Nov. 30, 1965 C. A. FLETCHER ETAL 3,220,082

JET APPARATUS FOR TREATMENT OF TEXTILE FIBERS

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Fig. 1

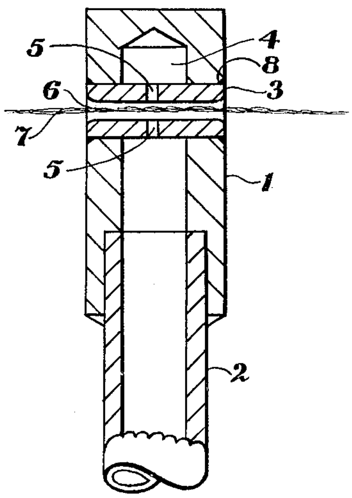

Fig. 2

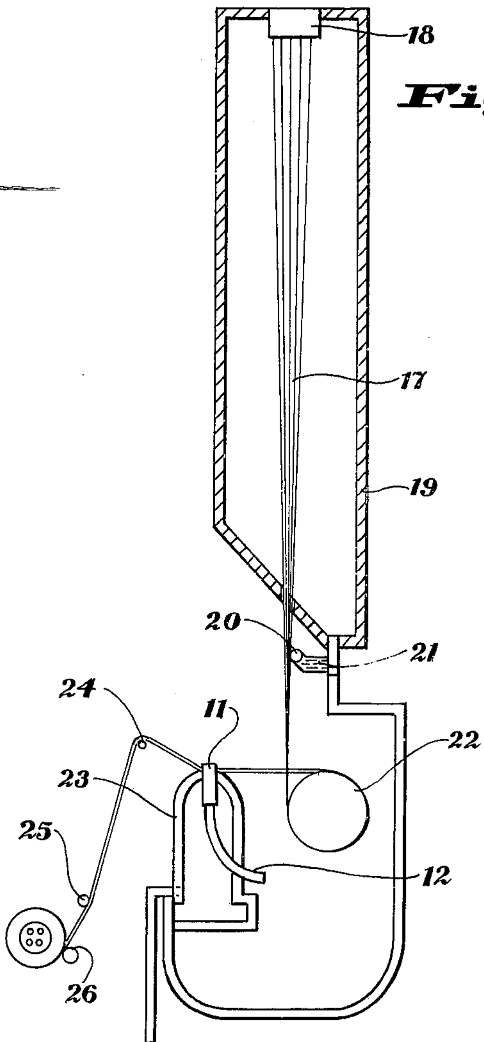

Fig. 3

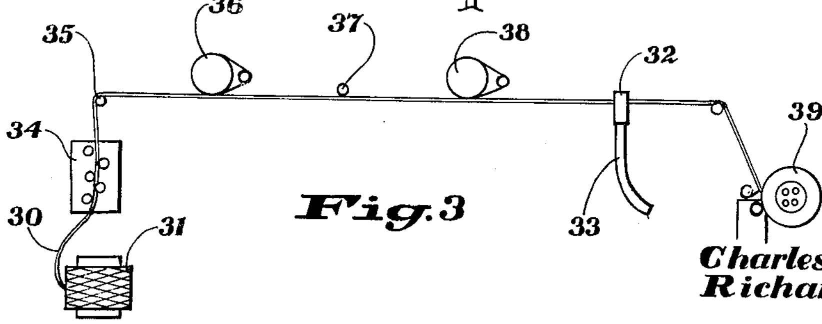

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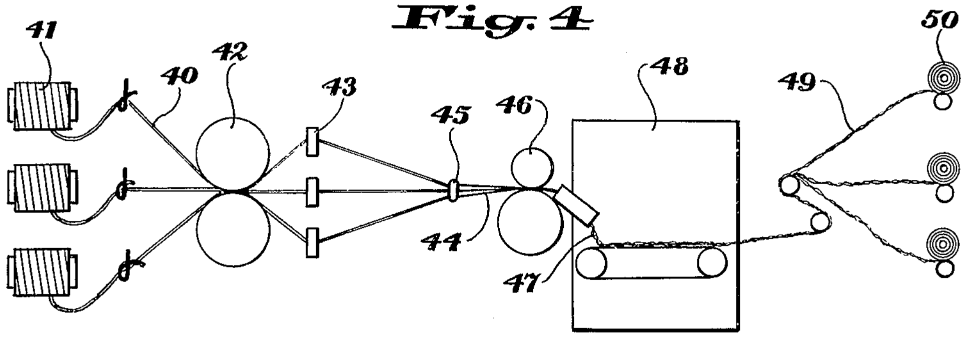
Fig. 4



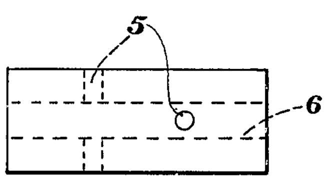


Fig. 5

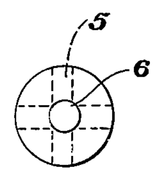


Fig. 6

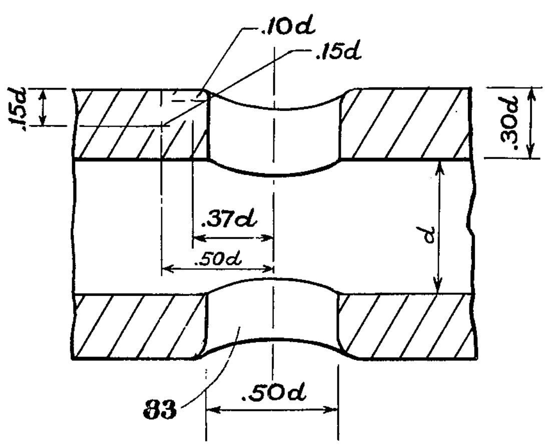


Fig. 8

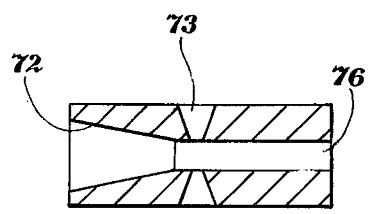


Fig. 7

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Fig. 9

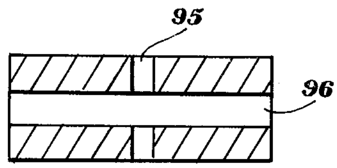


Fig. 10

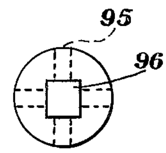


Fig. 11

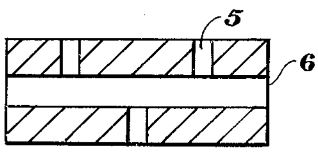


Fig. 12

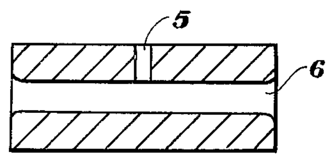


Fig. 13

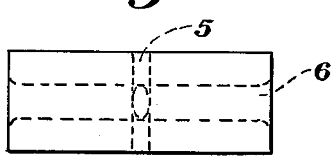


Fig. 14

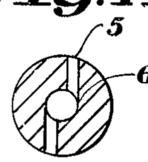
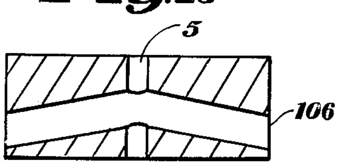


Fig. 15



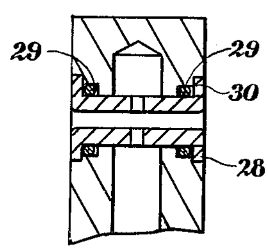


Fig. 16

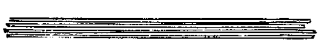


Fig. 17

Fig. 18

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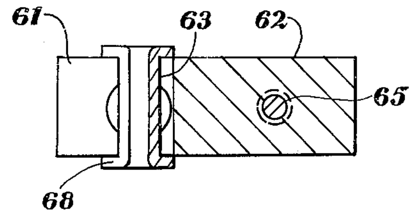
Fig. 20



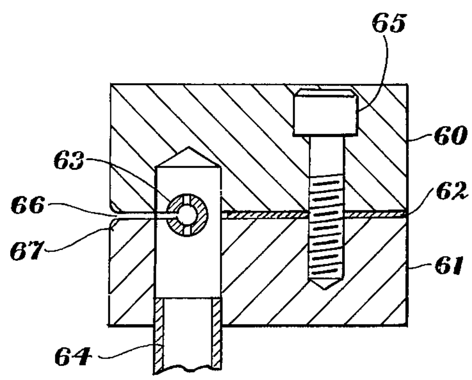


Fig. 19

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JET APPARATUS FOR TREATMENT OF TEXTILE FIBERS

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Filed Mar. 29, 1962, Ser. No. 183,448
7 Claims. (Cl. 28—1)

This invention relates to apparatus for the use in the treatment of textile yarns. More particularly, this invention concerns a new type jet adapted to be supplied with high velocity gas which imparts spaced entanglements to continuous filament synthetic yarns and tows.

For many years various textile treatment jets utilizing high velocity gas have been used in the textile industry for imparting to yarns a variety of physical properties and appearances. Illustrative of these jets are those shown in U.S. patents such as 2,067,251 2,100,588, 2,379,824, 2,460,390 2,661,588 2,737,688, 2,884,756, 2,924,868, 2,932,935 and 2,962,794. The several jets which have been described in the prior art have the capability of imparting many different treatments to yarn.. However, generally speaking, the prior art jets are best suited for a specific treatment. As new and improved configurations or physical properties for yarns are arrived at, treatment jets are needed for use in manufacturing these new products.

A treatment known for some time in the industry as intermingling, entangling or entwining yarn is now being used to improve the handling of zero twist yarn in various textile operations such as crimping, beaming, sizing, weaving, twisting, knitting and the like where various amounts of twist have heretofore been used and are normally required. Many of the existing jets mentioned above may be used for producing such type yarn, generically referred to as entangled yarn. However, it is believed apparent that the development of a specific simplified jet construction for treating yarn in this manner would be of substantial value to the trade. It, therefore, seems apparent that providing new jets which fulfill certain special needs of the industry represents a useful result. After extended investigation we have discovered certain relatively simple jet constructions which we believe to embody new and unobvious features.

The new jets of this invention are particularly of a construction for the production of the aforementioned entagled yarn and have a number of advantages over any of the previously available jets, such as low volume and low pressure air or other fluid requirements, one piece interchangeable ceramic jet inserts relatively small sized, no adjustment, and simplicity of design.

This invention has for one object to provide a jet construction of a nature that lends itself for use in the treatment of yarns and tows for purposes of entangling, entwining or intermingling, as mentioned above, of the individual filaments of a running strand thereof. Another object is to provide a jet of the class just mentioned which may be utilized to process the yarn continuously or to secure randomly spaced treatment along the yarn so as to give the yarn handling characteristics similar to that of yarn which has been twisted. A further object is to provide a jet structure for treating yarn so that the yarn is relatively free of any loops or other noticeable discontinuities but has a marked tendency to remain in a coherent bundle of filaments in textile operations. Still another object is to provide a jet that is capable of stripping excess liquids off running strands of yarn in operations such as wet spinning, sizing, dyeing, hot liquid drafting and the like so as to facilitate further treatment or winding of the yarn. Still another object it to provide a jet which, if desired, may be employed in operations such as bulking, texturing or lofting a running strand of yarn.

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Another object is to provide a jet which may be used for heating yarns with hot gases or other fluids in connection with drafting and relaxing operations. Still a further object is to provide a jet apparatus having utility as a frictionless yarn guide. A further and particularly important object is to provide jets of the class indicated wherein by the relatively simple feature of changing inserts the structure and function of the jet may be modified to accomplish one or more of the objectives set forth above. Other objects will appear hereinafter.

In the broader aspects of this invention our new treatment jet has two distinct parts; a jet body, the purpose of which is to receive and distribute the pressurized gas or other fluid (most frequently clean, dry air) and to support the other part which is the jet insert. This jet insert is a special construction for use in treating the yarn by directing onto the yarn a pressurized fluid received from the jet body in the form of high velocity jet streams. It will be observed as the description proceeds that we have provided a construction particularly versatile in this respect by virtue of our construction being susceptible of including certain inserts.

For assistance in a further understanding of this invention reference will be made to the attached drawings forming a part of this application.

FIGURE 1 is a side elevation view largely in section illustrating our simplified jet.

FIGURE 2 is a semidiagrammatic view of one illustrative process embodiment of textile operation wherein our new simplified jet construction may be used.

FIGURE 3, likewise, is a semidiagrammatic view somewhat in the nature of a flow sheet of another embodiment of textile operation wherein our new simplified jet construction may be utilized.

FIGURE 4 is still a further semidiagrammatic view of process and apparatus arrangement wherein the new simplified jet construction of the present invention may be employed.

FIGURE 5 is a side elevation view of a modified jet insert such as may be used in our simplified jet of FIGURE 1 so that other functions may be accomplished.

FIGURE 6 is an end elevation of the insert structure of FIGURE 5.

FIGURES 7–15, inclusive, are illustrations similar to FIGURES 5 and 6 of other insert constructions and configurations.

FIGURE 16 is a side sectional view showing another way of mounting the inserts in the jet.

FIGURES 17 and 18 are diagrammatical illustrations on a considerably enlarged scale of some of the yarn structures fed and obtained using the various jet constructions referred to above for the processing of yarns.

FIGURE 19 is an end sectional view showing a jet assembly featuring a yarn threading slot.

FIGURE 20 is a top sectional view of the same slotted jet assembly.

Referring to FIGURE 1 this invention is there shown in one of its simplest forms. The jet body, designated by the numeral **1**, is drilled and counter-bored to receive the pressurized gas conduit, **2**, at the bottom and also drilled through the sides to receive a ceramic jet insert, **3**, in such a manner that the center portion of the insert is incapsulated in the annulus, **4**, formed by the extension of the hole previously drilled for the gas conduit. The insert **3** itself is tubular in shape and has two inlets, **5**, which direct the pressurized gas from the annulus, **4**, into the treatment chamber, **6**. The yarn strand to be treated passes through the treatment chamber, **6**, as shown by the alternated filament bundle **7**.

Although an understanding of the functioning of this simplified jet is apparent to some extent from the foregoing description, a further understanding will be had from a consideration of the following examples:

Example I

This example is in accordance with FIGURE 2, concerns the utilization of the jet as applied to a dry spinning process for the production of 55 denier, 13 filament dull entangled acetate continuous filament yarn.

The yarn strand, **17** is formed by the extrusion of the acetate dope through a spinnerette jet, **18**, into a spinning cabinet, **19**, where the individual filaments are partially cured and combined into a single yarn strand. The yarn then passes out of the cabinet and contacts an oil applicator roll, **20**, where a yarn lubricant, **21**, is applied to it. It then passes around a godet roll, **22**, and into a collector housing, **23**, which contains the treatment jet, **11**, of this invention. Pressurized dry, clean air is supplied to the jet through conduit, **12**, and the undesirable oil-laden exhaust from the jet is collected and removed by the collector housing and connecting gutter, **23**, as described in more detail in companion application S.N. 138,943, filed September 18, 1961, now Patent No. 3,103,731. The yarn passes out of the housing, **23**, over ceramic guides, **24** and **25**, and into a conventional traverse mechanism, **26**, from whence it is wound into a package for use in subsequent textile operations. The conditions in the vicinity of the jet are as follows:

Yarn speed—660 meters/min.
Yarn tension at the treatment jet—5 grams (0.0909 g./den.)
Jet supplied with 15 p.s.i.g. treatment air

The yarn produced has the following physical properties:

55 denier—13 filament—O twist
Average entanglement spacing—4 inches
2.3% by weight lubricant
25% elongation
1.2 grams/denier (dry) strength

Example II

Another example of the use of the invention is illustrated in FIGURE 3, as applied to the drafting and entangling of a multifilament, continuous filament polyester fiber. The yarn strand, **30**, is withdrawn from an unoriented supply package, **31**, and passes through a tension gate, **34**. It passes over a ceramic guide, **35**, and onto a drafting input and advancing roll set, **36**. A hot pin, **37**, heats the yarn; and it is oriented or drafted by the drafting output and advancing roll set, **38**. It then passes through the treatment jet, **32**, supplied with pressurized air through conduit, **33**, from a source not shown, and is wound into a yarn package, **39**, by a conventional winding device. The treatment jet in this example imparts to the yarn at random intervals an entwining or intermingling of the individual filament around each other. The resulting yarn strand is bound together by these entwined spots and, in subsequent textile operations, handles in the same manner as yarn that has been twisted. The conditions in the vicinity of the treatment jet are as follows:

Yarn speed—422 yds./min.
Yarn tension—9 grams (0.128 g./d.)
Jet supplied with 20 p.s.i.g. dry air

The yarn produced had the following properties:

70 denier, 33 filament
Average spacing between entanglements—2″

Example III

A third example of the utilization of this new and simplified jet is illustrated in FIGURE 4, as applied to the production of a 2700 denier, 200 filament textured filament, modified acrylic yarn, such as described in greater detail in companion Haynes U.S. application Serial No. 102,880, now Patent No. 3,099,064. The yarn strands, **40**, from the supply package, **41**, of previously oriented fiber pass through a set of feed rools, **42**, into a set of treatment jets, **43**, supplied with pressurized air from a source not shown where fibers are individually entangled. They are then combined into a tow, **44**, by passing between guide pins, **45**, and crimped in a crimping machine, **46**. The crimped tow, **47**, is then heat set in an oven, **48**, and separated into individual ends, **49**, again for winding on a conventional winding device, **50**. The entanglement in this process is used in the place of twist to maintain the integrity of the individual strands while they are being processed in tow form so that, upon completion of the heat setting, they can be split apart and wound on individual packages. The texture of the yarn is derived from the crimping and not the entangling. The operating conditions in the vacinity of the treatment jet are as follows:

3% overfeed between feed roll and crimper
Yarn speed—175 meters/minute
Air pressure supplied to treatment jet—40 p.s.i.g.

The yarn produced is characterized by interfilament entanglements at ½ to 1″ intervals and a crimped texture which imparts to it a unique appearance and hand, particularly suitable for use in carpets, upholstery fabrics, and other textile products.

The jet constructions used in the above examples consist of ceramic tubes in a pressurized annulus, as illustrated in FIGURE 1. The preferred design of the insert and its relationship with the annulus can be further described by defining certain ratios and parameters between the various dimensions and the yarns to be treated. Referring to FIGURE 1, the yarn passage diameter, **6**, preferably is 5 to 20 times the yarn diameter. The length of the yarn passage, **6**, preferably is 3 to 15 times its diameter. The diameter of the air passage, **5**, preferably is 1 to ½ times the diameter of the yarn passage, **6**. The length of the air passage, **5** preferably is ½ to 3 times its diameter. The interior edges at the ends of the yarn passage, **6**, are chamfered or rounded so as to eliminate possible yarn damage and increase running efficiency. The diameter of the insert is selected so as to allow sufficient and proper air supply to the air passages, **5**.

Although in the above description one type of insert for the jet has been described; there are several variations which can be applied to the insert so as to achieve different effects. It is advantageous to use a jet body equipped with interchangeable inserts especially suited for imparting a desired treatment to yarns within a specified denier range. For example, a jet insert with a yarn passage diameter of .052″ and air passages of .040″ is preferred for yarn deniers from 35 to 150; whereas, an insert with a yarn passage of .095″ and air passages of .070″ is preferred for yarn deniers from 150 to 500, etc. Yarns of different chemical and molecular structure may better use different inserts because of their varied physical properties and handling characteristics.

While the insert illustrated in FIGURE 1 has two air passages of a cylindrical configuration, other shapes and arrangements of air passages along the yarn passage are desirable for imparting different treatments to various kinds and sizes of yarns. For example, the treatment jet used in the third process example FIGURE 4, may have as its insert the design illustrated in FIGURE 5. This figure illustrates an insert with four air passages, **5**, of cylindrical configuration whose axes intersect the axis of a cylindrical yarn passage, **6**, and are perpendicular to each other. FIGURE 6 is an end elevation view of the same insert. FIGURE 7, a sectional side elevation view, illustrates an insert with a conical configuration, **72**, on one end of cylindrical yarn passage, **76**, and conically shaped air passages, **73**. In this jet the included angle of the tapered portion, **72**, has been found to be most effective when it has a value of 4 to 15°, with 7° being a preferred value. This diverging portion of the jet forms the yarn exit from the tube, **76**, and promotes self-threading of the jet. This self-threading feature makes this jet particularly useful as a frictionless thread guide for use in a beaming operation where the yarn strands must be supported and guided over several hundred ft. at times. For this use the diameter of the cylindrical part of the passageway, **76**, should be as small as possible to reduce air usage requirements and may be from 2 to 10 times the yarn diameter. With low air pressures of 0.1 to 5.0 p.s.i. gauge, the yarn bundle is supported on a film of gas throughout the passageway, **76**, as a minor portion of the gas escapes through the yarn entrance, and a major portion escapes through the yarn exit taper, **72**. This division of the gas exhaust gives a gentle forwarding action to the yarn which helps to overcome atmospheric air drag when the yarn is traveling at high speeds or tension from the centrifugal forces generated as the yarn balloons out in the course of removal from the end of a supply package. The small size of the yarn passage permits the use of a minimum of air and thus avoids any derangement of the yarn filaments by the jet air guide which would cause them to take on an entwined, entangled, or loopy appearance. Of course, if desired, higher air pressure of say 5 to 150 p.s.i. may be used to cause any desired degree of entanglement or looping of the yarn filaments as well as the aforementioned yarn guiding effect.

The air entrance passages, as **5**, may be either straight as shown in FIGURE 1 or converging as shown in FIGURE 7. The converging type air entrance is helpful in accelerating the treatment gas to a high velocity to enhance the entangling or looping and entangling of the yarn filaments when these effects may be desired. An included entrance angle of 20 to 90° in the air entrance passages allows the use of lower gas pressures for a given level of filament entanglement or loopiness due to the increased kinetic energy imparted to the gas stream by accelerating it to a higher velocity by means of the converging air passages, **5**.

In FIGURE 8 is shown an enlarged portion of a preferred gas entrance, **83**, to a jet of the class described. This type entrance to the yarn tube has very low losses due to gas friction and turbulence and in certain instances it may be possible to treat several thousand ends of yarn at substantial savings in cost even though the initial cost of fabrication of the jet may be increased as compared to the straight gas tube, **5**, of FIGURE 1. In this case a diameter for the yarn passage is selected depending on the yarn denier and the type of treatment desired. In the case shown a value of "d" is selected for the inside diameter of the yarn passage. The outside diameter of the insert tube is then assigned the value of $1.6d$, giving the tube a wall thickness of $.3d$. The diameter of the gas inlet is $.50d$, and the entrance to the gas inlet tube is assigned two radii which merge into a straight cylindrical passage. The first entrance radius is given a value of $.10d$, the center point of this radius being located $.10d$ from the outer tube surface and $.37d$ from the axis of the gas entrance. This first radius is merged with a second radius having a value of $.15d$, the center of which is located $.15d$ from the outer surface of the tube and $.50d$ from the axis of the gas passageway. All these dimensions are based on a longitudinal cross-section as shown in FIGURE 8. It will be recognized that these values will be slightly different in other vertical cross-sectional planes that do not pass through the yarn passage axis due to the cylindrical shape of the outer surface of the jet insert.

FIGURE 9, a sectional side elevation view, illustrates a rectangular yarn passage, **96**, and cylindrical air passages, **95**. The rectangular yarn passage promotes eddy currents and air turbulence and is useful for increasing the entangling forces on the yarn filaments. FIGURE 10 is an end elevation view of the same insert.

FIGURE 11, a sectional side elevation view, illustrates an insert with three alternately spaced cylindrical air passages along a cylindrical yarn passage, **6**. FIGURE 12, a sectional side elevation view, illustrates an insert with one cylindrical air inlet, **5**, intersecting a cylindrical yarn passage, **6**. FIGURE 13, a side elevation view, illustrates an insert with cylindrical air passages which intersect the cylindrical yarn passage tangentially. FIGURE 14 is a sectional and elevation view of this same insert. This form of jet is useful when it is desired to impart a false twist to the yarn either for the purpose of improving the compactness and ease of handling of the yarn in an immediately prior or subsequent process step or for the purpose of achieving a curly crimp in the yarn filaments as described in companion Hoskins U.S. application Serial No. 826,714, now abandoned. While the outer wall of the gas entrances is depicted in FIGURE 14 as tangential with the wall of the yarn passage, it will be recognized that the axial offset of the gas passage, **5**, from the axis of the yarn passage, **6**, may be greater or less, depending on the amount of torsional force it is desired to impose on the yarn bundle. If only a low degree of false twist, say a few turns per inch, is desired in a frictionless thread guide such as shown in FIGURE 7, then the axis of the gas entrance tubes, **5**, may be displaced only a few thousandths of an inch from the axis of the yarn passageway, **6**. Such a jet configuration is particularly advantageous in handling delicate yarns to avoid damaging friction over guides and preventing excessive filament separation or entanglement by means of the low level of false twist imparted. Conversely with larger axial offsets and high air pressures, a high degree of filament entanglement or entanglement and loopiness together with a moderate level of false twist may be imparted to a yarn if so desired.

FIGURE 15, a side elevation sectional view, illustrates a V shaped yarn passage, **106**, with an included angle from 170° to 90° and cylindrical air passages **5**. Such a configuration is helpful when the jet is located at a point where a change in direction of the yarn path is desired, but space or other limitations require that the yarn must be entangled or looped simultaneously with the change in yarn path.

FIGURES 19 and 20 illustrate a jet assembly which features a yarn threading slot for improved operating efficiency and convenience. The slotted jet allows a running strand of yarn to be introduced into the treatment chamber simply by sliding the filaments through the slot. In continuous processes normally associated with the extrusion of synthetic fibers by melt, dry, or wet spinning this feature is highly desirable because the running strand of yarn does not have to be broken in order to thread it through the jet.

The jet consists of an upper body, **60**, a lower body, **61**, a spacer, **62**, a slotted ceramic insert, **63**, a pressurized gas conduit, **64**, and a conventional threaded fastener **65**. The slot is designated by the numeral **66**.

The width of the slot, **66**, is dependent upon the thickness of the spacer, **62**, and can be varied to accommodate large or small filament cross sections. For yarns with filament diameters in the range of .0005" to .002" a .004" spacer is preferred; larger filaments require a thicker spacer. The slot entrance has been provided with radii, **67**, to facilitate sliding the yarn into the treatment chamber.

A gentle flow of air issues through the fine slot in the insert thus insuring that the yarn filaments are not blown out of the treatment chamber by the more turbulent conditions existing therein. If desired the insert can be rotated with respect to the jet body after threading, misaligning the slots thus providing an additional means of preventing the escape of any filaments from the treatment chamber. The flanges, **68**, on either end of the insert serve to position the insert in the jet body and to prevent the snagging of filaments in the cracks formed by the junction of the outer diameter of the insert and the inner diameters of the jet bodies.

The jet of FIGURE 15, when used solely as a yarn guide, has particular advantages over the prior art snubbing guides which rub and abrade the yarn rather than "floating" it on a film of gas. These variations on the design of the insert are not all inclusive but serve to illustrate some of the possible insert configurations within the spirit of this invention. The inserts illustrated in FIGURES 1 and 19 are preferred for producing moderately tight entanglement on yarns from 35 to 500 denier, for example, in acetate spinning operations similar to the one illustrated in FIGURE 2; whereas, the inserts of FIGURE 5 and FIGURE 11 are better suited for producing heavy entanglement on larger deniers in processes similar to the bulking of modified acrylic yarns as illustrated in FIGURE 4. When only a mild entanglement is desired, the insert of FIGURE 12 is preferred. If it is desired to have the insert exert a slight pull on the yarn to facilitate withdrawal or threading or to act as a frictionless yarn guide, a jet similar to FIGURE 7 is preferred. If it is desired to eliminate any slight twisting or swirling of the yarn strand, then an insert similar to FIGURES 9–10 is preferred. The insert of FIGURE 8 is best suited for imparting a bulk or texture to the yarn so as to give it the appearance and hand of staple yarn. If a false twisting effect is desired, the insert of FIGURES 13–14 with tangential air passages is preferred. If it is desirable to direct the exhaust from the jet downward or upward, an insert similar to FIGURE 15 can be used.

All of these inserts exhibit a tendency to remove excess liquids from running strands of yarn; however, the inserts of FIGURES 1, 5, 7, 9, 11, 15 and 19 are preferred for this use. Inserts similar to the ones illustrated in FIGURES 1, 7, 9 and 19 are preferred when it is desired to obtain novelty delustered effect on bright or semi-bright yarns. The configurations of the air passages illustrated are typical of those that can be used; however, certain other shapes would still be within the spirit of this invention. The cylindrical air passages of FIGURES 1, 5, 9, 11, 12, 13, 15 and 19 are the easiest to form and give very good results, but special effects and higher efficiencies can be realized in using the conical, converging nozzle or other similar configurations of FIGURES 7 and 8.

Reference is now made briefly to FIGURE 16. To achieve a versatile apparatus, one method of mounting the insert in the jet body is accomplished by utilizing O ring seals, **29**, and a retaining ring, **28**, as illustrated in FIGURE 16. For applications where a permanent joint is desired, the two parts are joined by cement, **8**, as illustrated in FIGURE 1.

While it is not desired to be bound by theory, a further understanding perhaps may be had from the following explanation:

This invention it is thought may be considered an improvement over existing theory long known to those skilled in the art of treating yarn strands with high velocity gases or liquids. Simply stated, the jet streams of high velocity gas impinge on the yarn perpendicularly or at a slight angle to its axis and cause the individual filaments to be separated from each other and rearranged in an entwined, intermingled fashion as they exit from the treatment zone. This is further apparent by referring to FIGURE 17, where a short length of zero twist yarn is depicted with its filaments arranged in a parallel manner and comparing it to FIGURE 18, which depicts two entangled spots, **103** and **104**, in a short length of yarn treated with an insert similar to that of FIGURE 1. It can be seen that, in bright or semi-bright yarns, entangled spots along the strands of otherwise zero twist yarns have different reflective properties as described in companion Dyer application Serial No. 145,877. This results in a novel effect when these yarns are woven and finished into fabrics of various constructions. When jets of this invention are used to strip excess liquids off running strands of yarn, the action of the high velocity jet streams on the yarn in the treatment area penetrates through the yarn strand, atomizes any excess liquids present, and expels them as aerosol from either end of the jet insert. This can be further enhanced by utilizing hot or warm gas to vaporize some of the excess liquid.

The heating of yarns, particularly the polyester and polyolefin types, in drafting and relaxing processes can be readily accomplished using this type of jet due to the extremely efficient heat transfer obtained when the hot jet streams separate and incapsulate each individual filament. The jets of this invention can be designed and operated so that the yarn appearance and filament arrangement before and after passage through the jet remains the same, or the appearance remains the same but the filament arrangement is changed, or both the appearance and filament arrangement is changed as may be seen from the foregoing. The treatment jet of this invention is a relatively simple apparatus featuring only two parts, neither of which requires adjustment. It is highly versatile in that any number of different inserts can be used in the same jet body to impart many different treatments to various running strands of yarn. It can be fabricated from ceramic materials, thus eliminating wear caused by erosion due to the air flow or yarn abrasion and insuring a uniform quality of treatment over long periods of time. It is small in size and can be easily applied to existing textile operations where other type jets will not fit. It can also be adapted for slot threading thus improving operating efficiency and convenience. In summary, this unique jet, featuring small interchangeable ceramic inserts, can be used in the textile industry to entangle, loft, bulk, heat, deluster, texture, false twist and remove excess liquids from running strands of yarn.

Although the invention has been described in considerable detail with particular reference to certain preferred embodiments thereof, variations and modifications can be effected within the spirit and scope of the invention as described hereinabove, and as defined in the appended claims.

We claim:

1. A jet for the treatment of multifilament yarn, said jet being comprised of an elongated body member counterbored to provide a gas conduit extending inwardly in the body member and to receive a pressurized gas conduit on one end of the body member, the other end of the body member being closed, a single continuous insert of a length at least equal to the width of the body member extending across the body member and incapsulated therein, said insert being positioned in the body member so that the central portion of said insert is surrounded by the gas conduit of the body member, said insert being provided with at least one opening located at least ¼ L from the end of the insert length where L represents the insert length, the axis of which intercepts at substantially right angles the axis of the yarn passageway whereby pressurized fluid supplied to the body member may pass through the side of the insert and act upon the multifilament yarn passing through said insert in a non-twisting manner.

2. A jet construction of the class indicated in claim **1** wherein the insert is of a cylindrical configuration, the diameter to the yarn passageway is 5–20 times the yarn diameter and the length of the passageway is 3–15 times the passageway diameter.

3. A jet construction of the class indicated in claim **1** wherein the air passages are ½ to 3 times the diameter of the yarn passage and their length is ¼ to 1 times their diameter.

4. A jet construction in accordance with claim **1** wherein for 35–150 denier multifilament yarn the diameter of the yarn passageway is of the order of .052 inch and the diameter of the air openings are of the order of .040 inch and for 150–500 denier multifilament yarn the dimensions are of the order of .095 and .070 inch respectively.

5. A jet construction of the class indicated in claim **1**

containing a one piece insert wherein one end of the insert is provided with a yarn exit in the shape of a frustrum of a right circular cone where included angle is between 3° and 20° and a yarn entrance in the shape of a right circular cylinder of the same diameter as the small end of the frustrum of the cone, the exit and entrance portions having a common longitudinal axis and at least one fluid opening whose axis intersects said common axis at right angles and at a point between approximately ⅓ and ⅔ along the length of the insert.

6. A combination jet insert for the jet of claim **1** for both entangling and false twisting yarn containing a longitudinal cylindrical yarn passageway and at least one fluid opening which whose axis intersects the yarn passageway axis at right angles and at least one additional fluid opening whose axis is at right angles to the yarn passageway axis, the axes being displaced from each other by not more than a few thousands of an inch.

7. The apparatus of claim **1** wherein the pressurized fluid supply annulus of the body member is at least fout times the diameter of the fluid openings in the insert to avoid swirling and uneven air flow to the yarn passageway.

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