

Oct. 5, 1965

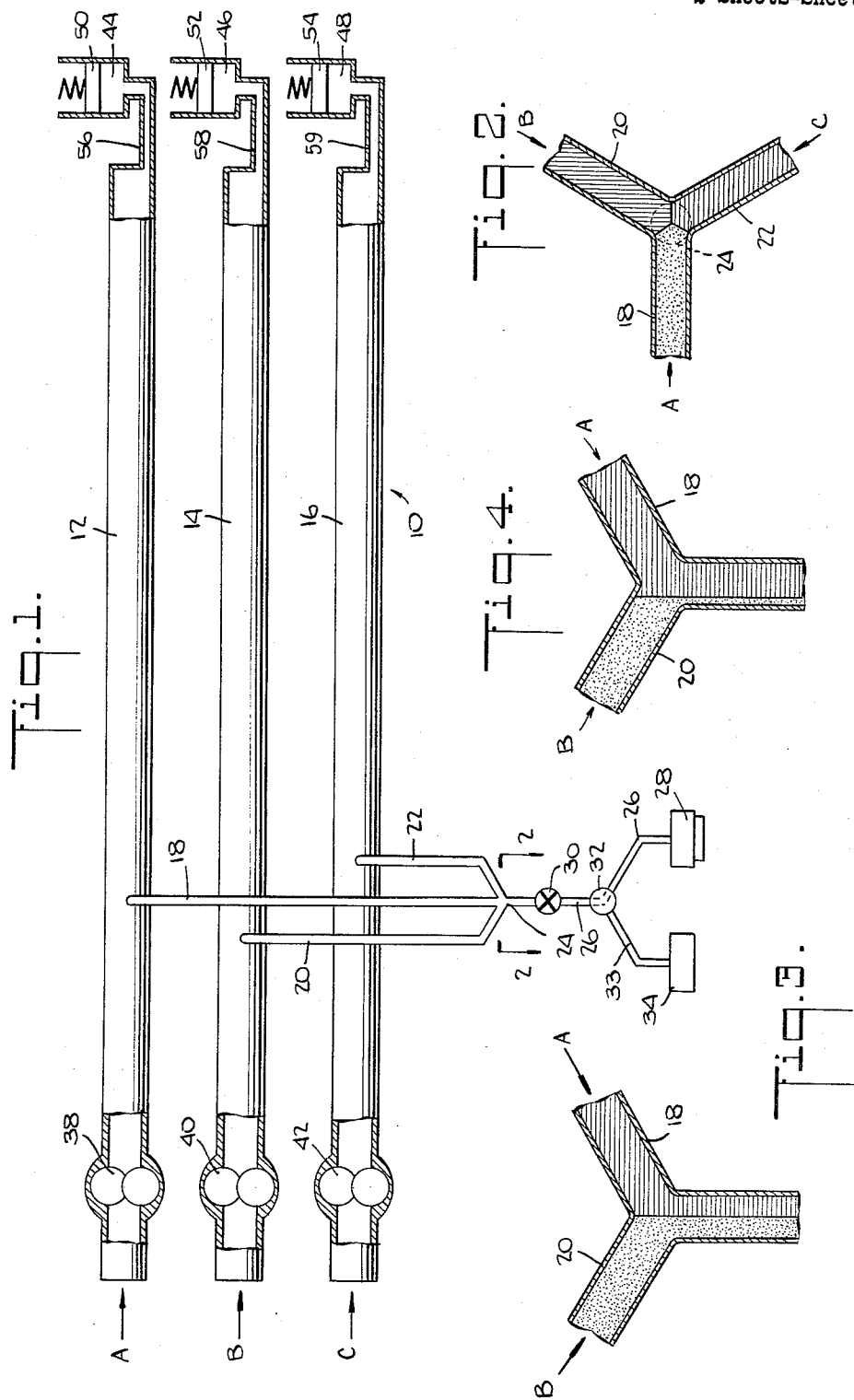
J. L. RILEY ET AL

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APPARATUS FOR PRODUCING MULTICOMPONENT FILAMENTS AND YARNS

Filed March 7, 1962

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

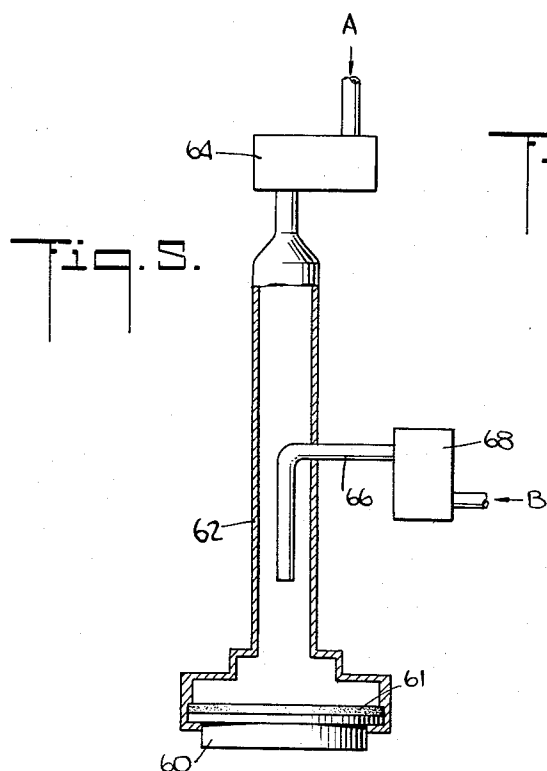


Fig. 7.

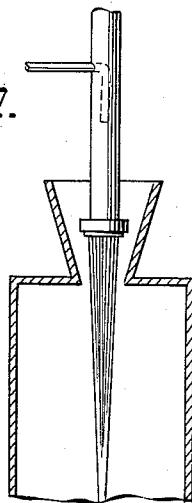


Fig. 6.

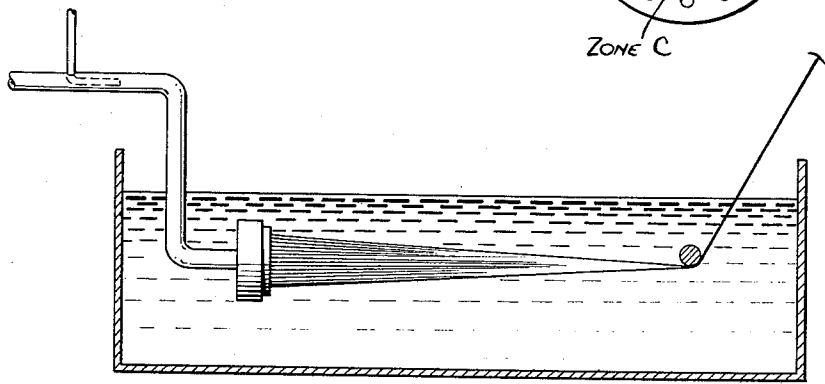
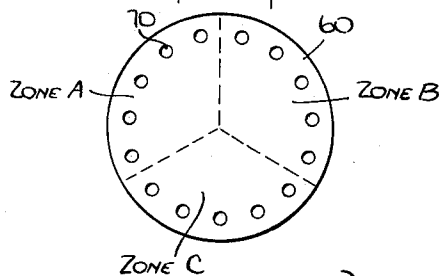


Fig. 8.

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APPARATUS FOR PRODUCING MULTICOMPONENT FILAMENTS AND YARNS

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8 Claims. (Cl. 18—8)

This invention relates to a novel apparatus for producing multicomponent filaments and yarns. More particularly, this invention relates to the production of multicomponent filaments and yarns from a plurality of different component-forming materials. Each such component forming material is maintained in a zone separate from the zones of the other such materials and under a substantially constant pressure, such pressure being of such magnitude as to induce viscous or laminar flow rather than turbulent flow of a stream of such material. A stream of component-forming material is removed from each of such zones, and the streams are brought together at a common juncture to form a common stream having streamlined portions made up of the separate component-forming materials. The common stream is passed through a jet or spinnerette to thereby form a multicomponent filament or a multicomponent yarn.

Multicomponent filaments and yarns are highly desirable because of the unique properties that can be obtained therein. For example, by the selection and incorporation of certain desired components into such filaments or yarns there can be obtained a resultant multicomponent filament or yarn having specific desired end characteristics, e.g., such end filament or yarn can be designed to exhibit certain dyeability characteristics, certain crimping characteristics, multicolor effects, abrasion resistance, etc.

Heretofore, a number of different apparatuses have been developed in an attempt to secure truly practicable means for the production of multicomponent filaments and yarns. However, such apparatuses have proven complex and costly, and frequently have not resulted in the obtaining of satisfactory results. Typically, the apparatuses which have been used have required complicated valving systems, individual metering pumps to introduce the various component-forming materials to the proper spinning position, complicated jet assemblies, etc.

It is an object of the present invention to provide a simple yet effective apparatus for the production of multicomponent filaments and yarns.

Another object of our invention is to provide an apparatus for the production of multicomponent filaments and yarns whereby individual metering pumps for the introduction of each component-forming material to the filament-forming jet are not required.

Additional objects will become apparent hereinafter.

Our invention will be best understood by the following description, taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a schematic illustration of the apparatus of our invention as set up to produce a three component filament or yarn;

FIG. 2 is an enlarged sectional view taken along the line 2—2 of FIG. 1;

FIG. 3 is a schematic illustration of our apparatus arranged to produce a filament or yarn made up equally of two components;

FIG. 4 shows an alternative arrangement to produce a two component filament or yarn wherein one component predominates;

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FIG. 5 illustrates apparatus for another embodiment of our invention wherein one component-forming material is fed as a sheath about a core of another component-forming material;

FIG. 6 is a plan view showing the face of the spinnerette used in the apparatus of FIG. 5;

FIG. 7 is a schematic illustration of apparatus arranged for dry spinning; and

FIG. 8 is a schematic illustration of apparatus arranged for wet spinning.

In accordance with one aspect of our invention, an apparatus is provided for the production of multicomponent filaments and fibers. For the formation of a three-component filament or yarn apparatus is assembled as schematically illustrated in FIG. 1. The apparatus, generally designated by the reference numeral 10, comprises three separate low pressure drop chambers or manifolds 12, 14 and 16. Separate conduits or pipes, 18, 20 and 22 communicate with chambers 12, 14 and 16, respectively. These separate conduits terminate and join together at a common juncture point 24 to form a common conduit 26, which ultimately terminates at a filament-forming jet 28. Between common juncture point 24 and jet 28 are disposed a throttle valve 30 and a two-way valve 32, each being operatively associated with common conduit 26. A second jet 34, communicates with two-way valve 32 through conduit 33.

Means, e.g., metering pumps 38, 40 and 42 are provided for introducing the desired component-forming materials A, B and C, at appropriate flow rates into chambers 12, 14 and 16, respectively. Such metering pumps communicate directly with the chambers. Means are provided for maintaining component-forming materials A, B and C at constant pressures within chambers 12, 14 and 16 respectively. As illustrated in FIG. 1, such constant pressure means comprise separate surge tanks 44, 46 and 48, which are fitted with spring actuated pressure pistons 50, 52 and 54, respectively. Surge tanks 44, 46 and 48 communicate with chambers 12, 14 and 16 through channels 56, 58 and 59, respectively.

While FIG. 1 illustrates the use of three separate surge tanks 44, 46 and 48 to maintain constant pressures in chambers 12, 14 and 16, respectively, a single constant pressure source could also be employed, such single source communicating with each chamber. Further, instead of using spring-actuated pistons to obtain such constant pressures, other means could be employed, e.g. a weighted piston or a constant head tank or the like.

To operate our apparatus, metering pumps 38, 40 and 42 are actuated to thereby pump component-forming materials or dopes A, B and C from their storage tanks (not shown) and at preselected flow rates into chambers 12, 14 and 16 until dynamic equilibrium conditions are attained. Spring-actuated pistons 50, 52 and 54 in surge tanks 44, 46 and 48 ensure the maintenance of constant pressures in each of the component-forming materials A, B and C contained in chambers 12, 14 and 16. Separate streams of dopes A, B and C are pressure driven to pass through conduits 18, 20 and 22, respectively, the flow rate of each such stream being determined by the pressure differential between the pressure within the chamber containing the component-forming material of such stream and the pressure outside the jet 28 and also by the cross-section and length of the conduit leading off from such chamber. It is of critical importance that such flow rate be of viscous or laminar character rather than turbulent. That is, the streams of component-forming materials passing through conduits 18, 20 and 22 must be flowing in streamlined fashion so they arrive at a common juncture 24 and unite with each other. The streamlined character of flow of each stream will then persist in the common

stream as it flows through conduit 26. Such streamlined flow is readily obtained by (1) appropriate adjustment of the magnitude of the constant pressure within the chamber of manifold and/or (2) adjustment of the cross-sectional area and length of the conduit leading off from such chamber.

When a plurality of dope streams, or streams of other fiber forming material, each of which is traveling in viscous flow, are brought together to form a single common stream, the interfaces between the different streams remain stable. This permits the feeding of such common stream to a jet to thereby obtain a multicomponent filament or yarn wherein the lines of demarcation between the various components persist and are preserved in the final product.

If a multicomponent filament is desired, the common stream (consisting of a plurality of streams of component-forming materials) is fed through a jet 28 having a single orifice, whereby each component retains its character and is identifiable in the resulting multicomponent filament. On the other hand, in order to obtain a multicomponent yarn, a spinnerette 60 (FIG. 6) having a plurality of orifices is substituted for single orifice jet 28 and the common stream is fed therethrough. Thus, to obtain a three component yarn the common stream formed from component-forming materials A, B and C (FIG. 2) is fed to spinnerette 60 whereby material A passes through the orifices in zone A, B through the orifices in Zone B, and C through the orifices in zone C. All of the filaments thus formed are collected together thereby forming a three-component yarn.

The denier of the ultimate multicomponent filament or yarn is controlled by suitable adjustment of throttle valve 30. Thus, the finer the denier desired, the tighter the valve position to thereby reduce the cross-section of the common stream flowing in conduit 26 as it passes throttle valve 30 and prior to its extrusion through jet 28.

Of course, instead of single conduits 18, 20 and 22 extending from each of chambers 12, 14 and 16, respectively, a plurality of conduits may communicate with each of such chambers. In this manner, the component-forming material within each chamber can be "tapped off" at numerous points and can hence supply a plurality of jets 28. However, it is essential that the pressure within any such chamber remain substantially constant so as to insure uniform flow rates. Therefore, and in accordance with another aspect of our invention, for each jet 28, a second jet 34, which jet functions essentially as a "dummy" jet, is connected to two-way valve 32 through a conduit 33. Jet 34 offers resistance to viscous flow equivalent to that offered by jet 28. When it is desired to alter the nature of the multicomponent filament by substituting for jet 28 another jet having a different sized orifice therein, the portion of two-way valve 32 is simply reversed so as to cut off the flow of the common stream to jet 28 and divert it through dummy jet 34. The jet 28 is removed, a new or different jet is placed in position and valve 32 is reversed to thereby readmit the stream through the new jet. By virtue of this construction the pressures in chambers 12, 14 and 16 remain constant even though one or more jets 28 is taken "off stream."

The particular processing technique utilized in forming the multicomponent filament or yarn from the common stream as it passes through the jet is not critical. Thus, the usual dry or wet processing techniques may be employed, or dopes of molten polymers can be melt extruded through the jet. If the filament is wet processed the particular composition of the bath will of course vary depending upon the nature of the filament or yarn and the end characteristics desired therein.

The component forming materials or dopes may be solutions which may contain the same filament-forming substance in solution but differ in the kind of solvent or

the concentration of the filament-forming substance. The materials may be polymeric substances which differ in their degree of polymerization or degradation; in the case of cellulose or its derivatives, the two solutions can be produced from the celluloses of different origin, for example one from cotton linters and the other from wood pulp. In the case of solutions which undergo a ripening process, such as viscose, differences in degree of ripeness may be the sole difference or one of several differences (which may include also cellulose content, sodium hydroxide content, carbon disulfide content) between solutions.

The material may comprise the same or different substances, but differ in that one contains incorporated therein, either suspended therein or dispersed therein, such as by true or colloidal solution or by emulsification, at least one substance which is not of itself a filament-forming substance. Alternatively, the materials can contain one or more of such additions in different concentrations. Such additions can be solid, liquid or gaseous, for example pigments, roughening agents, softening agents, agents for improving the feel, fats, oils, soaps, resins, dyestuffs, fungicides, medicinal substances, phosphorescent substances, and substance which can react chemically with the spinning substance in the solution or during the precipitation. One polymer may contain sites, such as sulfuric acid groups, to enhance the basic dyeing of the component fiber. In particular, those additions which are used to modify the properties of the filaments and have hitherto involved unavoidable disadvantages when applied to homogeneous fibers can be restricted to that zone of the filament where they are desired. For example, pigments and delustrants can be introduced into a dope for the purpose of roughening the filament, or of coloring or dulling the filament to cause a sensible decrease in the strength.

When our process is carried out with dopes which contain different substances in solution, the substances can be chemically related as, for example, two different cellulose esters, or a cellulose ester and a cellulose ether, or two different albuminous substances. Substances may, however, be used which belong to quite different classes of bodies, such as cellulose and an albuminous substance, or a cellulose ester or ether and an artificial resin or rubber produced by polymerization. The only limitation is that at least two of the materials do not mutually coagulate each other and if wet spun, are coagulatable by a common coagulating medium. By using materials which shrink to a different extent during precipitation, drying or after-treatment, there may be obtained, for example, strongly crimped threads. Also, one or more of the materials or solutions may consist of or comprise mixtures of two or more filament-forming substances insofar as this is permitted by the compatibility of the particular substances.

Various effects may be obtained by the incorporation of pigments or dyes into one or more of the dopes.

It will be apparent that our invention provides great flexibility and versatility as regards the obtaining of a multicomponent filament or yarn. For example, the relative amounts of components A, B and C in a three component fiber (FIGS. 1 and 2) are readily controlled by simply adjusting the flow rates of the streams in conduits 18, 20 and 22. If the cross-sectional areas and lengths of each of these conduits are the same, then the volume flow rates of the streams therewithin are proportional to the rates of introduction of dopes A, B and C into chambers 12, 14 and 16 and hence are proportional to the pumping rates of metering pumps 38, 40 and 42. Accordingly, the flow rate of the streams within conduits 18, 20 and 22 is controlled and adjusted by appropriate regulation of such metering pumps. If a filament or yarn is desired containing equal parts of components A, B and C, the pumping rates are kept equal to one another. If a filament or yarn containing 50% of component A and 25% each of compo-

nents B and C is desired, the rate of introduction of A into chamber 12 is kept at twice the rate of introduction of B and C into chambers 14 and 16, etc.

An alternative method of adjusting the volume flow rates of the streams in conduits 18, 20 and 22 is simply to vary their respective cross-sectional areas or lengths. This method offers the advantage of using the same pumping rates for all three metering pumps, 38, 40 and 42, yet still obtaining variable flow rates by varying the cross-sectional areas or lengths of conduits 18, 20 and 22. If desired, appropriate balancing devices may be also employed, which balancing devices are equipped with suitable bleed offs to compensate for any variable pressures in the system. Thus, the rate of delivery for certain pumps is relatively independent of the working pressure in the system, so that pressure compensators are then advisable.

FIGS. 3 and 4 illustrate another embodiment of our invention wherein a two component filament or yarn is formed. FIG. 3 shows the formation of a filament or yarn containing equal amounts of components A and B, the flow rate of dope A equalling that of dope B (the cross-sectional areas of conduits 18 and 20 being equal). FIG. 4 shows the formation of a filament or yarn predominating in component A, the flow rate of dope A in conduit 18 considerably exceeding the flow rate of dope B in conduit 20. It will be understood that if the stream of dopes A and B is fed into a jet containing a single orifice, a two-component filament is extruded. If instead the stream of FIG. 3 is fed to a spinnerette having a plurality of orifices disposed in a circle (e.g., see FIG. 6), then through half of these orifices dope A would be extruded, and through the other half, dope B. (If the stream of FIG. 4 were fed through such a spinnerette, then of course more filaments of dope A would be obtained than of dope B.)

FIG. 5 illustrates another embodiment of our invention wherein a multicomponent filament is formed from component-forming materials A and B. Material A is introduced into conduit 62 by metering pump 64. Material B is introduced through conduit 66 into the center of the stream of material A by metering pump 68. The rates of introduction of both materials A and B is controlled such that their flow is laminar or viscous rather than turbulent in character. Accordingly, material A forms a sheath stream about the core stream of material B. Little or no mixing of these two streams occurs. The common sheath and core stream is fed through filters 61 to spinnerette 60 (FIGS. 5 and 6), which spinnerette contains a plurality of orifices 70 disposed in circle. If the sheath and core streams are fed at the same flow rates then the core stream of material B will extrude from that half of each orifice 70 nearest the center of the spinnerette 60 and the sheath stream will extrude from the outer half of each such orifice. A two component filament made up of approximately 50% each of components A and B is then formed by conventional wet or dry spinning techniques. By varying the rates of introduction of each of the component forming materials into conduit 62 (and to spinnerette 60) the relative amounts of each of the materials in the resulting two components filament can readily be varied within any desired limits, e.g., less than 5% to in excess of 95%, or more preferably from about 10% to 90%.

It will be understood that this "sheath-core" embodiment is not limited to formation of only two-component yarns. Thus, while FIG. 5 illustrates formation and extrusion of a common stream consisting of a core of material B surrounded by a single sheath of material A, if desired, a second sheath of component-forming material C (not shown in FIG. 5) could be placed around sheath A so as to have a three component stream which, when extruded through the orifices 70 and spinnerette 60 would result in the formation of three component filaments. The relative amounts of components A, B and C therein would, of course, depend on their relative flow rates. In like manner "n" number of different component-forming materials can be introduced through the orifices of spinnerette

60 to produce a filament having "n" different components. We have found that best results are obtained when "n" does not exceed 5.

The principle of the "sheath-core" embodiment of our invention can be utilized to extrude from a spinnerette having more than one set of orifices disposed in a single circle. Thus, a two-component stream consisting of a core stream of component-forming material A sheathed with a stream of component-forming material B, further sheathed with a stream of component-forming material A can be extruded through a spinnerette having two sets of orifices disposed in two concentric circles. If the flow rates of core stream A and outer sheath stream A are kept the same and each such flow rate is half that of the flow rate of intermediate sheath stream B, then similar two-component filaments will be produced from all orifices. By keeping the flow rates of core stream A and sheath stream A equal and varying the ratio of the feed of intermediate sheath stream B to the sum of the feeds of core stream A and sheath stream A, the proportions of A and B in the ultimate filament can be varied as desired.

If desired, two-component filaments can be extruded from a spinnerette having "n" sets of orifices disposed in "n" concentric circles, merely by arranging that the total number of separate component-forming streams, i.e., the sum of the core stream plus all of the sheath streams, equals $n+1$.

Although the sheath core embodiment of our invention has been described with reference to individual metering pumps 64 and 68 (FIG. 5) for the introduction of streams of A and B into conduit 62, it will be apparent that the constant-pressure apparatus of FIG. 1 may be employed if desired. That is, the stream of B flowing in conduit 20 (FIG. 1) may serve as a core stream and be introduced into the center of the stream of A flowing in conduit 18, whereupon the conditions are similar to those illustrated in FIG. 5 in that conduits 18 and 20 (FIG. 1) correspond to conduits 62 and 66, respectively (FIG. 5). In this manner, there is no need for individual metering pumps, since the flow rates are proportional to the substantially constant pressures maintained in each of the chambers 12, 14 and 16, etc.

It will be noted that, if desired, the core can be radially divided so that it is made up of several different component-forming materials, while the sheath can be made up of a single component-forming material. By appropriate disposition of the orifice or orifices in the spinnerette, innumerable variations can be obtained in the multicomponent filaments and/or multicomponent yarns ultimately obtained.

Although in the various subsequent examples the multicomponent filaments or yarns are obtained by dry spinning techniques using an arrangement such as that illustrated in FIG. 7, our invention is equally adaptable to wet spinning techniques (FIG. 8), melt spinning, and the like. Filaments and yarns having novel properties are readily obtainable thereby. Thus, if two different polymeric materials, each having a different rate of coagulation in the spin bath, are wet spun (FIG. 8), the structural characteristics of each component in the filament can be made to differ markedly, thereby producing filaments having such novel properties as three dimensional crimp and the like.

It will be apparent that by the practice of our invention the number of components obtainable in the resultant fiber or yarn is virtually limitless, i.e. as many separate streams of component-forming dopes are provided as the number of components desired in the ultimate fiber. Thus, four, five or more component fibers can be produced using the principles of our invention.

The nature of the various individual component-forming dopes used may, of course, vary within wide limits. Suitable components in the multicomponent fibers or yarns obtained by our invention include cellulose acetate, cellulose triacetate, polyvinyl chloride, polyvinylidene

chloride, polyacrylonitrile, polyvinyl acetate, polycarbonates such as e.g. the reaction product of bisphenol A and phosgene, polyolefins such as e.g., polyethylene, polypropylene, and the like, polyesters, polyamides, polyurethanes, polyureas, etc.

As previously stated, the dope may comprise the desired filament component dissolved in a suitable solvent. The particular solvent used will, of course, depend upon the nature of the polymer being spun. Typical solvents include acetone, methylene chloride hydrocarbons such as xylene for the polyolefins, etc. The amount of component dissolved in the solvent may vary within wide limits and will depend upon the particular component used, the nature of the solvent, the particular characteristics desired in the resultant fiber, etc. In general, the amount of component dissolved in the solvent will be from about 8 to 35 percent by weight, a more preferred range being from about 15 to 30 weight percent.

At typical formulation for two different dopes, one a "bright" dope, the other a "dull" dope, these dopes capable of forming a distinctive two component fiber, comprises: (1) 17-25% cellulose triacetate dissolved in a mixture of methylene chloride and methanol (bright dope) and (2) a mixture of 17-25% cellulose triacetate and 1.25% titanium dioxide (based on the triacetate) dissolved in a mixture of methylene chloride and methanol (dull dope).

It is important to not that the dope need not necessarily be a solution of the component. That is, our invention also finds application in melt extrusion, wherein the dopes consist of molten polymers. Separate streams of such molten polymers are brought to a common juncture point and united as previously described, and the common molten stream is extruded through the jet in conventional manner.

After the multicomponent filament has been formed it can be further processed by any of the various prior art methods, depending upon the end results desired. Thus, a plurality of such filaments can be spun to produce a yarn, etc.

The following examples will further illustrate our invention. All parts are by weight unless otherwise stated.

EXAMPLE I

A two component filament composed of "bright" and "dull" cellulose triacetate was dry spun using the apparatus shown in FIG. 1, only chambers 12 and 14 being used. The bright dope consisted of 22.8% cellulose triacetate dissolved in a solution of 91% methylene chloride and 9% methanol. The dull dope consisted of 22.4% cellulose triacetate and 1.25% titanium dioxide (based on the triacetate) dissolved in 91/9 methylene chloride/methanol. The bright dope was delivered into chamber 12 by pump 38, the dull dope to chamber 14 by pump 40. The pumping rates and pressures maintained in the chambers were such that the common stream of the two dopes was delivered to single-orifice jet 28 at a flow rate of 2 cubic centimeters per minute. A plurality, i.e., three each, of "taps" 18 and 20 were taken off chambers 12 and 14, respectively, so that three two-component filaments could be formed. The common streams flowing in each of conduits 26 were extruded through jets 28, each such jet having an orifice of 0.036 in. in diameter, and then through 8 feet of air onto a ring spinning take-up unit. The jets and assembly were maintained at about 70° C. by an electronically heated tape wound around the jet and assembly. There resulted true two-component filaments, each consisting of about 50% bright triacetate and about 50% dull triacetate. The run was continued for about 4½ hours during which time the two-component composition of the filament was maintained.

EXAMPLE 2

Two component filaments composed of bright and dull triacetate were dry spun using the arrangement

shown in FIGS. 5-7. Bright dope (dope B) consisting of 22.8% cellulose triacetate dissolved in 91/9 methylene chloride/methanol was metered around the inner circumference of line 62 to form a sheath. The resulting sheath and core dope was fed to a 20 hole spinnerette. The twenty holes, each having a dogbone shape with a cross-sectional area of 1.1 sq. mm., were arranged on a single circle (FIG. 6) having a diameter of 0.75 inch. The long dimension of each hole lay on a radius of the spinnerette. The spinnerette and assembly were heated to 70° C. by means of an electrically heated tape wound around the spinnerette assembly. The pumps metering each dope delivered dope at a rate of 2 cc./min. Twenty two-component filaments consisting of bright and dull triacetate were extruded thereby through 8 feet of air onto a ring spinning take-up unit. The dark portion of each filament cross-section is dull triacetate while the white area is unpigmented triacetate. This twenty filament yarn was spun for a period of 4½ hours during which time the two component composition of the filaments was maintained.

EXAMPLE 3

The extrusion arrangement used in Example 2 was mounted on the top of a 23-foot long downdraft spinning column (FIG. 6). A 22% solids dope consisting of triacetate having an acetyl value of 61.5 and an intrinsic viscosity of 2.2 measured as a 4.6% solution of regenerated cellulose in cupriethylene diamine, 1.25% titanium dioxide (based on the triacetate), and the balance being 91/9 methylene chloride/methanol, was metered into the system as dope B. Dope A was a 22% solution of triacetate having an acetyl value of 62.1 and an intrinsic viscosity of 2.11 measured as a 4.5% solution of regenerated cellulose in cupriethylene diamine in 91/9 methylene chloride/methanol. The two dopes were metered at equal rates to a spinnerette provided with 15 holes each 0.042 mm. in diameter dressed with the filters composed of 3 layers of viscose fabric and 2 layers of Johnson and Johnson cellulose fiber filter paper LT-152. The filters caused no mixing of the two dope streams, two component fibers being formed at the spinnerette capillaries. Similarly, the demarcation between the two dope streams was sufficiently sharp that the corresponding phases in the extruded fibers were not mixed even though the composite dope was extruded through capillaries having a small diameter. The spinnerette and assembly were held at a temperature of 70° C. The extruded two component fibers were collected at the bottom of the spinning cabinet, which was heated to 70° C., on a ring twister at a take-up speed of 200 m./min. Cross-sections of these filaments showed each filament contained a bright and a dull portion of triacetate. This yarn crimped heavily due to its bilateral composition when held relaxed at a temperature of 18° C. for one minute. It also crimped heavily on immersion in a mixture of 25/75 acetone-water for one minute followed by air drying in a relaxed state. Fibers extruded from either of the single dopes alone did not crimp when subjected to the same two treatments. Two component fiber was also spun in the above described equipment from a 27% solids dope of secondary acetate of 54.5 acetyl value in 95.5/4.5 acetone/water and a 21.6% solids dope of cellulose triacetate of 61.5% acetyl value in 91/9 methylene chloride/methanol.

EXAMPLE 4

This example illustrates the application of our invention to melt extrusion. The apparatus of FIG. 5 is used. The entire assembly is heated, either electrically or by means of a heat transfer oil. Linear polyethylene is pumped into conduit 66 and isotactic polypropylene is pumped into conduit 62. The entire assembly is maintained at a temperature of about 300° C. The combined sheath-core molten stream is filtered by passage through

six alternating 50 and 400 mesh stainless steel screens mounted before the spinnerette, and is then extruded through a spinnerette having 10 holes of 0.015" diameter, which holes are disposed in a single circle. The pumping rate of the two pumps 64 and 68 are maintained equal and of such magnitude that the resulting bilateral filaments are taken up at a speed of about 400 meters per minute.

"Filamentary material" as used herein includes both filaments and yarns.

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention what we desire to secure by Letters Patent is:

1. Apparatus for producing a multicomponent filamentary material, said apparatus comprising at least two separate chambers, means for introducing different component-forming materials into said chambers, separate conduit means communicating with each of said chambers and terminating at a common junction point, substantially constant advancing pressure means operatively associated with each of said chambers including means for varying the volume of each of said chambers, whereby the pressures within said materials are maintained substantially constant, said pressure means being positioned upstream of said junction point, a filament-forming jet, and second conduit means communicating with said first-mentioned conduit means at said junction point and communicating with said jet.

2. Apparatus for producing a multicomponent filamentary material, said apparatus comprising at least two separate chambers, means for introducing different component-forming materials into said chambers, separate conduit means communicating with each of said chambers and terminating at a common junction point, substantially constant advancing pressure means operatively associated with each of said chambers including means for varying the volume of each of said chambers whereby the pressures within said materials are maintained substantially constant, said pressure means being positioned upstream of said junction point, a filament-forming jet, second conduit means communicating with said first-mentioned conduit means at said junction point and communicating with said jet, and valve means in said second-mentioned conduit.

3. Apparatus for producing a multicomponent filamentary material, said apparatus comprising at least two separate chambers, means for introducing different component-forming materials into said chambers, separate conduit means communicating with each of said chambers and terminating at a common junction point, substantially constant advancing pressure means operatively associated with each of said chambers whereby the pressures within said materials are maintained substantially constant, said pressure means being positioned upstream of said junction point, a filament-forming jet, second conduit means communicating with said jet, valve means in said second mentioned conduit, two-way valve means between said valve means and said filament-forming jet, a second jet of equivalent resistance to viscous flow as said filament-forming jet, and conduit means between said second jet and said two-way valve means.

4. Apparatus for producing a multicomponent filamentary material, said apparatus comprising at least two separate chambers for containing different component forming material therewithin, means for maintaining substantially constant advancing pressure in each of said chambers including means for varying the volume of each of said chambers, a separate conduit for each of said chambers, each of said conduits extending between its associated chamber and a common juncture for all of said conduits for passing separate streams of said com-

ponent-forming materials to said juncture in merger thereof, said pressure means being positioned upstream of said juncture point, a filament forming jet, and other conduit means extending between said juncture and said jet for passing said merged streams to said jet.

5. Apparatus for producing a multicomponent filamentary material, said apparatus comprising at least two separate conduits of different diameters, one of said conduits disposed concentrically and coaxially within a second of said conduits, means for introducing different component-forming materials into each of said conduits in laminar flow, and a spinnerette containing a plurality of orifices disposed about a circle having a larger diameter than that of said conduit of smallest diameter, said conduits operatively communicating with said spinnerette with the conduit of smallest diameter spaced some distance from said spinnerette.

6. Apparatus for producing a multicomponent filamentary material, said apparatus comprising a plurality of concentric and coaxial conduits, means for introducing different component-forming materials in laminar flow into said conduits, and a spinnerette containing a plurality of orifices disposed about a circle having a larger diameter than that of said conduit of smallest diameter, said conduits operatively communicating with said spinnerette with the conduit of smallest diameter being spaced some distance from said spinnerette.

7. The apparatus of claim 6 wherein said spinnerette contains a plurality of sets of orifices, each said set disposed in a circle, said circles concentric with one another.

8. Apparatus for producing a plurality of multicomponent filamentary materials, said apparatus comprising at least two separate chambers, means for introducing different component-forming materials into said chambers, a plurality of separate conduit means from each of said chambers, each such conduit means from one of said chambers also terminally communicating with one of said conduit means from another of said chambers at a common juncture point, substantially constant advancing pressure means operatively associated with each of said chambers including means for varying the volume of each of said chambers whereby the pressures within said materials are maintained substantially constant, said pressure means being positioned upstream of said junction point, filament-forming jets, and a plurality of second conduit means, each of said second conduit means communicating with one of said first-mentioned conduit means at said junction point and communicating with one of said jets.

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