

Feb. 7, 1961

H. J. McDERMOTT
MULTI-JET COUPLINGS

2,970,340

Filed April 3, 1958

3 Sheets-Sheet 1

FIG. 1

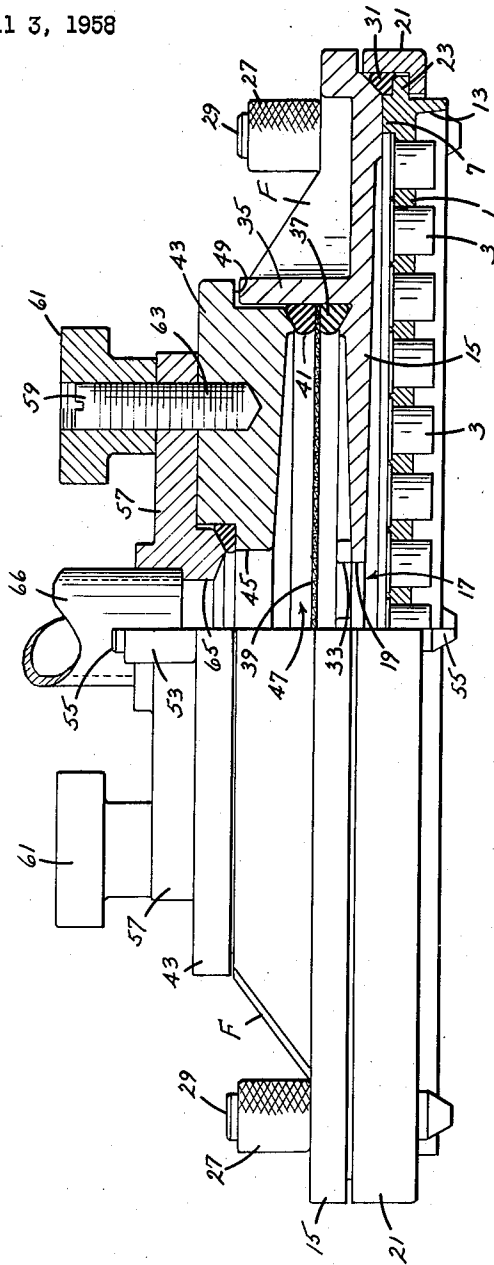
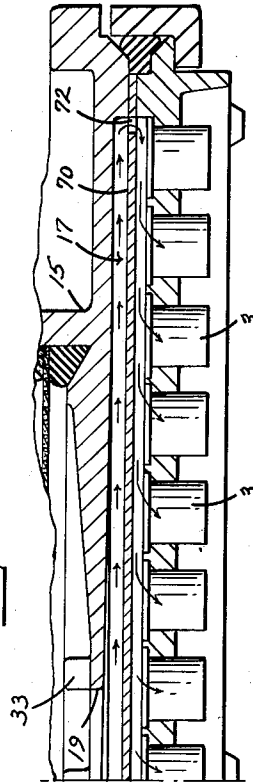


FIG. 5



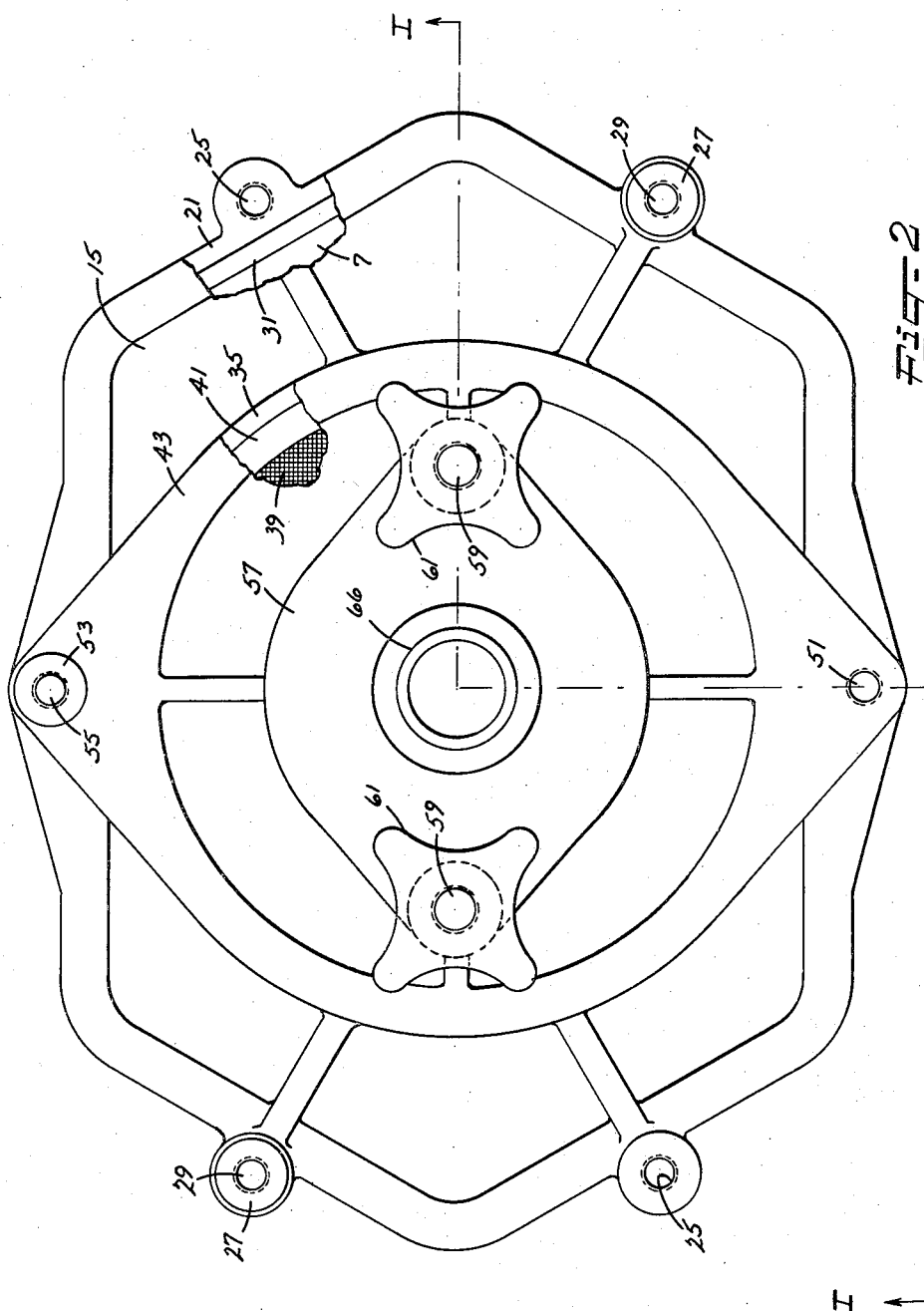
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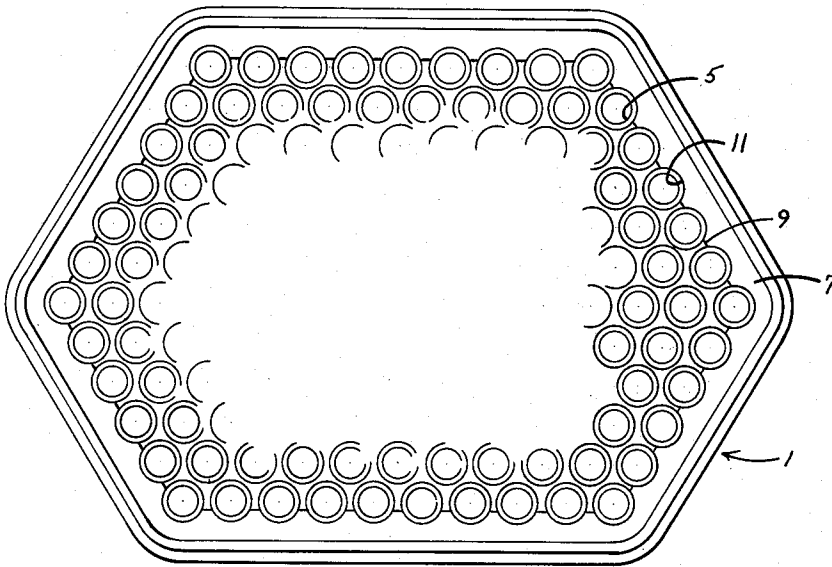


FIG. 3

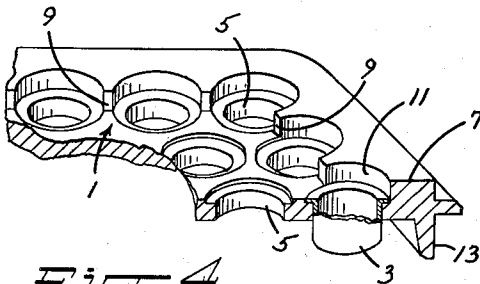


FIG. 4

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MULTI-JET COUPLINGS

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9 Claims. (Cl. 18—8)

The present invention relates to a multi-spinneret coupling for use in spinning heavy denier yarn from which staple fiber may be produced.

Within recent years the demand for staple fiber, especially rayon, for use in carpets and other products has greatly increased. In an attempt to meet this increased demand, the yarn manufacturers first merely increased the number of individual yarn extruding spinnerets used in their yarn-spinning apparatus. In the case of rayon, additional individual spinneret couplings therefore had to be provided which were positioned within the same size acid-coagulating troughs as were used before. Soon the troughs became so cluttered with these individual spinneret couplings that it was next to impossible to initially or subsequently thread up the yarn-spinning apparatus and to keep track of them during the operation to determine whether or not they were all operating satisfactorily.

The next step was to use multi-spinneret couplings wherein each coupling contained a small plurality of spinnerets from which a corresponding number of yarns could be extruded. This system provided temporary relief but as the demand increased, it was apparent that complete redesigning of the apparatus used, especially in the type of multi-spinneret coupling used, would be necessary to increase the amount of yarn produced to meet the stepped-up demand. The problems increased as the number of spinnerets supported by each coupling was increased.

One of the most difficult problems to overcome in the designing of a multi-spinneret coupling relates to the adequate supplying of yarn-spinning solution to those spinnerets located along and around the peripheral area of the coupling. With most couplings, these peripherally disposed spinnerets are starved for spinning solution since the solution tends to pass through the more centrally disposed spinnerets. In addition, dead spaces are generally encountered along the periphery of the coupling wherein spinning solution becomes trapped and stagnates in gel form. This stagnated viscose eventually breaks off to clog up the spinnerets or otherwise interfere with the proper functioning of the coupling.

Another difficulty encountered in developing a satisfactory multi-spinneret coupling lies in the problem of providing sufficiently large filter medium such as a screen, etc., which will be strong enough to resist distortion and buckling adjacent its more central portion as caused by the tremendous pressure exerted upon the filter medium by the amount of spinning solution passing into and through the coupling.

It is therefore an object of my invention to provide a new and novel multi-spinneret coupling containing a large plurality of spinnerets which is developed for use in a wet spinning operation.

Another object of my invention is to provide a novel and improved spinneret coupling wherein means are provided for directing a flow of a spinning solution from the more centrally disposed spinnerets into the peripherally

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disposed spinnerets of the coupling to prevent stagnation of the spinning solution in dead spaces along the coupling peripheries.

Another object of my invention is to provide a multi-spinneret coupling wherein the filter medium will not become unduly distorted or buckled because of the extreme pressure exerted thereupon by the flowing spinning solution during the yarn-spinning operation.

Another object of my invention is to provide an embodiment of the above new and novel multi-spinneret coupling wherein the flow of the spinning solution entering the coupling is first directed to the peripherally disposed spinnerets of the coupling after which it flows inwardly to the more centrally disposed spinnerets of the coupling.

Other objects and advantages of my invention will become more apparent from a study of the following description and drawing wherein:

Figure 1 is an elevation partially in section of my multi-spinneret coupling taken along line I—I of Figure 2;

Figure 2 is a view of one end of the coupling;

Figure 3 is a view of the inner face of the opposite end of the coupling;

Figure 4 is an enlarged detail partially in section of a portion of the coupling shown in Figure 3; and

Figure 5 is a broken view of an enlarged scale and in section showing an embodiment of the coupling of Figure 1.

My multi-jet coupling will now be described in detail. As seen in Figures 1, 3 and 4 of the drawing, a base plate 1 is provided for supporting a plurality of spinnerets 3, 3. The spinnerets 3, 3 are supported within complementary holes 5, 5 (Fig. 4) extending through the base plate 1. As seen more clearly in Figure 4, the inner surface of the base plate 1 includes a raised border 7 which is of scalloped formation with the projecting portions 9, 9 of the scallops extending inwardly of the plate between adjacent openings 5, 5 which extend around the periphery of the base plate 1 and which house the peripherally disposed spinnerets 3, 3. The receding walls 11, 11 of the scalloped border 7 conform to and lie in substantial alignment with the inner walls of the peripherally disposed openings 5, 5 which house the peripherally disposed spinnerets 3, 3. This scalloped formation aids in directing the flow of the yarn-spinning solution into the peripherally disposed spinnerets 3, 3 as will be explained more fully hereinafter.

To prevent damaging the outer face of the spinnerets 3, 3 during assembly or disassembly of the coupling, a skirt 13 extends from and around the periphery of the outer face of the base plate 1. The free end of the skirt extends beyond the face of the spinnerets 3, 3 whereby when the plate is set down on a table or other object, the face of the spinnerets will lie above the table surface or other supporting object.

The shape of the plate 1 is very important for satisfactorily carrying out applicant's invention.

As shown in Figure 3, the plate 1 and the spinnerets 3, 3 supported therein describe a hexagonal pattern. With this arrangement, a generally final rectangular ribbon or bundle of continuous yarn is produced. The use of a hexagonal spinneret pattern is required to produce a satisfactory rectangular shaped ribbon of yarn since the sides of the pattern extending outwardly at an angle to meet at the center line of the pattern prevents the top and bottom edges of the bundle from overlapping and collapsing the bundle shape when pressure is applied thereto by the usual treating rolls and guides.

The reason for developing the coupling to produce a generally rectangular ribbon of yarn having a uniform

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thickness is that the rectangular bundle is much more easily processed and more efficiently cut than is the usual circular tow or rope. Considering the large plurality of spinnerets used, it was found that penetration of the acid and treating liquids to the more centrally disposed yarns was more efficiently achieved with the rectangular shaped bundle.

Positioned adjacent the inner face of the base plate 1, is a divider plate 15 (Figures 1 and 2) which extends across and lies in spaced-apart relationship with the inner face of the plate 1 to provide a cavity 17. The divider plate 15 has a central aperture 19 which leads into the cavity 17. The divider plate 15 is supported upon the raised scalloped border 7 of the base plate 1 providing the only point of contact with the base plate 1. As the plate 15 extends inwardly toward its aperture 19, it tapers off or gradually decreases in thickness whereby cavity 17 in turn gradually diminishes in area as it progresses outwardly from the point adjacent the aperture 19 of the divider plate 15. The purpose for the above noted configuration of the divider plate 15 will be more fully explained hereinafter.

To secure the divider plate 15 firmly against the base plate 1, a base plate support 21 is provided which extends completely around the base plate 1. The support 21 is of L shape wherein one of the legs of the support fits under an extension ledge 23 of the base plate 1 to support the base plate.

As shown more clearly in Figure 2 of the drawing, the base plate support 21 and the divider plate 15 have bolt-retaining holes 25 extending through their peripheral portions at spaced positions around their peripheries.

As further seen in Figures 1 and 2 retaining nuts 27 are threaded over the retaining bolts 29 extending through the retaining bolt holes 25. When the retaining nuts 27 are tightened, the divider plate 15 is firmly pressed against the raised edge portion 7 of the base plate 1. To prevent leakage between the plates 15 and 1, a gasket 31 is positioned between the plates and the other leg of the base plate support 21. The gasket 31 thus lies to the outside of the point where the divider plate 15 contacts the base plate 1 to form a tight seal which prevents leakage of the spinning solution from occurring between the two plates.

As seen in Figure 1, a plurality of lugs 33 extend outwardly from the divider plate 15 from spaced points around the aperture 19 of the plate 15. The purpose of these lugs will be explained more fully when describing the filtering means for the coupling.

A wall 35 also extends outwardly from the divider plate 15 and extends completely around the divider plate 15 in a path which lies a set distance inwardly from the divider plate edge. To provide additional support for the wall 35 extending from the divider plate 15, a plurality of supporting fins F forming a part of the divider plate 15 back up the wall 35 and extend outwardly to a point adjacent the divider plate periphery. Contiguous with the inner surface of the wall 35 and the outer surface of the divider plate 15 at the point where the wall joins the plate (Figure 1), there is positioned a filter supporting gasket 37 which extends completely around the inner surface of the wall 35. Supported upon the gasket 37 is a filtering medium 39 which may comprise a metal or plastic screen of fine mesh and which extends completely across the area defined by the inner surface of the wall 35. A second gasket 41 is positioned immediately atop the filter medium 39 and lies continuous therewith and with the inner surface of the wall 35.

It should be pointed out here that the filter medium 39 normally lies out of contact with the lugs 33 positioned around the aperture 19 of the divider plate 15. However, when spinning solution is passing through the filter medium, pressure surges from time to time urge the filter medium 39 toward the lugs 33. The lugs 33

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prevent the filter screen from buckling completely whenever the pressure surges build up to such an extent that the screen is urged out of its normal position to a point immediately against the filter supporting lugs 33. If these lugs 33 were not present, the filter medium 39 could, of course, be urged by the pressure surges further out of its normal position to a point at which leakage or buckling would occur thus forcing the operator to temporarily terminate the use of the coupling until a new filter medium could be installed.

The filter gaskets 37, 41 are compressed against the filter medium 39 to firmly hold the filter medium in position by a head 43 which forms a substantially sliding fit with the inner surface of the divider plate wall 35. The peripheral portion of the head 43 rests directly upon the filter supporting gasket 41. As the head 43 extends toward its center, the inner surface thereof gradually tapers outwardly and terminates in a central aperture 45. With this arrangement, a second cavity 47 is formed with the filter medium 39 extending across and through the cavity 47 and with the aperture 45 of the head 43 leading into said cavity. The head 43 includes a peripheral shoulder 49 which rests upon the outer edge of the wall 35 when the coupling is assembled and ready for use.

To secure the head to the divider plate 15 and the base plate support 21, the shoulder expands outwardly from two opposing points on the periphery of the shoulder 49 which expanded portions have a bolt-retaining hole 51 which is in alignment with bolt-retaining holes extending through the border of the divider plate 15 and the base plate support 21 (see Figure 2). Retaining nuts 53 are positioned over retaining bolts 55 extending through these holes and when the nuts 53 are tightened against the outer shoulder 49 of the head 43, the head is firmly pressed against the filter gasket 41 to form a tight fit or seal therewith.

A connector plate 57 is secured to the outer face of the head 43 by threaded screws 59 which cooperate with and extend through hand knobs 61 and into a threaded hole 63 formed in the outer portion of the head 43. When the bolts are tightened to their full extent within holes 63, the connector plate is firmly clamped to the head 43. The plate 57 includes a central aperture 65 which is adapted to receive a spinning solution into the coupling through a spinning solution supply conduit 66.

An embodiment of my coupling is shown in Figure 5 of the drawing. The coupling shown therein is similar to that shown in the prior figures described above except for a flow-directing plate 70 which extends across the cavity 17 and lies in spaced relationship with the inner surface of the divider plate 15 and the inner face of the base plate 1. The flow-directing plate 70 includes peripheral openings 72 extending through the plate. As indicated in Figure 5, the spinning solution passes through the aperture 19 of the divider plate 15 and flows readily therefrom (see arrows) along the outer surface of the plate 70 until it approaches the peripheral openings 72 at which point it passes through the plate and into the area adjacent the inner face of the base plate 1 which supports the spinnerets 3,3. With this arrangement, starvation of the peripheral spinnerets is prevented and dead spaces adjacent the periphery of the base plate are also eliminated wherein spinning solution might collect and become trapped since there is a strong peripheral flow of the spinning solution at the periphery of the plates 70 and 1. The scalloped raised border 7 is not required with this embodiment. If desired, however, it may be used to further assure the elimination of spinning solution traps adjacent the periphery of the base plate 1.

In operation of both embodiments, the yarn spinning solution enters the coupling through the supply conduit 66 after which it passes through aperture 45 of the head 43 and into the cavity 47. At this point, the spinning solution spreads readily throughout the cavity 47 and

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through the filter medium 39. The spinning solution then passes inwardly toward and through the central aperture 19 of the divider plate 15. The lugs 33 in no way interfere with the flow of the spinning solution which passes therearound into the aperture 19 of the divider plate 15. From this point, with the embodiment of Figures 1-4, the solution flows readily toward the periphery of the coupling and enters the spinnerets 3, 3 as it flows. Because of the decreasing taper and thus the decreased area adjacent the inner face of the divider plate 15, the flow is stepped up adjacent the peripheral spinnerets.

As the spinning solution approaches the raised scalloped border 7 of the base plate 1, its flow is directed from the angular projections 9 of the border 7 along the receding walls 11 of the border to provide continuous flow of the spinning solution adjacent this peripheral area. Since the solution flows along the receding walls 11 from both sides, it is forced into the adjacent spinneret as the two flows meet at a point along the wall 11 of the border 7.

As mentioned above, this arrangement prevents the spinning solution from being trapped along the periphery of the plate 1 where it gels and subsequently clogs up the spinnerets after it eventually is broken away from the periphery of the spinneret plate.

The depending skirt 13 protects the spinneret face preventing any contact therewith when the plate 1 is deposited upon a table or other support during assembly or disassembly of the coupling.

As also mentioned above, the filter supporting lugs 33 prevent buckling of the filter medium 39 such as a metal screen when pressure surges are exerted against the filter medium.

To assemble the couple, the members are assembled as shown in Figure 1 after which the assembly is placed within an arbor-type press wherein the members are compressed together after which the retaining nuts and screws, as described above, are tightened to hold the assembly in its compressed condition.

The operation of the embodiment of Figure 5 has been already described in the general description of the embodiment set forth above.

With my above described coupling I have provided a single assembly unit which is inserted within the coagulating medium for the yarn-spinning solution which may be sulfuric acid in the case of rayon production. A rectangular type of yarn bundle is formed which, when dealing with such a large number of yarns, is more efficiently processed and cut than when the bundle is in rope or round form.

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

I claim:

1. A multi-spinneret coupling for use in spinning artificial yarn comprising a base plate, a plurality of spinnerets extending through and beyond the outer face of the base plate, a raised scalloped border extending around the peripheral portion of the inner face of the base plate for directing the peripheral flow of a yarn-spinning solution into the peripherally disposed spinnerets, a base plate support positioned around and cooperating with the outer edge of the base plate, a centrally apertured divider plate supported by the base plate support to extend over the inner face of the base plate in spaced-apart relationship therewith whereby a cavity is provided between the base plate and the divider plate with said aperture of the divider plate leading into said cavity, a centrally apertured head secured to the divider plate and base plate support to lie adjacent and to extend across the divider plate in spaced-apart relationship therewith to form a second cavity with said aperture of the head leading into said second cavity, and a spinning solution filter medium supported between

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opposing surfaces of the head and divider plate to extend through and across the second cavity.

2. A multi-spinneret coupling according to claim 1 comprising a skirt extending from the outer face of the base plate to terminate at a point beyond the spinnerets extending through the plate to protect the spinnerets from damage during assembly or disassembly of the coupling.

3. A multi-spinneret coupling according to claim 1 comprising filter medium supporting lugs extending from the divider plate which lugs terminate a specified distance from the normal position of the filter medium.

4. A multi-spinneret coupling according to claim 3 wherein the lugs lie in spaced relationship around the divider plate aperture.

5. A multi-spinneret coupling according to claim 1 wherein the pattern in which the spinnerets appear is of hexagonal shape.

6. A multi-spinneret coupling for use in spinning artificial yarn comprising a base plate, a plurality of spinnerets extending through and beyond the outer face of the base plate, a raised scalloped border extending around the peripheral portion of the inner face of the base plate for directing the peripheral flow of a yarn-spinning solution into the peripherally disposed spinnerets, a base plate support positioned around and cooperating with the outer edge of the base plate, a centrally apertured divider plate extending over and in spaced-apart relationship with the inner face of the base plate whereby a cavity is provided between the base plate and the divider plate with said aperture of the divider plate leading into said cavity, means for securing the divider plate to the base plate support to form a tight seal between the periphery of the divider plate and the spinning solution flow-directing means, a centrally apertured head supported adjacent the divider plate which extends across and lies in spaced-apart relationship with the divider plate to form a second cavity with said aperture of the head leading into said second cavity, means for securing the head to the divider plate and the base plate support, a spinning solution filter medium supported between opposing surfaces of the head and divider plate to extend through and across the second cavity, and a centrally apertured connector cap secured to the outer surface of the head for receiving a yarn-spinning solution supply conduit.

7. A multi-spinneret coupling for use in spinning artificial yarn comprising a base plate, a plurality of spinnerets extending through and beyond the outer face of said base plate, said spinnerets being arranged in a hexagonal pattern, means forming a cavity behind said base plate, and means in said cavity for directing a spinning solution toward the outermost ones of said spinnerets.

8. A multi-spinneret coupling for use in spinning artificial yarn comprising a base plate, a plurality of spinnerets extending through and beyond the outer face of said base plate, said spinnerets being arranged in a hexagonal pattern, means forming a cavity behind said base plate, a centrally apertured divider plate extending across said cavity and dividing it into a first compartment adjacent said base plate and a second compartment separated from said base plate by said divider plate, a spinning solution filter screen mounted in said second compartment and extending thereacross generally parallel to said divider plate, supporting lugs on said divider plate and spaced around the central aperture thereof, said lugs extending toward said filter screen but being normally spaced from said screen so as not to impede the passage of spinning solution through the screen.

9. In a multi-spinneret coupling for use in spinning artificial yarn including a base plate, a plurality of spinnerets extending through and beyond the outer face of the base plate, and means adjacent the inner face of the base plate for directing the flow of yarn-spinning solution into the peripherally disposed spinnerets, said means comprising a raised scalloped border with projections

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of the scalloped border extending between adjacent spinnerets.

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