March 24, 1970 R. P. DOUGLAS, JR., ET AL 3,501,805

APPARATUS FOR FORMING MULTICOMPONENT FIBERS

Filed Jan. 3, 1963 6 Sheets-Sheet 1

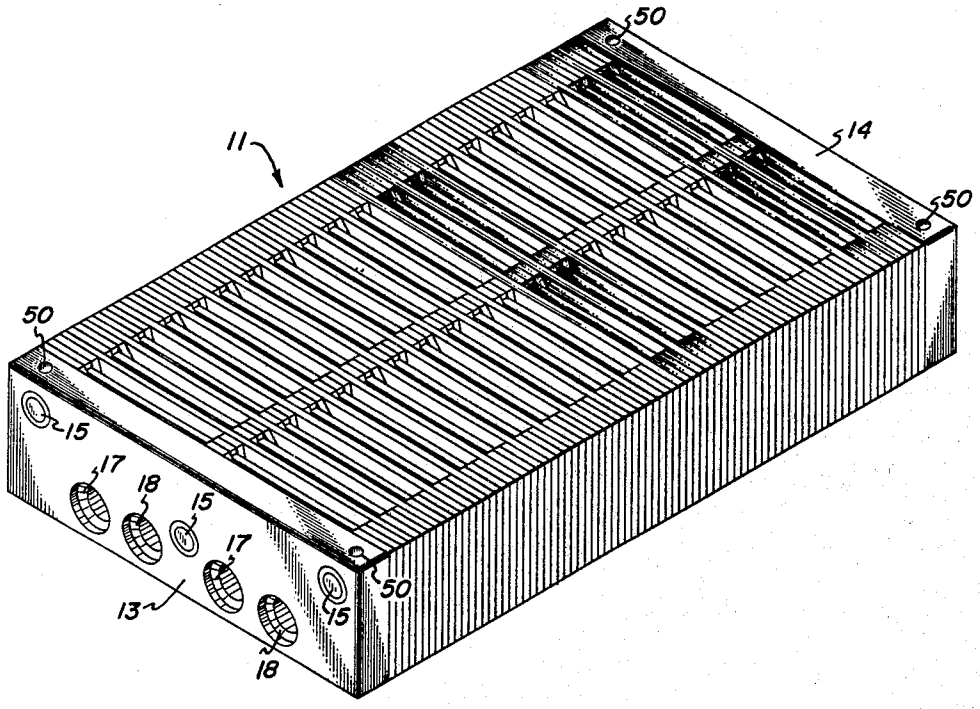


FIG - 1

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APPARATUS FOR FORMING MULTICOMPONENT FIBERS

Filed Jan. 3, 1963 6 Sheets-Sheet 2

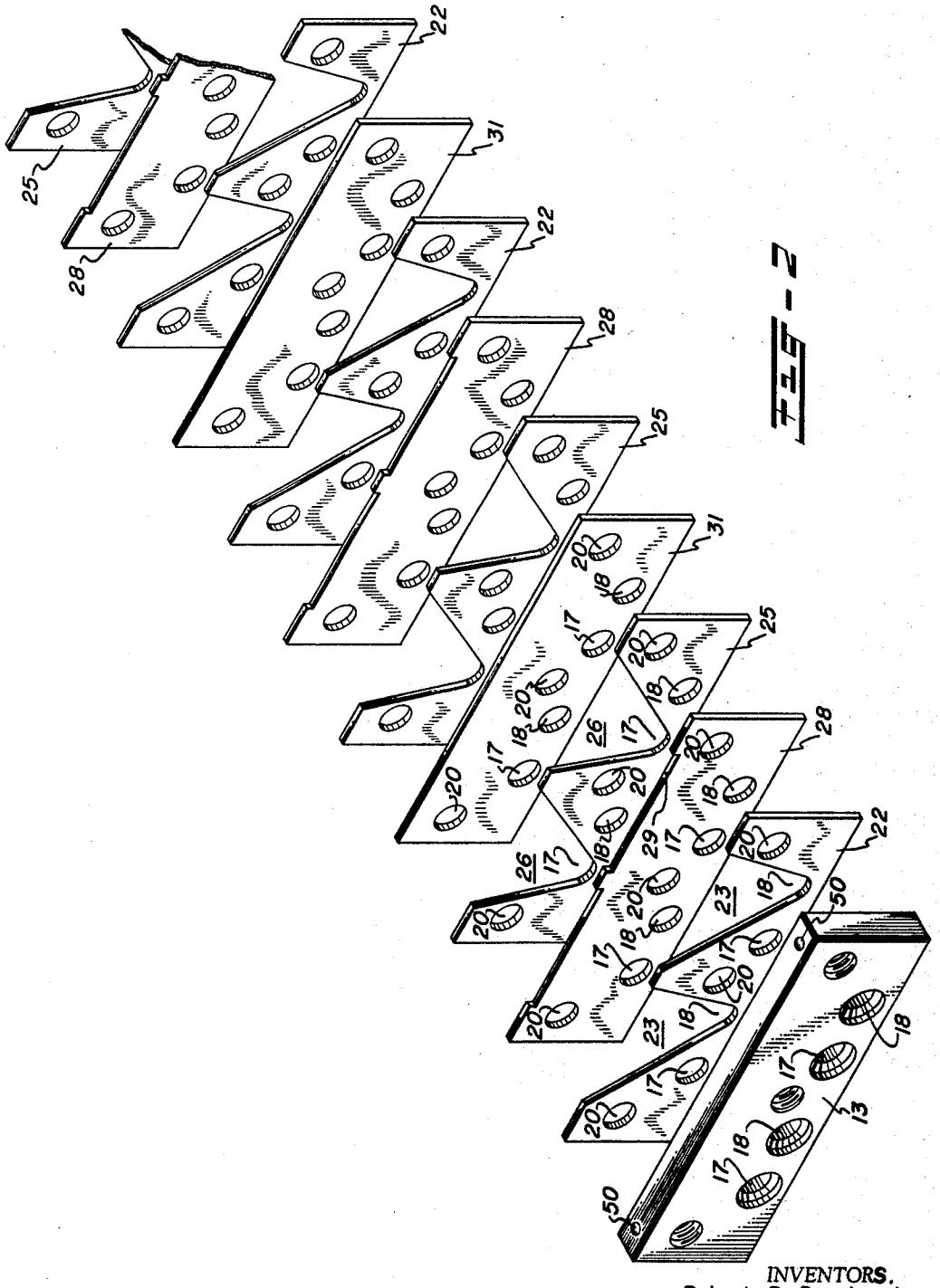


FIG. 7

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APPARATUS FOR FORMING MULTICOMPONENT FIBERS

Filed Jan. 3, 1963 6 Sheets-Sheet 3

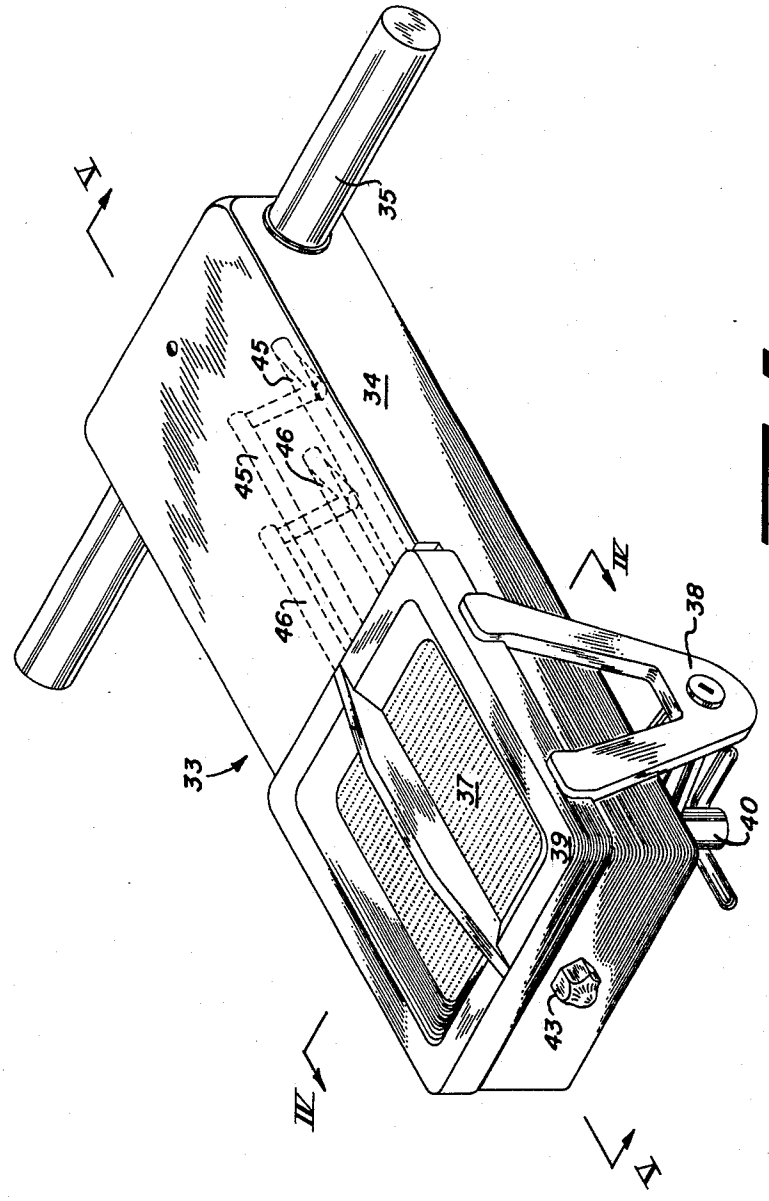


FIG-3

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APPARATUS FOR FORMING MULTICOMPONENT FIBERS

Filed Jan. 3, 1963 6 Sheets-Sheet 4

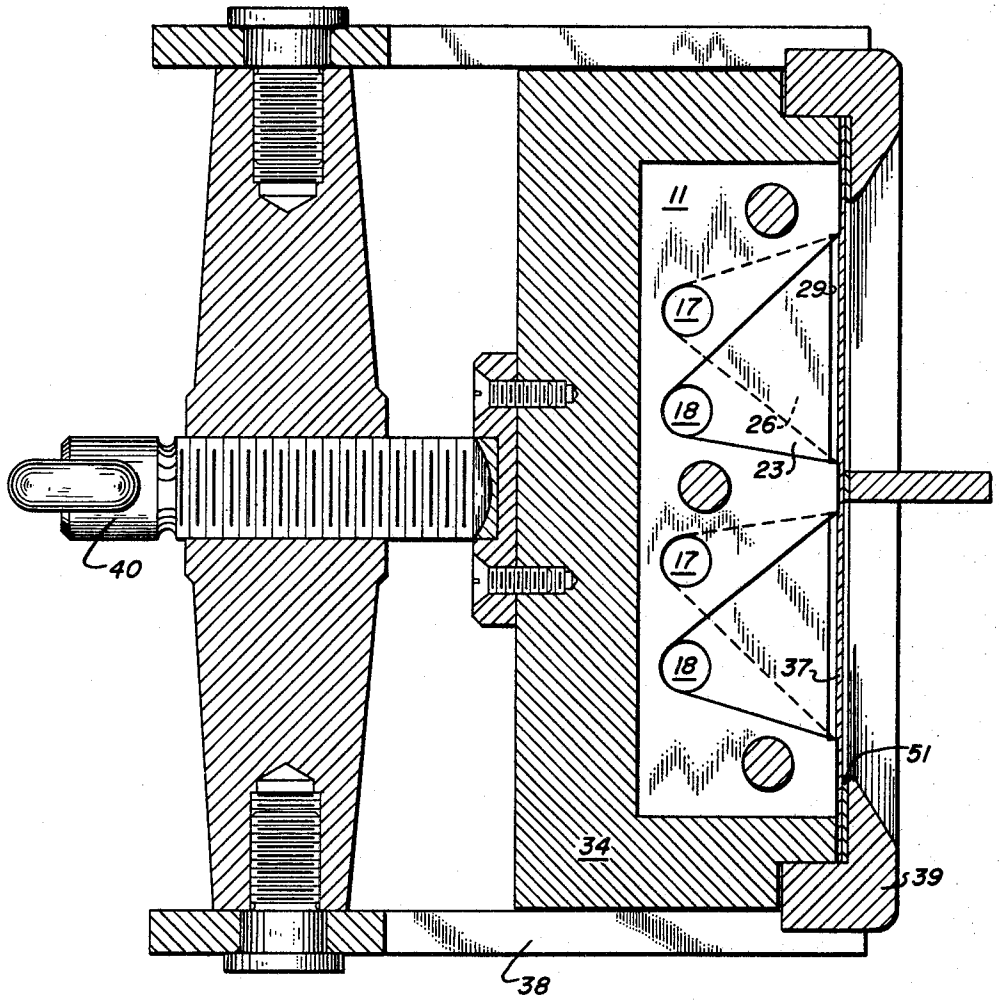


FIG - 4

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APPARATUS FOR FORMING MULTICOMPONENT FIBERS

Filed Jan. 3, 1963 6 Sheets-Sheet 5

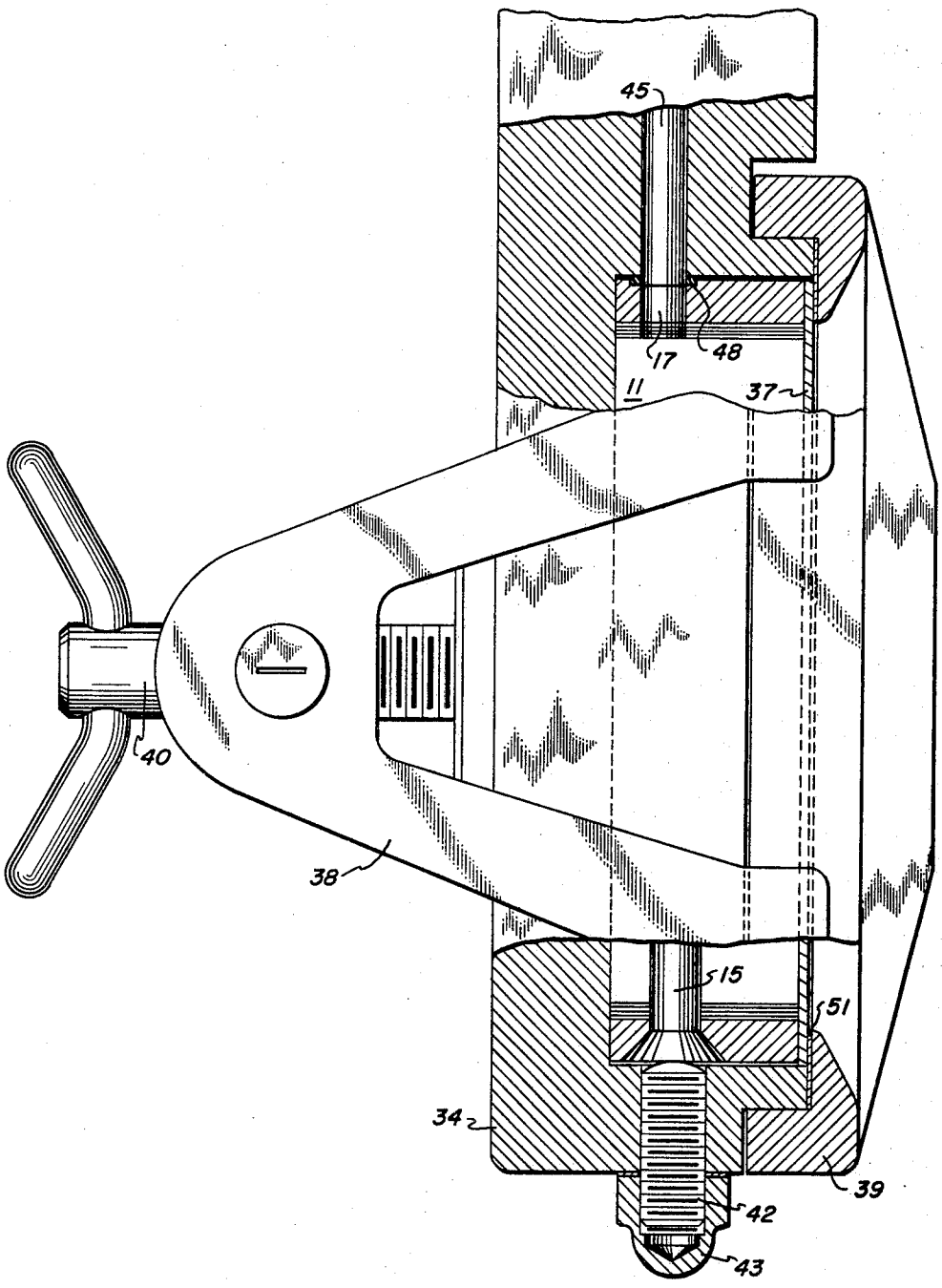


FIG-5

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APPARATUS FOR FORMING MULTICOMPONENT FIBERS

Filed Jan. 3, 1963 6 Sheets-Sheet 6

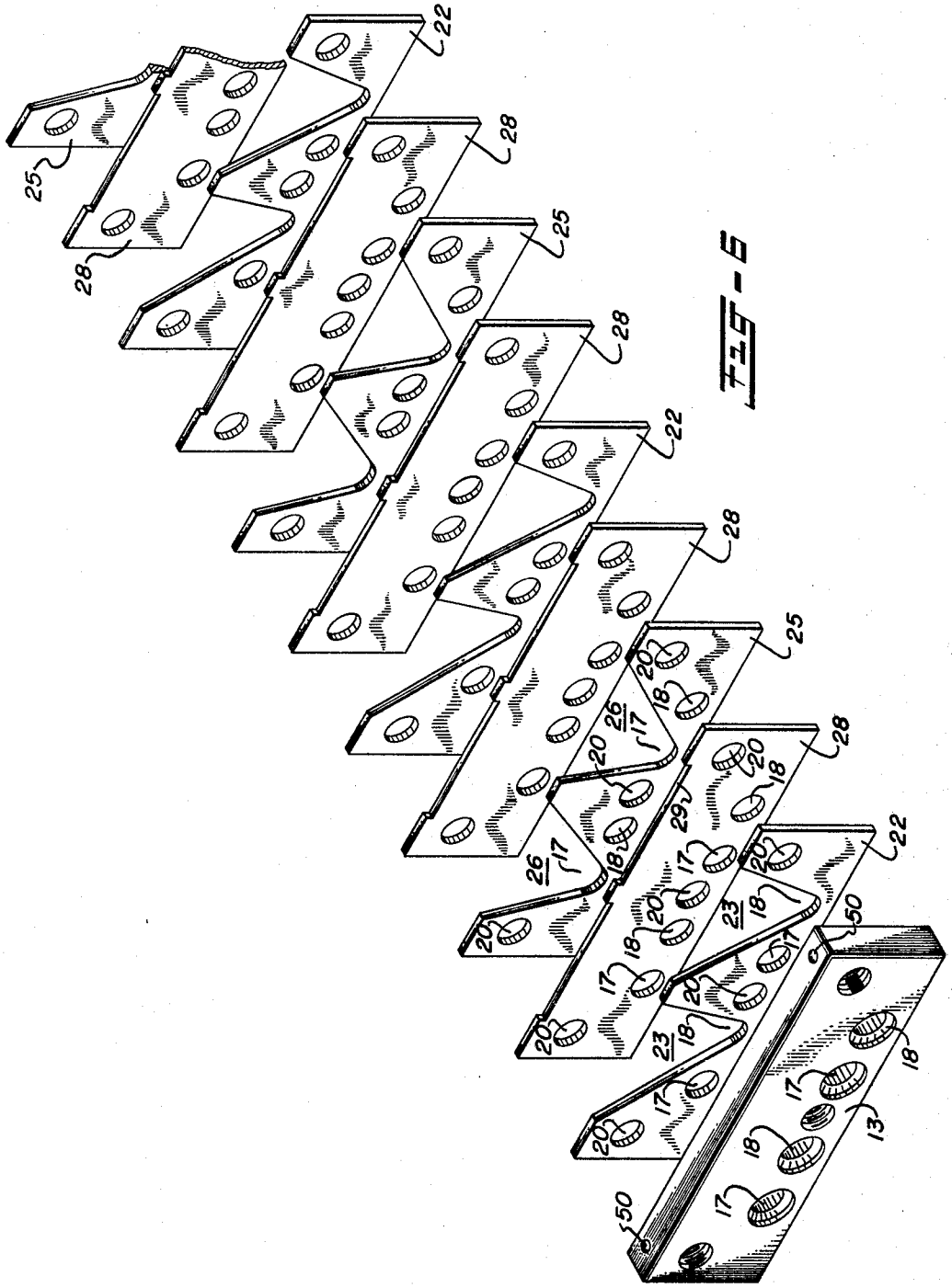


FIG - 5

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Patented Mar. 24, 1970

3,501,805

APPARATUS FOR FORMING MULTI-COMPONENT FIBERS

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Int. Cl. D01d 3/00
U.S. Cl. 18—8 7 Claims

This invention relates to apparatus for spinning fibers, and more particularly, to apparatus for spinning multicomponent fibers.

It is known to produce fibers by processes wherein a plurality of spinning solutions are extruded through a common orifice either simultaneously or sequentially to produce special effects. For many purposes these special effect fibers are highly desirable but are economically not competitive with ordinary fibers due, in part, to the high costs and low productivity per spinning position of the known equipment necessary to perform such processes.

It is an object of this invention to provide means for extruding a plurality, and more specifically, two different spinning solutions through common orifices of a multi-orifice spinnerette.

It is another object of this invention to provide economical and easily fabricated distribution means for distributing each of such spinning solutions to each of a relatively large number of orifices in a single spinnerette.

It is yet another object of this invention to provide such apparatus in such form as to permit the carrying out of the known processes of spinning multicomponent fibers where such apparatus may be constructed inexpensively and is adaptable for use in spinning tows comprising large numbers of filaments.

In accordance with this invention a novel spinnerette assembly is provided comprising a plurality of plates secured together to form a stack. Through such stack a plurality of passageways is provided by similarly positioned orifices through each plate. Such passageways may be considered as belonging to two groups, a first group for one spinning solution and a second group for a second spinning solution. In this stack, a first group of plates is provided with openings connecting such first group of passageways to a flat surface of the stack, and a second group of plates is provided with openings connecting such second group of passageways to the same flat surface of the stack. These first and second plates are separated from each other by a third type of plate which is slightly recessed adjacent the same flat surface of the stack. In some instances, it may be desirable to have a fourth plate isolating each subgroup of a single first plate, a single second plate, and a single third plate from adjacent subgroups. The afore-described spin dope distribution assembly is used with a spinnerette placed against such flat surface of the stack. The spinnerette is provided with a plurality of orifices disposed in a plurality of parallel rows and is matched with its coacting stack so that each row of orifices in the spinnerette lies directly over the recess in each such third plate.

With such unit, multicomponent fibers may be spun in either of two fashions. For preparing crimped fibers simultaneous extrusion of a pair of spin dopes through the two groups of passageways, through the openings in the first plates and the second plates respectively to the recesses in the third plates, and simultaneously through the orifices into a coagulating medium can be performed. For other special effects wherein alternate lengths of different materials are desired alternate extrusion of a first spin dope through the first group of passageways, the openings in the first plates, the recesses in the third plates, and the orifices

may be alternated with extrusion of a second spin dope through the second group of passageways, the openings in the second plates, the recesses in the third plates, and through the orifices.

For a clearer and more detailed understanding of this invention particularly with reference to preferred embodiments thereof, reference may be had to the following description read in conjunction with the drawings wherein:

FIGURE 1 is a perspective view of the spin dope distribution assembly;

FIGURE 2 is an exploded view of a portion of the stack shown in FIGURE 1;

FIGURE 3 is a perspective view of the complete spinnerette assembly;

FIGURE 4 is a cross sectional view taken on the line IV—IV of FIGURE 3;

FIGURE 5 is a cross sectional view taken along line V—V of FIGURE 3; and

FIGURE 6 is an exploded view of a stack similar to that in FIGURE 1 but illustrating a different arrangement of plates within such stack.

Referring next to the drawings, and more particularly to FIGURES 1 and 2 thereof, there is illustrated a spin dope distribution assembly **11** in the form of a stack of plates having a generally flat, though recessed, surface facing uppermost in FIGURE 1. This stack is comprised of a plurality of plates, which will be described hereinafter, secured together between a pair of end plates **13, 14** by means of a plurality of bolts **15**. End plate **13** is provided with four orifices **17, 18, 17,** and **18** which, as will be explained later, are used to introduce spin dope into the spin dope distribution assembly **11**.

End plate **14** is generally similar to end plate **13** except that orifices **17** and **18** are not provided therein.

As best seen in FIGURE 2, the stack of plates is composed of a plurality of different plates having different functions arranged in a definite sequence. Each of these plates is provided with three holes **20** appropriately positioned which line up in the stack assembly with the corresponding holes in end plates **13** and **14** and through which bolts **15** pass. Additionally, each plate is provided with orifices **17, 18, 17,** and **18** which, when the plates are assembled in the form of a stack, line up with the corresponding openings **17, 18, 17,** and **18** in end plate **13** to provide four spin dope passageways leading through the stack from end plate **13** to the last plate prior to end plate **14**.

Adjacent end plate **13** in the stack, there is a first plate **22** which is provided with openings **23, 23** leading from orifices **18, 18** upward to the generally flat upper surface of the spin dope distribution assembly **11**. Thus, first plate **22** provides a pathway for spin dope from the first group of pasageways **18, 18** through openings **23, 23** to the surface of the stack. Note that orifices **17, 17** are isolated from openings **23, 23** and therefore there is no communication by way of first plate **22** between the second group of passageways **17, 17** and the surface of distribution assembly **11**.

Temporarily skipping the next plate in the stack, we find that the plate after it is a second plate **25** which, preferably, may be the mirror image of first plate **22** and, as such, may be manufactured as a plate identical with first plate **22** but inserted into the stack in a reversed position. Second plate **25** is provided with openings **26, 26** which communicate between orifices **17, 17** and the same surface of the distribution assembly **11** as do openings **23** in plate **22**. Note that orifices **18, 18** in plate **25** are isolated from openings **26, 26**. Thus, second plate **25** provides a pathway for spin dope between the second group of passageways **17, 17** through openings **26, 26** to the surface of the distribution assembly.

Between first plate **22** and second plate **25** there is interposed a third plate **28** which serves to separate openings **23** from openings **26** in the adjacent plates **22** and **25** except for a region adjacent the surface of distribution assembly **11** where recesses **29** are provided.

After second plate **25**, there is provided a fourth plate **31** which is provided with neither openings nor recesses and effectively serves to isolate one first plate **22**, one third plate **28** and one second plate **25** from the other similar groups of three plates to follow. After plate **31**, the stack continues with plates in the following order in a repetitive pattern: second plate **25**, third plate **28**, first plate **22**, fourth plate **31**, first plate **22**, third plate **28**, second plate **25**, fourth plate **31**, etc. for whatever number of plates may be desired before reaching end plate **14**.

Referring next to FIGURES 3, 4, and 5, there is shown a spinnerette assembly for use in spinning multi-component fibers making use of the spin dope distribution assembly **11** previously described and illustrated in FIGURES 1 and 2. As seen in FIGURE 3, spinnerette assembly **33** generally comprises a housing **34** suitably supported in a conventional style pivot block (not shown) by pivot rod **35**. This conventional mounting provides for movement of the spinnerette assembly **33** from a first position wherein the spinnerette is disposed for spinning to a second position wherein it is disposed for bleeding as is well known in the art. Spinnerette assembly **33** also includes a spinnerette **37** which is provided with a plurality of orifices arranged in a plurality of rows and which is removably secured to the spinnerette assembly by means of clamp **38**. Clamp **38** includes a picture-frame-like retainer **39** which presses spinnerette **37** against housing **34** by means of screw **40**.

Within housing **34** (see FIGURES 4 and 5) spin dope distribution assembly **11** is positioned within an appropriately configurated recess. When so positioned, and pressed into place by means of adjusting screw **42** (which is provided with a cap **43**), spin dope distribution assembly **11** is positioned with passageways **17**, **18**, **17**, and **18** in registry with passageways **45**, **46**, **45**, and **46**. Pressure exerted by adjusting screw **42** compresses O-rings **48** to effectuate a leak-proof seal between the passageways in the housing **34** and the passageways in the distribution assembly **11**.

In order to assure accurate alignment of the stacked plates of the distribution assembly **11** with the spinnerette **37**, end plates **13** and **14** are provided with holes **50** which mate with corresponding holes in spinnerette **37** and which are adapted to receive alignment pins (not shown) which lie under the retainer **39** of clamp **38**, suitably protected by gasket **51**. Preferably the alignment is such that each third plate **28** is positioned directly adjacent a corresponding row of orifices in spinnerette **37** such that the center of any third plate **28** and the line connecting the centers of the orifices of its associated row of orifices are substantially coplanar.

In operation, a first spin dope will pass through the spinnerette assembly **33** by following the pathway through passageways **46**, passageways **18**, openings **23**, recesses **29**, and through the orifices in spinnerette **37** through a suitable coagulating medium and a second spin dope will pass through passageways **45**, passageways **17**, openings **26**, recesses **29**, and the same orifices in spinnerette **37** through the suitable coagulating medium. Where it is desired to produce a bi-component fiber containing a pair of dissimilar materials in a side-by-side relation extending throughout the length of the fiber, the two spin dopes are fed simultaneously to the respective dope pathways by conventional means, such as gear pumps (not shown). Where it is desired to have a bi-component fiber which contains alternating segments of different materials throughout the length thereof, alternating one spin dope and then the other spin dope are fed to the spinnerette assembly **33** by the varying operation of the suitable pumps for each such spin dopes.

Referring next to FIGURE 6, there is shown an exploded view of an alternate form of spin dope assembly

utilizing the same types of plates as were used in the spin dope distribution assembly **11** previously described. It will be noted that in this assembly, the same end plates **13** and **14** are used as well as using a plurality of first plates **22**, second plates **25**, and third plates **28**. However, this arrangement differs from the arrangement of FIGURE 2 in that no fourth plates are used and the remainder of the plates are arranged in a different sequence. As shown in FIGURE 6, after end plate **13**, the sequence of plates utilized is as follows: a first plate **22**, a third plate **28**, a second plate **25**, a third plate **28**, a first plate **22**, a third plate **28**, a second plate **25**, a third plate **28**, etc.

This spinnerette assembly is useful for spinning multi-component fibers from any of the known spin dopes, such as nylon, rayon, acrylics, polyesters, polyvinyl compounds, glass, etc. whether produced by wet-spinning, dry-spinning, or melt-spinning and of course, depending upon the nature of the specific spin dopes being used and the specific coagulating medium involved, suitable materials of construction must be selected as is well known in the art.

While the foregoing description has been of specific illustrative embodiments presently preferred for the construction of the apparatus of this invention, obviously, numerous modifications will readily occur to one skilled in the art following the teachings of this invention. It is intended that all such modifications as fall within the scope of the appended claims are to be considered as part of the present invention.

Illustrative of such modifications might be mentioned the following: alterations of the shapes of openings **23** and **26**, utilization of only a single passageway **17** and a single passageway **18** extending through the stack, securing the plurality of plates in the distribution assembly **11** together by soldering, welding, brazing, etc. in place of bolts **15**, or even injection molding the plates in the stack as a unitary structure in a suitably configurated mold.

Also, while each plate has been shown as made from a single sheet of material, it is obvious that a plate may be made from a plurality of thinner sheets stacked together to provide the desired thickness. While the spinnerette orifices have been illustrated as being disposed in rows which are parallel and equidistant, such is not necessary since wedge-shaped plates can be used with non-parallel rows of orifices and various thicknesses of plates can be used with spinnerettes whose rows of orifices are not equidistant.

We claim:

1. A spinnerette assembly comprising:

(a) a spinnerette having a plurality of orifices disposed in a plurality of parallel rows in the face thereof,

(b) a spin dope distribution assembly mounted adjacent said spinnerette comprising a plurality of plates secured together to form a stack, such stack including:

(1) a plurality of first plates having openings communicating from a first spin dope passageway to first regions immediately adjacent said spinnerette,

(2) a plurality of second plates having openings communicating from a second spin dope passageway to second regions immediately adjacent said spinnerette, and

(3) a plurality of third plates interposed between each such first plate and its neighboring such second plate to isolate the aforesaid openings from each other and to provide communication between each such first region and each such second region immediately adjacent said spinnerette; and

(c) support means for mounting said spinnerette and said spin dope distribution assembly with each of

said third plates aligned with a corresponding row of orifices in said spinnerette and with each of rows of orifices located between a pair of adjacent first and second regions.

2. A spinnerette assembly as defined in claim 1 wherein said spin dope distribution assembly comprises a plurality of repeating units of (a) a first plate, (b) a third plate, (c) a second plate, and (d) a third plate.

3. A spinnerette assembly as defined in claim 1 wherein said spin dope distribution assembly includes a plurality of fourth plates between each adjacent pair of first plates and between each adjacent pair of second plates to effectively separate each pair of adjacent openings in any pair of like plates from each other.

4. A spinnerette assembly as defined in claim 3 wherein said spin dope distribution assembly comprises a plurality of repeating units of (a) a first plate, (b) a third plate, (c) a second plate, (d) a fourth plate, (e) a second plate, (f) a third plate, (g) a first plate, and (h) a fourth plate.

5. A spinnerette assembly as defined in claim 1 including mating holes in said spinnerette and said spin dope distribution assembly and pin means inserted in such mating holes to ensure proper alignment of said rows of spinnerette orifices and said third plates in said spin dope distribution assembly.

6. A spinnerette assembly as defined in claim 1 wherein said plates comprising said spin dope distribution assembly are secured together by bolts extending between end plates in said stack.

7. A spinnerette assembly as defined in claim 1 wherein said plates comprising said spin dope distribution assembly are secured together by being molded as a unitary structure.

References Cited

UNITED STATES PATENTS

2,031,387	2/1936	Schwarz	18—8
3,017,686	1/1962	Breen et al.	18—8 X

WILLIAM J. STEPHENSON, Primary Examiner