures on the order of 200–500 atmospheres are not uncommon.

The presence of these high pressures significantly increases the magnitude of forces acting on the container and components and makes it very difficult and costly to construct a container having sufficient strength and rigidity to withstand such forces. It is especially difficult to effect a complete seal between the container and the closure means used to gain access to the components of the assembly. Leakage is particularly noticeable, especially along the circumference of the lid and great numbers of large bolts are usually required around the top of the lid in an effort to prevent it. Securing the lid by bolts is an expedient which is both very costly to construct and operate. Continual removal of the number of

bolts usually required in order to gain access to the assembly for cleaning and repair purposes is very time-consuming, notwithstanding the fact that recurring assembly-disassembly causes excessive wear to the lid.

It is, therefore, an object of this invention to provide an improved spinneret assembly of generally the above-mentioned type in which a considerably better seal between the container and functional components thereof is realized in order to facilitate spinning highly viscous polymeric solutions.

Reference is now made to the accompanying drawings for a better understanding of the nature and the objects of the present invention, which drawings illustrate the best mode presenting contemplated for carrying out the objects of the invention. Its principles are not to be construed as restrictive or limiting in any manner above that which is claimed. In these drawings,

FIGURE 1 is a longitudinal section taken along the axis I—I of FIGURE 2;

FIGURE 2 is a cross section along line II—II of FIGURE 1;

FIGURE 3 represents a sectional view along lines III—III of FIGURE 1; and

FIGURE 4 is a plan view of the spinneret plate.

In brief, the present invention envisions a spinneret assembly for spinning highly viscous polymers in which a locking member for the component parts of such apparatus is connected to the container in a manner which facilitates easy removal of the components yet while preventing polymer leakage when such components are in an operating position and being subjected to extremely high polymer pressures.

The invention features a spinneret pack container including a closure or locking member so constructed to present the smallest surface area possible to the effects of polymer pressures prevalent in the container. An assembly is provided wherein the distribution plate and the spinneret plate are rectangular in shape and means are provided for lateral assembly or disassembly thereof through the sidewalls of the container. The opening provided in the container for such assembly or disassembly is so constructed that its dimensions approximate or are only slightly larger than the actual thickness of the distribution plate and the spinneret plate and, as a preferred embodiment, the length of the opening approximates the length of the smallest side of these two rectangular shaped components. Thus according to this embodiment, it will be obvious that the opening in the container should then be constructed in at least one of the short sidewalls of the container in contradistinction to positioning the opening along the front or back sidewall thereof; or at the top of the container.

The container may be made self-sealing in which case a closure or locking member is preferably constructed as a slide with the long edges thereof guided in oppositely opposed grooves provided in facing sides of the container sidewall. In this embodiment a gland, packing rings or ring (which expands as a result of the polymer pressure) and an end ring are interposed between the slide and the distribution and spinneret plate components.

Referring now to the drawings, in FIGURE 1 numeral 1 refers to the rectangularly shaped container of the spinneret assembly according to the present invention. Distribution plate 2 and the spinneret plate 3 are also substantially rectangular in shape. Spinneret plate 3 is positioned on shoulder 4 in container 1. A packing ring 5, formed from conventional materials such as high temperature resistant rubber or alternatively, deformable metal, is conveniently provided between the shoulder and the spinneret plate. Spinneret plate 3 is

provided with a number of shape imparting orifices **6** which are also arranged in a substantially rectangular pattern which possibly can best be seen in FIGURE 4. Spinneret plate **3** supports distribution plate **2**. Plate **2** has several distribution channels machined therein. Two chambers **8** and **9** are provided on both the top and lower surfaces of the distribution plate. Chamber **9** serves to equalize the pressure exerted by the polymer and chamber **8** serves to receive a filter gauze pack **10** which is conveniently mounted in support ring **11**.

A feed conduit for the molten polymer to be spun into filaments, threads and fibers is provided and is connected to the container above the distribution plate. A polymer melt is fed to the container via line **14** positioned in heating jacket **15** which is adapted to completely surround container **1**. The polymer then passes through channel **12** to chamber **13**. The top of chamber **13** gradually recedes in a direction towards the rectangular sidewall of the container in order that a uniform distribution of melt over the entire surface of filter pack is obtained. The joint between the lines **12** and **14** in container **1** and jacket **15** are sealed by means of a packing sleeve and a bolt (not shown) which is adapted to be fitted into recess **16** of container **1**. Container **1** is supported in heated jacket **15** by means of bars **17** and **18**.

As detailed in FIGURES 1, 2 and 3, opening **19** is provided in the housing and is located opposite distribution plate **2**. The height of the opening generally corresponds to or is only slightly larger than the thickness of distribution plate **2** and spinneret plate **3**. Thus, it will be observed that the surface area of the opening **19** is therefore much smaller than the face or underside of the spinneret plate or distribution plate and, accordingly, relatively large apparatus may be provided yet while having a relatively small opening wherein functional component parts of the apparatus may be assembled or removed.

Each of the openings **19** is adapted to be closed by cover **21** which is slidably mounted in grooves **22** provided in container **1**. Pressurized sealing of the closure is accomplished in providing gland **23**, packing ring **24**, and end ring **25**. As soon as the pressurized molten polymer is introduced into the container, complete sealing is effected.

In practice and when the apparatus is assembled, packing ring **5** is first mounted on shoulder **4**. The spinneret plate is then inserted through any one of the openings **19** after which the distribution plate, including filter pack **10**, is inserted. To facilitate inserting distribution plate **2** within the housing, a slightly projecting top edge of spinneret plate **3** is provided with a bevel **26**.

When dismantling the components of the apparatus, the above procedure is carried out in reverse order.

Gland **23** is provided with a threaded hole to receive a draw bolt (not shown) to facilitate its removal. As detailed in FIGURE 2, it will be apparent that container

1 is substantially unitary in construction with the exceptions being; opening **19** and the essentially U-shaped cavity for positioning the above-mentioned components. Such an expedient makes it possible for the apparatus to withstand the extremely high pressures which are normally encountered when spinning the highly viscous polymeric melts into filaments and fibers.

The materials of construction of the apparatus are not critical and may be selected from any materials that are known to be satisfactory for the extrusion of melt solutions. Materials such as titanium or stainless steel are quite satisfactory.

Although the invention has been illustrated in its application to processes for shaping fibers, filaments or threads from highly viscous polymer melts, it obviously has utility in production of solution or melt cast films.

Other modifications or changes in embodiments within the scope of the invention will be apparent to those skilled in the art. Hence, it is intended that the invention be limited only to the extent as set forth in the following claims.

What is claimed is:

1. In a spinneret apparatus for the manufacture of synthetic filaments, fibers and threads, said spinneret comprising, in combination, a container, means for delivering polymer solution to said container, a spinneret plate in said container provided with orifices to impart shape to said polymer, a distribution plate in said container between said means for delivering the polymer solution to said spinneret plate, the improvement of providing at least one opening in one side of said container for installing and removing said distribution and spinneret plates, said container, distribution plate, and spinneret plate being rectangular in shape, the height of said opening being equal to or slightly larger than the thickness of said components and the length of said opening being equal to or slightly longer than the length of the smallest side of said components, said opening being capable of being closed with a sliding locking member positioned in said opening, said container being self-sealing when said opening is closed and subjected to polymer pressure.

2. The improved spinneret of claim **1** wherein opposite side walls of said rectangular container are provided with a closable opening providing access to said spinneret plate and said distribution plate.

References Cited

UNITED STATES PATENTS

823,009	6/1906	Waddell.
2,045,722	6/1936	Pierrat et al.
2,661,497	12/1953	Birmingham.
2,771,636	11/1956	McIntosh et al.
2,838,084	6/1958	Samler.

WILLIAM J. STEPHENSON, Primary Examiner