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APPARATUS FOR THE PRODUCTION OF ARTIFICIAL STRUCTURES

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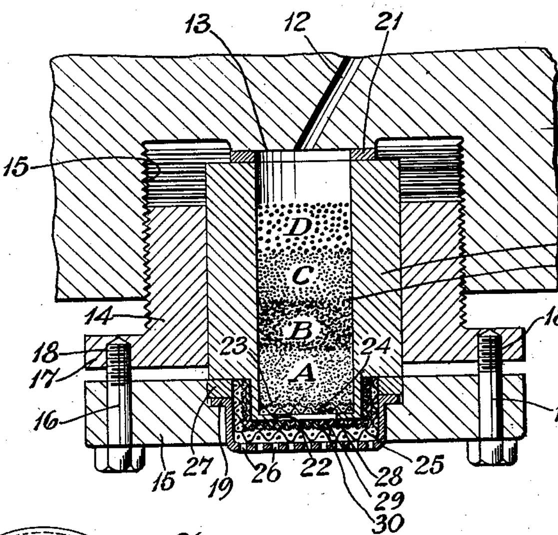

Fig. 1

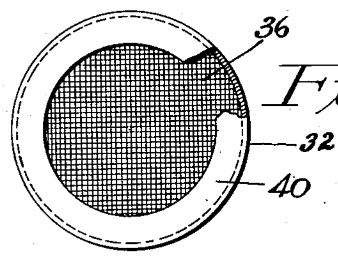

Fig. 3

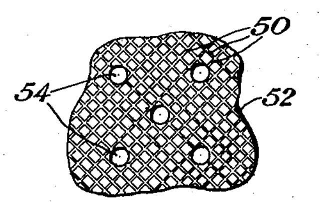

Fig. 4

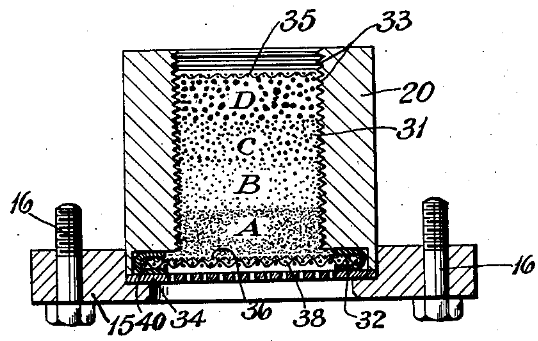

Fig. 2

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APPARATUS FOR THE PRODUCTION OF ARTIFICIAL STRUCTURES

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4 Claims. (Cl. 18—8)

This invention relates to improvements in the production of yarns, filaments, ribbons, and the like from synthetic materials. More particularly, it relates to the melt spinning of yarns, filaments, ribbons, and the like from organic filament-forming compositions. It is particularly concerned with the uninterrupted melt spinning of multifilament yarns from synthetic linear polymers with the proper maintenance of constant pressure on the molten material to prevent bubble formation.

For convenience, the invention will be described with respect to the melt spinning of synthetic linear polyamides of the type described in U. S. patents to Carothers Nos. 2,071,250 and 2,071,253. These synthetic linear polyamides are of two types: those obtainable from monoaminomonocarboxylic acids and those obtainable from the reaction of suitable diamines and dibasic carboxylic acids. These synthetic linear polyamides may be prepared, for example, by a process of condensation polymerization such as is described in U. S. Patent No. 2,130,948.

It has been proposed in Carothers U. S. 2,130,-948 to produce multifilament yarns by extruding a molten mass of these synthetic linear polyamides through a multiplicity of spinning orifices into a relatively cool atmosphere. The molten material solidifies quickly in the form of continuous filaments which may be suitably treated and collected to yield a multifilament yarn of high commercial utility. The extrusion orifices in the spinneret are necessarily very small and care must be exercised to prevent their clogging by particles of foreign matter or, indeed, particles of partially melted polyamide material. If a single opening is even temporarily wholly or partially closed, the formation of a filament at that opening will be retarded or interrupted, resulting in variation of the filament denier, the number of filaments, and the jet velocity at the open spinneret orifices and also in broken filaments, thus preventing production of a uniform yarn. It is evident that means must be provided for insuring delivery of a clean, liquid mass to the spinneret.

The organic filament-forming compositions of which the synthetic linear polyamides are an example have a tendency to change at the elevated temperatures of a melt spinning process. The synthetic linear polyamides are obtained by a polymerization at elevated temperature so there is a tendency for the polymerization to continue thus altering the physical properties such as the viscosity, as well as the chemical properties. There is also a tendency for slight chemical decomposition to take place with the liberation of gaseous products and attendant formation of gas bubbles. These gas bubbles will have the same effect as a foreign particle insofar as the spinning operation is concerned because if a bubble is permitted to reach the spinneret opening a broken filament is likely to result.

In accordance with the invention described in the copending application to Graves, Serial No. 223,997 filed August 9, 1938, provision is made for the melt spinning of synthetic linear polyamides whereby the melting can be controlled so that a constant supply of molten material can be furnished to the spinneret with a minimum of exposure to melting conditions. By this means, changes in the polymeric material, caused by subjection to melting conditions, can be kept at a minimum. In copending application to Graves, Serial No. 232,314, filed September 29, 1938, provision has been made, by compressing the molten synthetic linear polymer, to redissolve any gaseous bubble-forming decomposition products and to prevent further harmful bubble formation in the molten mass, whereupon the bubble-free molten mass is then delivered by a suitable metering device to the spinneret assembly.

In the above-mentioned application to Graves, Serial No. 232,314, there is described a filter pack between the metering pump and the spinneret composed of a large number of metallic screens. The screen pack assembly disclosed therein consists of 180 screens selected to have a variety of screen mesh sizes. When arranged in the preferred fashion, the screen assembly offers in practice at least as much over-all resistance to the liquid flow as the spinneret holes themselves. This arrangement of filtering screens is, however, cumbersome and costly. Screens of sufficiently fine mesh are difficult to secure and the arrangement of them to avoid clogging and to insure delivery of the spinning melt uniformly over the area of the spinneret is difficult. It is very difficult to arrange the screens to prevent a by-passing or channeling of the liquid at the edges of the screens. Even if this screen assembly is modified to the extent that gaskets are introduced to eliminate channeling or by-passing, the assembly becomes even more cumbersome and requires so much space that the volume of melt required to fill the filter chamber will be excessive and this will result in difficulty of temperature control and in harmful decomposition or polymerization of the synthetic linear polyamide.

Unless a screen pack is constructed with great accuracy with the screens of varying mesh sizes properly arranged various spinning difficulties may be encountered. Due to improperly constructed screen packs difficulty has been encountered from dripping spinneret orifices, non-uniform flow from spinneret orifices particularly when starting the spinning operation, broken filaments, and rapid building up of pressure causing shearing of pins in the spinning pumps and denier variations in the yarn.

It is an object of this invention to provide an improved spinneret assembly for the melt spinning of multifilament yarn.

It is another object to provide an improved spinneret assembly which will maintain a uniformity of pressure and suitably filter a molten organic filament-forming composition while maintaining the volume of melt at a minimum.

It is another object to provide an improved spinneret assembly for the melt spinning of multifilament yarn which assembly will have a long spinning life.

It is another object to provide an improved spinneret assembly by means of which multifilament yarn of uniform character may be spun from molten organic filament-forming compositions.

It is another object to provide an improved spinneret assembly by means of which broken filaments, uneven filament denier and spinneret fouling can be substantially avoided during long periods of melt spinning.

It is another object to provide an improved spinneret assembly which substantially eliminates all channeling or by-passing of the spinning melt.

Other objects of the invention will appear hereinafter.

The objects of the invention can be accomplished, in general, by the use of a spinneret assembly containing a mass of inert, finely divided material arranged in a predetermined order of graduated particle size together with means for supporting the finely divided material and means for uniformly distributing the spinning melt over the internal face of the spinneret.

The invention will be more readily understood by reference to the following detailed description taken in conjunction with the accompanying illustrations.

Referring now to the drawing:

Figure 1 is a sectional view through a portion of the spinning unit assembly.

Figure 2 is a sectional view of a modified form of spinneret assembly.

Figure 3 is a plan view of the screen assembly shown in Figure 2.

Figure 4 is an enlarged fragmentary plan view of a spinneret plate surface.

With reference to Figure 1, the base of a portion of a melt spinning apparatus is represented by reference numeral 11 having the channel 12 in communication with a suitable metering device (spinning pump not shown), by which the molten material to be spun is brought to the spinneret assembly. As shown, the base is provided with the shoulder 13 to facilitate a tight connection between the base 11 and the spinneret assembly. An externally threaded bushing 14 is screwed into the internally threaded opening 15 of the base 11. The bushing 14 is provided with several threaded holes 18 to receive the bolts 16 by which a ring 15 is bolted against the flange 17 of bushing 14. The ring 15 is used to clamp the spinneret assembly against the shoulder 13, the gasket 21 assuring a tight joint. The bushing 14 also serves to aline and support a spinneret pack retaining tube 20. The spinneret 25 caps the open end of the tube 20 and by means of the gasket 27 a tight joint is secured when the bolts 16 are tightened bringing the ring 15 tightly against the flange 19 of spinneret 25. The arrangement of clamping elements shown is typical, but any other means for holding the spinneret assembly securely in place may be employed as desired.

In the modification of spinneret assembly shown in Figure 1, the tube 20 defines a chamber which is filled with a spinneret pack comprising a finely divided inert material 31 which rests on a fine mesh screen 23 which in turn rests on a coarse mesh screen 24. The coarse mesh screen 24 is supported on an annular ledge 22 of the tube 20. A pair of fine mesh screens 28 and 29 are cupped over the end of tube 20 while a coarse mesh screen 30 rests on the inner surface of the hat-type spinneret 25 which latter is provided with perforations 26 of sufficient size and number to produce the desired multifilament yarn.

In the modification of the spinneret assembly shown in Figure 2, the finely divided inert material 31 rests on a screen assembly 32. In this case a plate-type spinneret 34 is employed. The screen assembly is shown in greater detail in Figure 3 from which it can be seen that it includes a fine mesh screen 36. A coarse mesh screen 38 is positioned adjacent screen 36 as will be seen in Figure 2. The screens are held together in an annular frame 40. The frame 40 may be composed of any suitable material such as gasket metal into which the screens may be fitted and held together as a unit. The spinneret pack retaining tube 20 is provided with internal grooves 33. These grooves are made sufficiently large and deep so as to permit the accumulation of the finely divided inert material therein. By this expedient it is found possible to avoid channeling or by-passing of the molten filament-forming material along the walls of the tube and to aid in preventing shifting of the strata of finely divided material. A comparatively coarse mesh screen 35 is also positioned on the top of the loose, finely divided inert material to prevent its displacement, and to function as a distributing member for the molten material.

Referring to Figure 4 of the drawing, fine grooves 50 may be provided on the internal face of the spinneret plate 52. These grooves will function as a distributing means for molten filament-forming composition and thereby cause an even, uniform flow to all of the spinneret orifices 54. A fine mesh screen can be positioned directly in contact with the internal face of a spinneret plate constructed in this manner without interfering with the passage of the liquid through the spinneret orifices.

The spinneret pack comprising the finely divided inert material 31 is critical to the successful operation of the melt spinning apparatus, and in its preferred form comprises a mass of clean, dry sand of carefully selected particle size, arranged so that when the retaining chamber of the spinneret pack is in operating position, the particles of largest size are nearest the channel 12 in the spinning apparatus base 11, while the particles of smallest size are nearest the supporting screen 23, as shown in Figure 1.

The spinneret pack is divided into several strata of sand represented in Figure 1 by the letters A, B, C, and D. The sand for each of these strata is carefully selected, as will be described below, and elutriated to remove any dust or excessively fine particles which may be present normally or as the result of sieving operations. The elutriation process may be carried out conveniently as follows: Two hundred grams of sand are dispersed in a mixture of 200 cc. of water and 12 grams of a 35 per cent sodium silicate solution. A glass tube about 36 inches in length and 2.5 inches in internal diameter is drawn down at one end to a diameter of about 0.25 inch. The elutriator tube is arranged in an upright position with the small end lowermost. By means of a water line connected to the small end of the elutriator tube, water is passed upwards through the tube, overflowing at the top of the tube at a rate of about 1600 cc. per minute. The sand and water dispersion is then poured into the tube where it is elutriated by the flowing stream of water. The elutriation is continued until no more sand washes over the top of the tube. This treatment removes all spherical particles with diameters substantially less than 100 microns and also non-spherical particles with long dimensions up to about 150 microns.

Generally speaking, the fine sand in stratum A should have a particle size of about 60 to 150 mesh, predominantly 100 to 150 mesh. The sand in stratum B should be about 45 to 100 mesh, predominantly 45 to 65 mesh. The sand in stratum C should be about 35 to 65 mesh with the coarser sizes predominating. Preferably, all the sand in stratum D should be coarser than 65 mesh although it should not be coarser than about 10 mesh. By defining the size of particles in "mesh size" is meant those particles which will just pass through a screen having the number of square meshes per inch specified as the particle size.

Several commercial grades of silica sand are available which can satisfy these requirements and the following table sets forth a typical screen analysis of a commercial sand which has been found useful in the practice of this invention. This specific analysis is, however, not to be taken as limitative of the invention.

Table I

Screen size	Useful for—			
	Stratum D	Stratum C	Stratum B	Stratum A
	Percent	*Percent*	*Percent*	*Percent*
28 x 28	30.0			
35 x 35	68.5	58.0	2.0	0.1
40 x 40	1.0			
48 x 48			36.0	3.0
60 x 60			27.2	8.5
65 x 65		41.8	15.2	17.2
100 x 100		2.0	16.5	50.0
140 x 140			2.6	16.0
Pan	0.5	0.2	0.5	5.2

Any commercial sand which is substantially inert to the molten filament-forming composition being spun, when elutriated as above described and thoroughly dried, can be employed in accordance with the following examples which are illustrative but not limitative of the invention.

Example I

A spinneret pack retaining tube of the type illustrated in Figure 1 having an internal diameter of 0.75 inch and an internal length of about 1.25 inches was provided with four disc-shaped square-mesh screens to support the spinnet pack. The two lowermost screens were 16 x 16 mesh, the next was 80 x 80 mesh and the uppermost (nearest the sand) was 150 x 150 mesh. Four layers of sand were arranged above these screens in order of increasing coarseness using for each layer elutriated sand having a screen analysis as set forth in Table I, and using 2.0 grams for layer A, 1.5 grams for layer B, and 1.0 gram each for layers C and D. Atop the sand was placed a disc-shaped 80 x 80 mesh screen and about this a similar 16 x 16 mesh screen to hold the sand in place. Two disc-shaped 325 x 325 mesh screens were cupped over the small lower end of the retaining tube in such a manner as to permit their being held snugly in place by the hat-type spinneret plate. A single disc-shaped 80 x 80 mesh screen was cut to just fit the inside face of the hat-type spinneret plate provided with 15 holes (each hole 0.007 inch in diameter) and containing the last-mentioned screen pressed tightly over the cupped fine mesh screens. The entire assembly was then clamped in position on the base of the spinning apparatus as shown in Figure 1 of the drawing.

Polyhexamethylene adipamide having a melt viscosity of approximately 500 poises at 285° C. was melted and pumped at a rate of 14.75 grams per minute through the spinneret assembly made up as described above. An initial pressure of 890 lbs. per square inch was developed back of the spinneret pack. The quality of spinning was excellent. The yarn was wound up at approximately 2,800 feet per minute and spinning continued uninterruptedly for 41 hours. During this period the back pressure of the spinneret pack increased to only 1200 lbs. per square inch representing a pressure increase at the rate of only 7 lbs. per hour of spinning.

Example II

A spinneret pack of the type illustrated in Figure 2, having an internal diameter of 1.5 inches and a length of about 1.5 inches, was provided with two disc-shaped screens to support the filter bed and a flat disc-type spinneret, the latter being perforated with 15 holes (each hole 0.007 inch in diameter). The supporting screens of 325 x 325 mesh and 50 x 50 mesh were held in an annular gasket as shown in Figures 2 and 3 and were arranged in the assembly so that the fine mesh screen was uppermost and the coarse mesh screen was adjacent the upper surface of the spinneret plate. The interior surface of the filter chamber was grooved as illustrated in Figure 2. The filter chamber was filled with four layers of elutriated silica sand, each layer having a screen analysis as set forth in Table I. Layer A was composed of 20 grams of sand, while 15 grams of sand were used for each of the remaining layers. The spinneret assembly was clamped to the base of the spinning apparatus in a manner similar to that shown in Figure 1.

Polyhexamethylene adipamide having a melt viscosity of 400 poises at 285° C. was melted and pumped at a rate of 12.5 grams per minute through the filter and spinneret assembly. The start-up of spinning and the spinning itself were excellent. The yarn was wound up at approximately 2500 feet per minute and spinning continued uninterruptedly for 105 hours.

The screen assembly at the lower end of the filter bed can be modified to meet the needs of the particular spinneret pack. In any case, however, the mesh of the uppermost screen must be finer than the particle size of the finest sand. This is necessary in order to retain the sand in the spinneret pack and also to insure maintenance of a substantially uniform resistance to flow of the liquid through the pack. The lowermost screen normally rests in contact with the upper surface of the spinneret and serves primarily as a distributing member to insure distribution of the liquid mass over the entire area of the spinneret. The mesh of this lowermost screen will be chosen as large as possible to insure good distribution without interfering with the passage of the liquid through the openings in the spinneret. Screens having an 80 x 80, 50 x 50, 30 x 30 or 16 x 16 mesh have been found useful. If desired, the lowermost coarse screen may be omitted, provided the upper surface of the spinneret is channeled in some way to facilitate and insure free flow of the liquid to each spinneret opening. A modification of the spinneret surface which will permit this is shown in Figure 4 of the drawing.

Instead of the screen sizes and arrangements illustrated by the drawing and examples, other arrangements may be used to advantage. Thus, for the screens supporting the spinneret pack one may use a combination of (*a*) one 200 x 200 mesh and one 50 x 50 mesh screen or (*b*) one 200 x 200, one 325 x 325 and one 50 x 50 mesh screen. If desired, such combinations can be arranged in groups held together as illustrated in Figure 3 and the groups can then be arranged in the desired order. Generally speaking, in any one group of screens the arrangement will be such that the screen sizes progress from fine to coarse in the direction of flow of the molten material. Care should be taken to avoid any sudden reduction in resistance to flow of the liquid until just before the liquid passes to the spinneret opening. This may require one or more very fine mesh screens in order to maintain the high pressure behind the face of the spinneret. These fine screens will preferably be placed close to the spinneret in order to keep the free space between them and the spinneret at a minimum. It might be supposed that sufficiently fine holes could be provided in the spinneret to maintain high pressure on the molten material; however, it has been found impractical to use holes of diameter substantially less than 0.005 inch if frequent fouling of the spinneret openings is to be avoided.

If desired, the uppermost surface of the spinneret pack may be confined by means of the coarse screen **35** in Figure 2. This screen will be chosen of a mesh size somewhat finer than the coarsest sand. This screen will also act as a distributing member to aid in the more uniform distribution of the liquid mass so that it will spread more uniformly over the entire area of the spinneret pack. A combination of two or more screens may be used at this point as set forth in Example I. In such a case the progression of screen size is preferably coarse to fine in the direction of flow of the liquid.

Wherever screen materials are required in the spinneret assembly, suitable materials will be chosen which will be non-corrodible under the conditions of use, such, for example, as stainless steel, Monel metal, Illium, or similar metal alloys.

If desired, the interior surface of the filter chamber may be scored, grooved, or threaded, as illustrated by **33** in Figure 2. This scoring or grooving will afford more intimate contact of the sand particles with the wall of the filter chamber and will frequently aid in preventing shifting of the sand layers, as well as in preventing any tendency toward channeling or bypassing of the liquid between the filter bed and the wall of the filter chamber.

In the above description of this invention, it has been pointed out that the preferred spinneret pack is composed of silica sand. The object of the invention may be accomplished by the use of any finely divided, inert, dry, solid material which will not disintegrate into finer particles during the period of and under the conditions of its use. Thus, for example, glass particles or metal filings, such as iron filings, may be substituted for the sand. In using these other spinneret pack materials, equal care must be exercised to eliminate excessively fine particles and to stratify the pack in the same manner as described for a sand pack.

The arrangement of the finely divided materials in the spinneret pack is critically important and the progression of particle size must be from coarse to fine in the direction of liquid flow. If the progression of the sand particles is from fine to coarse in the direction of flow, there will be a progressively diminishing resistance to the flow of the liquid. This will result in the spinning of many broken filaments and the formation of drips. These are believed to be caused by evolution of gas back of the spinneret, or in the molten portion of the filaments.

When a single layer of fine sand is used instead of the four layers of graded sand as described, the rate of pressure build-up is so much greater that spinning cannot be continued for a practical length of time. A partial explanation, at least, may reside in the fact that the major portion of the foreign materials in the molten filament-forming composition will be collected by the first portion of the sand layer, clogging the spinneret pack rapidly. By passing the molten materal through a coarse pack medium first the foreign materials are collected gradually and the clogging of the pack is delayed sufficiently to make its use highly practical.

If the fine sand is omitted, along with the fine mesh screens, the back pressure developed by the spinneret pack is low and results in difficult start-up of spinning, broken filaments, reduction in jet velocity at certain spinneret openings to the point where the molten mass oozes out and collects on the spinneret face, fouling the spinning by what are commonly called "drips." The low back pressure is insufficient to force solution of any gases entrapped in the spinneret pack as the molten material advances, and is insufficient to prevent bubble formation by decomposition of the material. Formation of a bubble at the face of the spinneret frequently causes a broken filament, while if the bubble forms upon approaching the spinneret a "drip" is likely to be formed.

Under the conditions of Example I an initial back pressure of 890 lbs. per square inch was developed. Most of this pressure was developed by the sand layers A and B, by the 325 x 325 mesh screens and by the spinneret openings. It is believed that about 300 lbs. pressure was developed by the sand layers, 300 lbs. by the two screens (325 x 325 mesh) and the remainder by the spinneret. Since the only free space between the spinneret and the 325 mesh screens was that in the meshes of the 80 x 80 mesh screen, the molten polyamide was not exposed for more than a very short time to a pressure of the order of 300 lbs. or less before being extruded. Thus bubble formation was substantially eliminated.

The style of spinneret assembly of Example II is preferred. The larger spinneret pack permits longer life, the fine mesh screen is more positively sealed, and there is no space between the fine sand and the finest screen. The presence of the coarse (50 x 50 mesh) screen effects distribution of the liquid mass so that all filaments will be substantially alike in diameter. The spinneret of disc type is preferred to the hat type used in Example I since it can be made heavier and stronger, and the sand can be brought closer to the face of the spinneret.

The amount of sand used in the spinneret pack is not critical so long as enough fine sand is used to result in a back pressure sufficient to prevent bubble formation, "drips," etc. For best spinning a pressure of at least 500 lbs. per square inch should be developed at the start. Pressures above 1500 lbs. per square inch should be avoided to guard against abnormal wear on the spinning pump. Usually the spinneret pack chamber should be substantially filled so that the amount of polyamide or other molten material required to completely fill the remaining space will be as small as possible. This will insure a flow sufficiently rapid to help minimize the time of exposure of the molten material to the elevated temperature.

The invention has been described in connection with its use in the manufacture of multifilament yarn from synthetic linear polyamides of which polyhexamethylene adipamide is a specific example. The invention is applicable, however, to the melt spinning of any organic filament-forming composition which is subject to the formation of bubbles from whatever cause under the conditions just prior to and during the spinning thereof, provided the gases redissolve under pressure and the decomposition is slow enough to permit metering before sufficient gases are formed to exceed the solubility under the conditions of temperature and pressure. As examples of such filament-forming compositions, the following may be mentioned: synthetic linear polyamides, that is, synthetic linear polymers containing —CONH— units in the linear chain, synthetic linear polymers such as polyesters, polyethers, polyacetals, and mixed polyester-polyamides, such as may be prepared by condensation reactions as described in U. S. Patent No. 2,071,250 may also be employed. Other types of synthetic polymers, such as ethylene polymers, vinyl polymers, polystyrene and polyacrylic acid derivatives may also be spun with advantage in accordance with the present invention.

The filament-forming material used in accordance with the present invention may contain modifying agents, e. g., luster-modifying agents, plasticizers, pigments, and dyes, antioxidants, resins, etc. The present invention can be used to advantage in extruding film- or filament-forming compositions in which the bubble formation may be caused by the presence of a modifying agent.

The use of the spinneret pack described in the present specification offers many advantages in a melt spinning process for the manufacture of multifilament yarn. A pack of sufficient depth is easily possible so that the pack can remain in operation for longer periods of time before it becomes necessary to change it. A voluminous pack medium is provided so that the volume of molten material in the pack chamber is small in proportion to the flow area in order that the amount of material which is kept subject to decomposition at elevated temperature remain at a satisfactory minimum. The pack is adaptable to conditions of high pressure which are required in the spinning process to prevent bubble formation and consequent imperfect spinning. The pack medium is cheap, efficient, and compact; can easily and quickly be replaced when necessary; and substantially eliminates the possibility of channeling or by-passing of the liquid through the pack. The pack medium aids in the distribution of heat, easily maintaining the molten material in proper condition for good spinning. It aids in distribution of flow of the liquid so that the latter is uniformly supplied to the spinneret, and it aids in guarding against a pressure drop on the liquid prior to passage of the liquid through the spinneret.

Since it is obvious that many changes and modifications can be made in methods and apparatus hereinabove described without departing from the nature and spirit of the invention, it is to be understood that the invention is not to be limited except as set forth in the appended claims.

We claim:

1. Apparatus for the spinning of molten organic filament-forming compositions comprising a spinneret assembly comprising a flow-resistant spinneret pack containing a finely divided inert material of varying particle size, a retaining chamber for said spinneret pack, said retaining chamber provided with a plurality of internal circumferential grooves, said chamber being capped by a spinneret plate and a screen assembly interposed between said chamber and plate to prevent said inert material from passing to said spinneret plate, the inert material in said pack arranged in order of diminishing particle size in the direction of flow of said molten composition.

2. Apparatus for the spinning of molten organic filament-forming compositions comprising a spinneret assembly comprising a flow-resistant spinneret pack and a spinneret plate containing one or more orifices, said spinneret pack containing finely divided inert material of varying particle size, said spinneret plate provided with a plurality of grooves on the internal face thereof, a screen assembly interposed between said spinneret plate and said pack to prevent said inert material from passing to said spinneret plate, the inert material in said pack arranged in order of diminishing particle size in the direction of flow of said molten composition.

3. Apparatus for the spinning of molten organic filament-forming compositions comprising a spinneret assembly comprising a flow-resistant spinneret pack containing a finely divided inert material of varying particle size, a retaining chamber for said spinneret pack, said chamber being capped by a spinneret plate and a screen assembly interposed between said chamber and plate to prevent said inert material from passing to said spinneret plate, the inert material in said pack arranged in order of diminishing particle size in the direction of flow of said molten composition.

4. Apparatus for the spinning of molten organic filament-forming compositions comprising a spinneret assembly comprising a flow-resistant spinneret pack and a spinneret plate containing one or more orifices, said spinneret pack containing finely divided inert material of varying particle size, a screen assembly interposed between said spinneret plate and said pack to prevent said inert material from passing to said spinneret plate, the inert material in said pack arranged in order of diminishing particle size in the direction of flow of said molten composition.

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