

Sept. 30, 1947

W. A. SISSON ET AL

2,428,046

ARTIFICIAL FILAMENTS

Filed Aug. 3, 1943

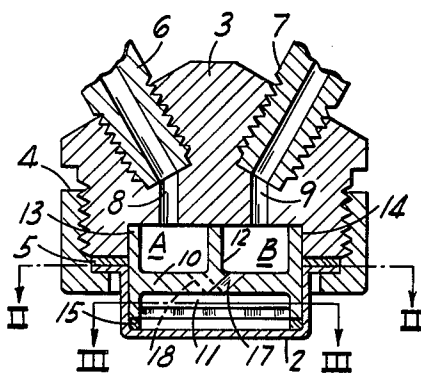


Fig. 1.

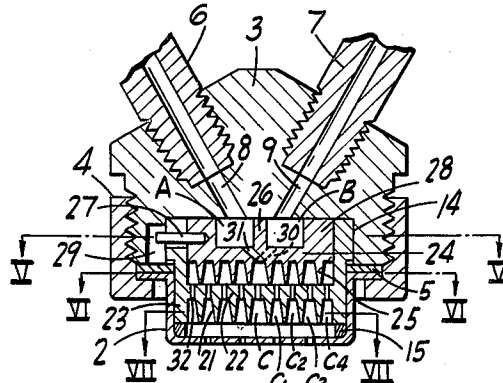


Fig. 4.

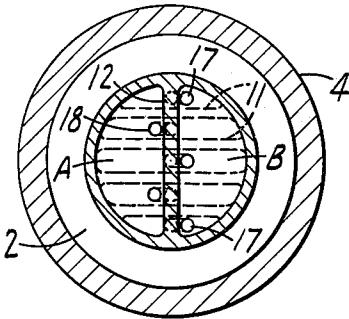


Fig. 2.

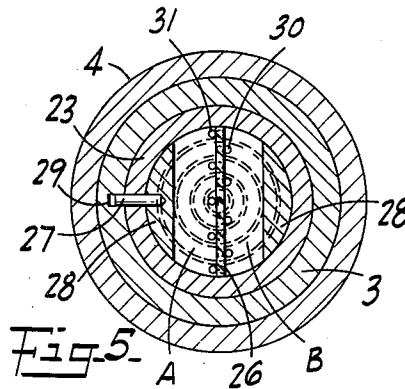


Fig. 5.

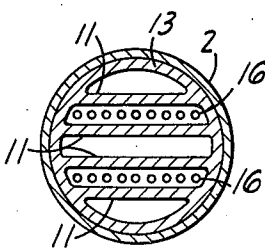


Fig. 3.

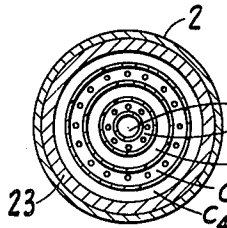


Fig. 7.

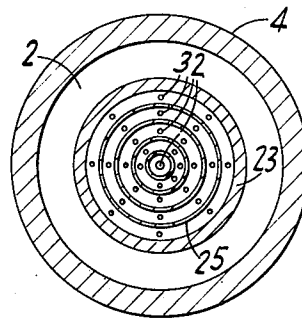


Fig. 6.



Fig. 8.

Fig. 9.

BY

INVENTORS.
WAYNE A. SISSON
WESLEY L. WEBB
Carl A. Castellano
ATTORNEY.

UNITED STATES PATENT OFFICE

2,428,046

ARTIFICIAL FILAMENTS

Wayne A. Sisson, Silverdale, Del., and Wesley L. Webb, Glen Moore, Pa.

Application August 3, 1943, Serial No. 497,156

3 Claims. (Cl. 28—32)

1

This invention relates to filaments of composite character comprising at least two basic components, one of which is disposed between two portions of the other or others which may cover the lateral surfaces of the former component completely or only partially. In the former case, a core or sheath arrangement is obtained, while in the other, novel effects may be obtained.

It is an object of this invention to provide filaments having novel effects. Further objects and advantages of this invention will be apparent from the drawing and the description thereof hereinafter.

In the drawing illustrative of the invention, Figure 1 is a mid-section through an extrusion device for producing filaments of the invention;

Figure 2 is a cross-section taken on line II—II of Figure 1;

Figure 3 is a cross-section taken on line III—III of Figure 1;

Figure 4 is a mid-section of another extrusion device for producing filaments of the invention;

Figure 5 is a cross-section taken on line V—V of Figure 4;

Figure 6 is a cross-section taken on line VI—VI of Figure 4;

Figure 7 is a cross-section taken on line VII—VII of Figure 4;

Figure 8 illustrates in cross-section various of the novel filaments obtainable in accordance with the invention; and

Figure 9 illustrates in cross-section, additional varieties of filaments obtainable in accordance with the invention.

As shown in Figures 1 to 3, the spinneret 2 is attached to a supply head 3 for the spinning materials or solutions by a coupling 4. A gasket 5 is positioned between the flange of the spinneret 2 and the supply head 3 to assure a tight seal. Feed pipes 6 and 7 communicate with passages 8 and 9 respectively. Within the space back of the face of the spinneret 2, there is provided a partitioning means comprising a plate 10 from which a plurality of approximately parallel ribs 11 extend toward the back face of the spinneret without being in contact therewith. A partition 12 extends from the plate 10 in the opposite direction to divide the space back of the plate 10 into two separate regions A and B communicating with the passages 8 and 9 respectively. This partitioning means may be formed integrally within a cylindrical sleeve 13 fitting within the recess 14 within the supply head 3 and resting upon a spacing ring 15 to support the

2

partitioning system out of contact with the back face of the spinneret. The spinneret is provided with two rows of orifices 16 arranged in registry with alternate spaces between the ribs 11. Thus, as is shown in Figure 3, every other space between the partitions 11 faces a portion of the spinneret face which is lacking in orifices, while the intervening spaces between partitions 11 are arranged in direct opposition to the spinneret orifices. Passages 17 through plate 10 connect the chamber B with the alternate spaces between ribs 11 which face blank portions of the spinneret, while passages 18 connect the chamber A with the other alternate spaces which face the orifices of the spinneret.

It will appear from a study of the arrangement of Figures 1 to 3, that if two different spinning materials or solutions are supplied by pipes 6 and 7, the material or solution immediately back of the spinneret face would be more or less stratified into alternating layers of the two types of spinning materials, one of the types being found in the spaces between the ribs 11 facing the spinneret orifices and the other type being found in the spaces between ribs 11 which face blank spaces of the spinneret face. Since both pumps force the spinning materials or solutions to find egress, the material or solution in the spaces between partitions 11 which face blank spaces of the spinneret face must flow through the spinneret orifices on either side of the spinning material or solution flowing through the spaces between the ribs 11 facing the spinneret orifices. Such flow gives rise to filament cross-sections such as those shown in Figure 8. If the pump associated with pipe 7 is operated at great volumetric speed than that connected with pipe 6, the lateral portions of filament-forming material completely envelop the central portion as shown in Figure 8a. When the pump speeds are more nearly equal, a cross-section of filament similar to Figure 8b is obtained, while if the pump associated with pipe 7 is operated at considerably lower volumetric output than that associated with pipe 6, the filament structure of Figure 8c is obtained. The cross-section can also be controlled by selection of spinning materials. For example, in the case of two viscoses, if the intermediate viscose shrinks more rapidly in setting up, than the outer viscose, the cross-section of Figure 8a is obtained, whereas a reversal of shrinkage characteristics results in the cross-section of Figure 8c. Again, control can be effected by altering both pump speeds and viscose shrinkage characteristics. Although the

3

boundaries between the components of the filaments are shown distinctly in the drawing, there may be some intermingling of the different components on either side of the boundaries.

The extrusion device of this invention may be used for wet or dry spinning or for spinning molten materials. The two spinning materials 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 spinning 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 celluloses of different origin, for example one from cotton linters and the other from wood pulp. In the case of spinning solutions which undergo a ripening process, such as viscose, difference of 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 the spinning solutions.

The two spinning materials may comprise the same or different spinning substances, but differ in that one of the two 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, both spinning 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 substances which can react chemically with the spinning substance in the solution or during the precipitation. 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 which are introduced into the spinning mass for the purpose of roughening the surface of the filament, or of coloring or dulling the filament, cause a sensible decrease in the strength. By the new process such substances, which can fulfill their purpose when disposed only at the surface of the filament, need be introduced only into the spinning material or solution for forming the outer envelope of Figure 8a, while the core remains undiluted by such additions and, therefore, maintains its normal strength.

When the process is carried out with two spinning solutions which contain different spinning substances in solution, the two spinning 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. Two spinning substances may, however, be used which belong to quite different classes of materials, 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 the two spinning materials do not mutually coagulate each other and are coagulatable by a common coagulating medium. According to whether one kind of spinning substance forms the core or intermediate portion and another kind the sheath or lateral portions of the filaments, or

4

vice versa, filaments of different properties can be obtained from the same substances. By using two spinning 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 both spinning 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 enclosing a pigment or dyed core by an uncolored sheath, or one which is colored but not so deeply as to prevent the core from exerting an influence on the appearance of the filament. By sandwiching a colorless or lightly colored component between lateral components intensely dyed or heavily pigmented to form structures having cross-sections similar to Figures 8b and 8c, or by reversing the disposition of the lightly and densely colored components respectively, novel and interesting effects are obtained, and such effects are accentuated when the two components are made of materials having different shrinkages, and are subsequently differentially shrunk to effect crimping thereof.

Further modifications may be obtained by changing the partition 12 from a simple transverse rib to a partition of Y-shape, and providing another pipe connection similar to 6 and 7 for supplying a third spinning material or solution to the third chamber thus provided. In that case, the central one of the spaces between the several partitions 11 may be connected to the third chamber receiving the third spinning material or solution by a suitable passage similar to the central passage 17 shown in Figure 2. In such an arrangement, the filaments would be composed of three filament-forming materials arranged similarly to the layers of Figures 8a, 8b and 8c, but with one of the laterally disposed materials of different composition than the other lateral member. This arrangement is illustrated in Figures 9a, 9b, 9c. This arrangement may be of particular advantage to form crimped filaments by associating a plurality of filament-forming materials at least two of which show different shrinkage characteristics, particularly after stretching, and subsequently crimping them by taking advantage of these characteristics.

Figures 4 to 7 show a modification of the extrusion device in which the partitioning means within the space back of the spinneret face is arranged to co-operate with a spinneret having concentric groups of orifices, such as circular rows of orifices. In this arrangement, the space immediately back of the spinneret face is divided by a plurality of concentric partitions 21 (four being shown, though any number may be used) into concentric annular chambers C₁, C₂, C₃ and C₄ about a central chamber C. These partitions 21 may extend from a transverse plate 22 secured in or integrally formed in a sleeve 23 fitting within the walls of the spinneret 2 and the recess 14 on the supply head 3. In the space back of the plate 22, there is disposed a distributor member having a transverse plate 24 from which the concentric partitions 25 extend into contact with plate 22. A transverse rib or partition 26 divides the space back of the plate 24 into two compartments or chambers A and B. A locating pin 27 extends from a bore in one of the walls 28 extending back of the plate 24 through a slot in sleeve 23 to a slot 29 in the supply head 3. This locating pin 27 is arranged so that the passages 8 and 9

5

are each associated with only one of the compartments A and B respectively on either side of the rib 26. The passages 30 join compartment B with alternate regions or chambers between the concentric partitions 25, while passages 31 connect the compartment A with the other annular regions or chambers (including the central region) between partition 25. Passages 32 connect the corresponding regions and chambers in front of and in back of plate 22. The orifices of the spinneret are arranged to face alternate annular regions or chambers between the annular partitions 21, namely C₁ and C₃, thus leaving blank the portions of the spinneret face opposite the intervening chambers C, C₂ and C₄ between partitions 21.

The operation of the device of Figures 4 to 7 is analogous to that of Figures 1 to 3, the spinning materials or solutions immediately behind the spinneret face being arranged as concentric strata instead of the parallel linear strata of Figures 1 to 3. As in Figures 1 to 3, the partition 26 may be of Y-shape and an additional spinning material feed pipe similar to 6 and 7 may be provided and connected with the third compartment thus provided by the Y-shape of partition 26. In such event, the third compartment may be connected with a separate region or chamber between the partitions 25 by passages similar to 30 and 31, so that the spinning materials will alternate in sequence to provide filaments similar to those of Figure 9. Thus the third spinning material may be directed into the chamber C₂, leaving the other two materials to follow the same channels as shown in the drawing.

The following examples are illustrative of the invention:

Example 1

Equal volumetric amounts of two different types of viscose solutions were spun, through a form of apparatus similar to that described above and shown in Figure 4, into a spinning bath containing 10% sulfuric acid, 2% zinc sulfate and 19% sodium sulfate at a temperature of 45° C. One of the types of viscose solution was made from wood pulp using 30% carbon disulfide based on the air dry weight of the pulp and contained 7½% cellulose and 6½% sodium hydroxide. This viscose was aged for 100 hours and had a common salt point of 1.9. The other type of viscose solution was made from cotton pulp using 44% carbon disulfide based on the air dry weight of the pulp and contained 7½% cellulose and 8% sodium hydroxide. To this viscose was added 6% finely ground titanium dioxide based on the weight of cellulose present. This viscose was aged for 48 hours and had a common salt point of 5.5. The young viscose containing titanium dioxide was allowed to pass through the apparatus, so as to enter the blank spaces of the spinneret face C, C₂ and C₄. The other viscose entered the alternate spaces facing the spinneret orifices C₁ and C₃. Owing to the more rapid setting up or shrinkage rate of the older viscose the titanium dioxide containing viscose almost completely surrounded the other viscose to give a cross section approaching closely that shown in Figure 8a. The resulting filaments which were of 5 denier had a dull delustrated appearance owing to the presence of the titanium dioxide on the outside sheath of the filament.

Example 2

Two different types of viscose solution were prepared and spun exactly the same as in Example 1, with the exception that the titanium di-

6

oxide was added to the older viscose made from wood pulp instead of being added to the younger viscose. The cross section which was of the type shown in Figure 8a contained the titanium dioxide viscose surrounded by the other viscose, which imparted to the filaments a glossy delustrated appearance owing to the presence of the delustrant in the core of the filament.

Example 3

Two different types of viscose solution were prepared and spun exactly as in Example 1, with the exception that the young titanium dioxide containing viscose was allowed to pass through the apparatus so as to enter the spaces C₁ and C₃ facing spinneret orifices, and the old viscose to enter the face blank spaces C, C₂ and C₄. The resulting cross section was of the type illustrated in Figure 8c with the titanium dioxide containing viscose only partially surrounding the other viscose.

In the claims, the term "alternate" is intended to refer to corresponding members of a series of two or greater than two members, which series may be repetitive. For example, the unit of a three-membered series would be ABCB, which could be partially repeated as in: ABCBA or ABCBABCBA.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined by the appended claims.

We claim:

1. Filaments of regenerated cellulose of composite character whose transverse cross-section comprises three distinct components, one between two others, the intermediate component being substantially free of a pigment and the outer components containing a pigment, and the outer portions being generally symmetrically arranged with respect to the intermediate portion.

2. Filaments of composite character whose transverse cross-section comprises three distinct components, one between two others, the intermediate component being of a composition different from that of the outer components, said outer components containing a visibly contrasting material in finely subdivided form.

3. Filaments of composite character whose transverse cross-section comprises three distinct components, one between two others, the intermediate component being of a composition different from that of the outer components, and said outer components containing a colored material in finely subdivided form.

4. Filaments of composite character whose transverse cross-section comprises three distinct components, one between two others, the intermediate component being of a composition different from that of the outer components, said outer components containing a delustrant in finely subdivided form, the intermediate component being substantially free of the delustrant.

5. Filaments of regenerated cellulose of composite character whose transverse cross-section comprises three distinct components, one between two others, the outer components containing a visibly contrasting material in finely subdivided form.

6. Filaments of regenerated cellulose of composite character whose transverse cross-section comprises three distinct components, one between two others, the intermediate component being substantially free of a delustrant and the outer components containing a delustrant.

7

7. Filaments of regenerated cellulose of composite character whose transverse cross-section comprises three distinct components, one between two others, the outer components containing a visibly contrasting material in finely subdivided form, said filaments being crimped by virtue of different shrinkage characteristics of the regenerated cellulose components.

8. Filaments of regenerated cellulose of composite character whose transverse cross-section comprises three distinct components, one between two others, the intermediate component and each of the two outer components being derived from viscoses having different characteristics imparting to the final composite filament a crimped condition.

WAYNE A. SISSON.
WESLEY L. WEBB.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date	
2,209,919	Hermann	July 30, 1940	25

Number	
2,063,897	
2,063,180	
2,313,296	5
2,233,442	
2,031,387	
1,620,233	
1,884,069	
1,999,404	10
1,975,153	
1,993,847	
2,041,798	
2,044,135	
2,072,926	15

8

Name	Date
Riley et al.	Dec. 15, 1936
Meyer et al.	Dec. 8, 1936
Lamesch	Mar. 9, 1943
Wiley	Mar. 4, 1941
Schwartz	Feb. 18, 1936
Rosenthal	Mar. 8, 1927
Mendel	Oct. 25, 1932
Dreyfus	Apr. 30, 1935
Jacquet	Oct. 2, 1934
Koch	Mar. 12, 1935
Taylor	May 26, 1936
Taylor	June 16, 1936
Taylor	Mar. 9, 1937

FOREIGN PATENTS

Country	Date
Netherlands	Oct. 15, 1941

OTHER REFERENCES

Ser. No. 354,117, Thinius, (A. P. C.) pub. Apr. 27, 1943.