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FLUID NOZZLE FOR TEXTURING YARNS

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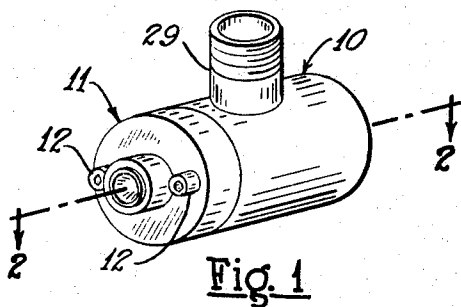


Fig. 1

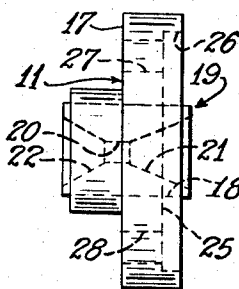


Fig. 5

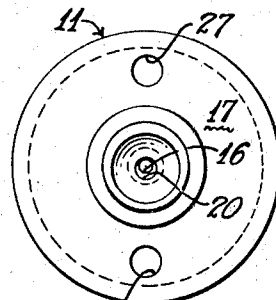


Fig. 6

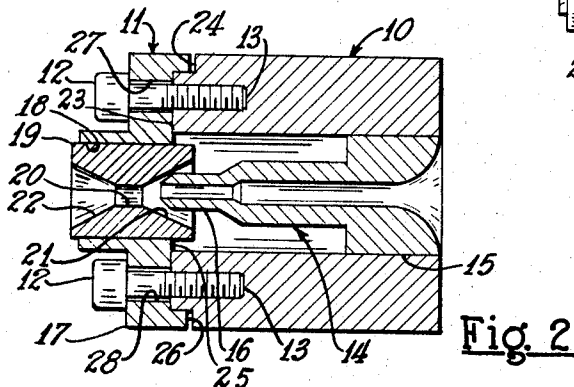


Fig. 2

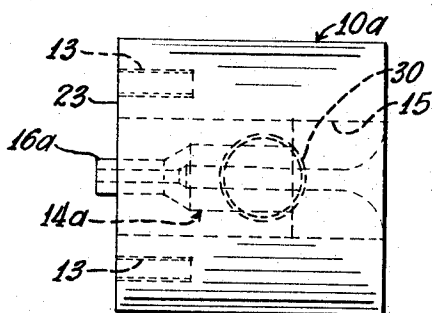


Fig. 3

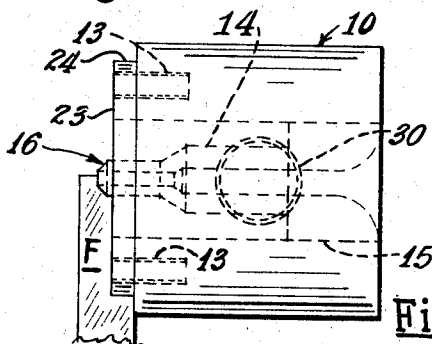


Fig. 4

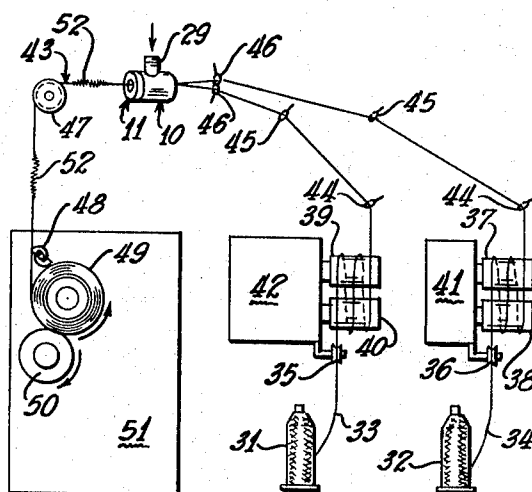


Fig. 7

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1

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FLUID NOZZLE FOR TEXTURING YARNS

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4 Claims. (Cl. 28—1)

ABSTRACT OF THE DISCLOSURE

A fluid nozzle for texturing textile yarns comprising a hollow cylindrical body member having an axially extending yarn guide therein. A removable cap having a restricted yarn and fluid orifice therein, eccentrically disposed with respect to said cap, is secured to one end of the body member with the orifice located adjacent the tip of the yarn guide which extends a predetermined distance beyond the end of the body member, such that the axis of the orifice is laterally spaced from the axis of the yarn guide and hollow body.

This application is a continuation of application S.N. 407,758, filed Oct. 30, 1964 and now abandoned.

This invention relates to an improved apparatus for bulking or texturing continuous filament or staple yarns by means of fluid treatment and the method of fabricating this apparatus. More particularly, this invention relates to an improved yarn texturing jet and a method of fabricating the same in which the dimensional relationships of the various components thereof may be closely controlled and in which each texturizing jet within a given series may be made with substantially identical dimensions.

Fabrics comprised of bulked or textured yarn of almost any synthetic material including glass fibers have met with considerable commercial acceptance due to their increased insulating properties, novel texture and other improved properties. The basic process of bulking or texturing yarn by passing it through a confined zone of turbulent fluid, such as air, is fully described in United States Patent 2,852,906. This process has been successfully used with yarns, untwisted strands and even staple fibers. It is to be understood that the term "yarns" as hereinafter used is intended to include both twisted and untwisted continuous fibers as well as staple fibers.

A major difficulty encountered in the commercial production of such textured yarns is in controlling product uniformity between yarns textured by different texturing jets. Variations in the textured yarns produced by different jets, which adversely affect the appearance and performance of a product using such yarns, are caused by (1) variations in the relationship of the rate of feed of untextured yarn to the jet to the take-up rate from the texturing jet, (2) by variations in air pressure supplied to the jet, and (3) by minute variations in the dimensional relationship of component parts of the jet (such as the distance of the tip of the yarn needle from the restricted orifice, venturi size and shape, needle size and shape, and axial alignment of the needle with respect to the venturi). It has been found that these latter dimensional relationships critically affect performance characteristics of the jet. For instance, it has been determined that a variation as small as .010 inch in the distance between the axis of the yarn needle and the axis of the jet orifice or venturi may increase or decrease the airflow through the jet by as much as fifty percent.

While some texturing jets of the prior art include provision for manual adjustment of the axial distance between the yarn needle tip and the venturi throat so as to enable the operator of the texturizing apparatus to ob-

2

tain an acceptable textured product, use of such adjustment has not been entirely satisfactory due to the fact that the yarn needle tip and orifice distance is of such a critical nature. For instance, in texturing jets of the type disclosed in U.S. Patent 2,852,906, in which the cap of the yarn needle is threaded upon the body of the jet and the axial distance between the restricted orifice and the tip of the yarn needle is changed by rotation of the yarn needle cap, it has been found that it is necessary to provide a locking mechanism, such as a set screw on the cap threads, to insure that the adjustment will not accidentally be disturbed during the operation of the texturizing apparatus. While such locking means may be satisfactory to prevent accidental rotation of the cap after it has been set, it has further been found that the slight amount of clearance required between the threaded surfaces of the yarn needle cap and the jet body permits a small amount of tilting or cocking of the axis of the yarn needle in relation to the axis of the restricted jet orifice when the set screw or locking means is tightened. As previously stated, the relationship between the axes of the venturi and the yarn needle is critical. Therefore, a considerable amount of experimentation is necessary to finally set the cap screw at the optimum position and lock it there, due to the fact that the tightening of the locking device changes the initially adjusted position of the cap.

Another inherent disadvantage in a manually adjustable type of jet just described is that, due to the fact that the yarn needle and the venturi must be periodically cleaned, reassembly after such cleaning necessitates the relocation and readjustment to optimum operating positions of the yarn needle in relation to the venturi. Therefore, in a texturing installation having a plurality of such texturing jets, a substantial amount of "down time" is inherently present with the manually adjusted type of jet due to the fact that it must be readjusted for optimum operation relationships each time after the jet is cleaned.

Accordingly, it is an object of this invention to provide a yarn texturing jet having closely controlled and fixed dimensional relationships and which may be assembled and disassembled for cleaning and other servicing quickly and easily without disturbing these fixed dimensional relationships.

It is another object of this invention to provide a method of fabricating a yarn texturing jet having fixed and closely controlled dimensional relationships, which method enables the production of a series of yarn texturing jets, each jet in said series having identical dimensional relationships, particularly between the tip of the yarn needle and the venturi or restricted orifice.

Still another object of this invention is to provide a yarn texturing jet wherein the yarn needle is rigidly secured in a fixed position in relation to the annular jet body and the restricted air orifice may be rigidly and nonadjustably but removably secured to the annular jet body in a fixed and predetermined relationship to the tip of the yarn needle such that assembly and disassembly for cleaning and other servicing does not disturb this fixed and predetermined relationship.

It is yet a further object of this invention to provide a method of producing a series of yarn texturing jets having interchangeable parts wherein variations in dimensional relationship between the tip of the yarn needle and restricted air orifice or venturi may be accomplished through use of a number of differently dimensioned venturi caps which may be interchangeably used with any one of a number of annular jet bodies and in which the dimensional relationships between the tip of the yarn needle and the venturi, when the venturi cap and jet body are assembled, will be substantially fixed and identical throughout a given series of texturing jets when identical venturi caps are used.

Other objects and advantages of the invention will be

3

apparent from the following detailed description of a preferred embodiment thereof, reference being made to the accompanying drawings, in which:

FIGURE 1 is a view in perspective of the improved texturing jet of this invention, showing the orifice cap assembled upon the jet body and an air inlet pipe assembled thereon;

FIGURE 2 is a cross-sectional view taken along line 2—2 of FIGURE 1 and showing, on an enlarged scale, the details of construction of the preferred embodiment of this invention;

FIGURE 3 is a plan view of the annular body and hollow yarn needle of the texturing jet shown in FIGURES 1 and 2, and illustrating the integral unit prior to machining the orifice cap abutting surfaces and yarn needle tip;

FIGURE 4 schematically illustrates the step of machining the orifice cap abutting surfaces of the annular jet body and the yarn needle tip illustrated in FIGURE 3;

FIGURE 5 is a side view of the orifice cap included in the texturing jet shown in FIGURES 1 and 2, showing the complementarily machined inner surfaces which abut the machined surfaces of the annular jet body;

FIGURE 6 is a front view of an assembled jet body shown in FIGURE 4 and orifice cap shown in FIGURE 5, this view showing the offset or spaced relationship between the axis of the restricted air orifice and the axis of the yarn needle; and

FIGURE 7 is a schematic diagram illustrating a complete yarn texturing apparatus including a takeup device, the improved texturing jet of this invention, and two separate supply sources of untextured yarn which are to be combined into a single textured or bulked yarn.

Referring to FIGURES 1 and 2, the improved texturing jet of this invention comprises an annular body 10 with an orifice cap 11 removably secured to one end by means of two bolts or set screws 12 which extend through the orifice cap 11 and into threaded recesses 13 in the annular body 10. The annular body 10 contains an elongated yarn needle 14 having a radially enlarged base portion 15 which is press-fit or otherwise securely held within the annular body 10. The tip 16 of the yarn needle 14 is of reduced diameter and extends from the main body of the yarn needle 14 toward the open end of the annular body 10. The entrance to the axial passageway within the yarn needle 14 (shown at the right of FIGURE 2), is conical or outwardly flared to facilitate threading the untextured yarn through the texturing jet.

The orifice cap 11 of the illustrated preferred embodiment comprises a generally flat, disk-like cap member 17 having a central opening 18 which receives an orifice insert 19 which is press-fit or otherwise securely held therein, as clearly shown in FIGURE 2. The orifice insert 19 includes the restricted orifice throat 20 communicating with outwardly flared passages 21 and 22 which complete the yarn and fluid path through the orifice insert 19.

As is seen in FIGURE 2, the open end of the annular body 10 has a generally planar outer face 23 with an annular recess 24 on its radially outer surface. As seen in FIGURE 5, the abutting inner face 25 of the orifice cap 11 is generally planar and is terminated by a laterally extending, continuous outer flange 26 which cooperates with the recess 24 in the outer face 23 of the annular body 10 to securely seat the orifice cap 11 upon the annular body 10. The bolts 12 pass through bolt holes 27 and 28 in the orifice cap 11 and are threaded into the recesses 13 to securely hold the orifice cap 11 upon the annular body 10. An air pipe 29, shown in FIGURE 1, is secured within a radially extending air inlet 30 in the annular body 10 and communicates with the air space circumjacent the yarn needle 14.

FIGURES 3 and 4 schematically show the annular body 10 and yarn needle 14 as they are initially constructed prior to and during a machining step which is of critical importance in the method of fabricating the

4

improved texturing jet of this invention. FIGURE 3 schematically shows the annular body 10 with the base portion 15 of the yarn needle 14 press-fit in one end of the annular body 10. The cylindrical, annular body 10, in this illustration designated as 10a, and the yarn needle tip 16, designated in this figure as 16a, are not shaped at this stage of fabrication to their final form as illustrated in FIGURE 2. After the annular body blank 10a and yarn needle blank 14a have been rigidly secured to form an integral unit, as shown in FIGURE 3, the outer face 23 and yarn needle tip 16 are machined by a single forming cutter F, as schematically illustrated in FIGURE 4, which forms the recess 24 and shapes and determines the length of the yarn needle tip 16. It is important to note that because the unitized annular body 10 and yarn needle 14 are machined by a single forming cutter F, the dimensional relationships between the position of the yarn needle tip 16 and the outer face 23 of the annular body 10 will be constant for any number of units machined by this forming cutter F. Fabrication in this manner of a unitized annular body 10 and yarn needle 14 and shaping with a single cutter F makes possible the production of a number of units having fixed, predetermined and identical dimensional relationships between the yarn needle tip 16 and the outer face 23 of the annular body 10. As previously stated, this provision of identical dimensional relationships is critical in producing a series of texturing jets having the same yarn bulking or texturing characteristics.

FIGURE 5 is a side view of the orifice cap 11 with the orifice insert 19 press-fit therein. The inner face 25 of the cap member 17 is machined to be complementary in shape to the forming cutter F, illustrated in FIGURE 4. A single forming cutter complementary in shape to cutter F may be used.

The central opening 18 in the orifice cap member 17 is drilled and has a diameter large enough to receive the orifice insert 19 which is press-fit therein. The central opening 18 is carefully positioned so that the restricted orifice throat 20 will be in a predetermined relationship with the axis of the yarn needle 14. By using a suitable drilling jig, the central opening 18 may be positioned so that it is concentric or nonconcentric in the cap member 17, as desired, and therefore will be coaxial or offset from the yarn needle 14 when the orifice cap 11 is secured to the annular body 10. The use of a drilling jig insures a constant dimensional relationship between the orifice throat 20 and the axis of the yarn needle 14 throughout a given series of jets.

After this machining operation has been completed and the orifice cap 11 is ready to be removably secured to the annular body 10, the final step in fabrication of the improved texturing jet of this invention is to press-fit the orifice insert 19 in position for uniform flow and texturing characteristics. As previously explained, the position of the orifice throat 20 with respect to the axis of the yarn needle 14 is fixed by the location of the central opening 18. The axial distance from the orifice throat 20 to the tip of the yarn needle 14 is also important and should be uniform throughout a given series of jets. This uniformity is attained by use of a flow meter connected in series with the orifice throat 20 which, by adjustment of the axial position of the orifice cap 17, will indicate the flow and texturing characteristics of that jet. Thus, a series of jets with identical flow and texturing characteristics may be fabricated with this method of adjustment and each one of a series of identical orifice caps 11 will, when associated with any one of a series of identical annular body members 10, provide the identical amount of offset or eccentricity (and other dimensional relationships) and will therefore have the same texturing characteristics. As previously stated, reproduction of an identical series of texturing jets, prior to the method of fabricating such jets disclosed in this invention, had been

impossible and the manual adjustment procedures necessary to obtain uniformity of the textured yarns through a series of such prior art texturing jets were unsatisfactory.

FIGURE 7 schematically illustrates a complete yarn bulking apparatus including the improved texturing jet of this invention. Two yarn supply packages, 31 and 32, provide, for example, a source of core yarn 33 and effect yarn 34. Yarns 33 and 34 are drawn upwardly over guiding and tension rollers 35 and 36 by pairs of feed rolls 37, 38 and 39, 40. Motor and control means 41 and 42 provide a variable speed control of the feed rolls 37, 38 and 39, 40, respectively. The feed speed of the core yarn 33 and effect yarn 34 may be variably adjusted in relation to each other and in relation to the takeup speed of the bulked composite yarn 43. The core yarn 33 and effect yarn 34 are passed through a series of guide eyes 44, 45 and 46 which lead the core and effect yarns 33 and 34 to the improved texturing jet of this invention which is supplied with air under pressure through the air pipe 29. The bulked, composite yarn 43 leaving the texturing jet is passed around a guide wheel 47, past a conventional traversing device 48 which directs the yarn back and forth across the package 49. A constant yarn takeup speed is obtained by driving the yarn package 49 by frictional contact with a power roll 50 which is driven by a driving mechanism 51. The increased diameter of the package 49 from the buildup of yarn does not increase the takeup speed due to the fact that the power for driving the package 49 is derived solely from frictional contact with the surface of the yarn itself by the power roll 50.

An important parameter in controlling the amount of bulking of the composite yarn 43 is the relationship of the feed speed of the core yarn 33 and the effect yarn 34 to the takeup speed of the bulked, composite yarn 43. With the takeup speed approximately the same as the feed speed of the core yarn 33 and effect yarn 34, no bulking or texturing of the composite yarn is accomplished. When, however, the core and effect yarns 33 and 34 are delivered to the texturing jet at a higher rate than the rate of takeup, convolutions are formed in the effect yarn 34 and to a certain extent in the core yarn 33 by the air turbulence which whips and whorls them as they leave the tip of the yarn needle 14 within the improved texturing jet of this invention. The larger the overfeed of the core and effect yarns 33 and 34, the more bulky or convoluted is the composite yarn 43. Furthermore, it is possible, by intermittently varying the rate of overfeed of the core and effect yarns 33 and 34, to produce intermittently bulked or textured areas which occur at intervals between areas of unbulk or untextured yarn. Such intermittent bulked areas are schematically illustrated in FIGURE 7, as indicated by reference numeral 52.

As previously stated, the dimensional relationships between the components of the texturing jet, particularly the distance between the axes of the yarn needle 14 and the orifice throat 20 are of critical importance in producing a composite, bulked yarn of desired characteristics. Because there are many variables which must be accurately controlled in producing such yarns, it is the primary object of the improved texturing jet of this invention to accurately and positively provide uniformity of the dimensional relationships mentioned above within each one of a series of identical texturing jets. Thus, with such standardized jets, a given bulked yarn may be produced throughout a series of texturing installations such as that schematically shown in FIGURE 7 through use of identical texturing jets and the identical adjustment of the feed speed of the core and effect yarns 33 and 34 in relation to the takeup speed of the bulked composite yarn 43. As previously stated, such dimensional identity has been impossible to accomplish using manually adjustable jets known in the prior art. Furthermore, such jets must be periodically cleaned and serviced which

therefore previously required the tedious and time-consuming task of readjustment after every such servicing. An inherent advantage in the improved unitized jet of this invention is the fact that it may be assembled and disassembled by the operator of the texturing apparatus quickly and conveniently by removal and replacement of the bolts 12 which hold the orifice cap 11 to the annular body 10. Because these pieces are accurately machined to mate with one another in a pre-established relationship, there is no adjustment needed subsequent to cleaning or other servicing. It may be desirable to provide the adjacent surfaces 23 and 25 of the annular body 10 and the orifice cap 11 with complementarily shaped male and female indexing means to assure rapid and easy positioning by the operator. Such positive acting indexing means are less susceptible to misalignment than would be visual indicia on each part to indicate proper position. Furthermore, the method of fabricating such jets provides for identical reproduction of each jet within a given series, an advantage which was unobtainable with texturing jets known in the prior art.

Various modifications of the above described preferred embodiment of the invention will be apparent to those skilled in the art, and it is to be understood that such modifications can be made without departing from the scope of the invention, if within the spirit and tenor of the accompanying claims.

I claim:

1. A fluid nozzle for treating a textile product comprising a cylindrical hollow body member having a peripheral sidewall and a closure at one end defining a cylindrical fluid cavity therein, a yarn inlet opening into said body member, a yarn guide integral with said body member extending from said yarn inlet opening axially through said cavity and terminating in a tip having a yarn outlet projecting a predetermined distance beyond and a predetermined distance laterally from the open end edges of the peripheral wall of said body member, a cap member shaped for mated association with said edges of the body member including a projecting portion eccentrically disposed in and extending a predetermined distance beyond the inner face of said cap member, said projecting portion having a yarn and fluid passage extending through said cap member, said passage through said projecting portion having a converging entrance extending into said cavity and into which the tip of said yarn guide with its yarn outlet projects when the inner face of said cap member and said edges of the body member are secured in abutting relation to one another, the distance of projection of said tip into said converging passage entrance being equal to the sum of (1) the distance of projection of the yarn guide beyond said edges of the body member and (2) the distance of extension of said projecting portion beyond the inner face of said cap member, said yarn and fluid passage positioned in said cap member with its axis laterally spaced a predetermined distance from the axis of the cylindrical fluid cavity of said hollow body member.

2. A fluid nozzle for fluid treating a textile product comprising in combination, a hollow cylindrical member with an axial bore therethrough, a yarn guide comprising an elongate hollow needle coaxially positioned within said bore of said cylindrical member and having a tip of reduced diameter and an enlarged concentric end portion integrally secured into one end of the hollow cylindrical member with the tip of said yarn needle extending a first predetermined distance beyond the other end of said cylindrical member, a cap member having an inner face complementarily shaped for engagement with said other end of said cylindrical member and secured upon said other end, an aperture extending through said cap in a direction parallel to the axis of said cylindrical member, the axis of said cap aperture laterally spaced a second predetermined distance from the axis of said hollow cylindrical member with the diameter of said

cap aperture being smaller than the diameter of said axial bore in said cylindrical member, a fluid orifice having a cylindrical body press fit within said cap aperture, eccentrically disposed with respect to said cap member, and extending a third predetermined distance into the axial bore of said hollow body, said fluid orifice having a flared passage converging to a restricted opening extending axially through said cylindrical orifice body with said flared passage circumjacent the tip of reduced diameter of said hollow yarn needle whereby said yarn needle tip extends into said flared passage by the sum of said first and third predetermined distances and whereby the axes of said restricted opening in said fluid orifice and of said yarn needle are laterally spaced apart said second predetermined distance.

3. A fluid nozzle for treating a textile product comprising a cylindrical hollow body member having a peripheral sidewall and a closure at one end defining a cylindrical fluid cavity therein, a yarn inlet opening into said body member, a hollow yarn guide extending from said yarn inlet opening through said cylindrical cavity and terminating in a tip having its axis coincident with the axis of said fluid cavity and projecting a predetermined distance beyond the end edges of the peripheral wall of said body member, a cap member having an inner face shaped for mated association with said end edges of the body member including a projecting portion eccentrically disposed in and extending a predetermined distance beyond said inner face of said cap member, said projecting portion having a yarn and fluid outlet passage extending through said cap member, said outlet passage through said projecting portion having a converging entrance into which the tip of said yarn guide projects when the inner face of said cap member and said end edges of the body member are secured in abutting relation to one another, the distance of projection of said tip into said converging entrance being equal to the sum of (1) the distance of projection of the yarn guide tip beyond said end edges of the body member and (2) the distance of extension of said projecting portion beyond the inner face of said cap member, said yarn and fluid outlet passage positioned in said cap member with its axis laterally spaced a predetermined distance from the axis of said hollow yarn guide.

4. A fluid nozzle for fluid treating a textile product comprising in combination, a hollow cylindrical member with an axial bore therethrough, a yarn guide comprising an elongate hollow needle coaxially positioned within said bore of said cylindrical member and having a tip and an enlarged concentric end portion integrally secured into one end of the hollow cylindrical member with the tip of said yarn needle extending a first predetermined axial distance beyond the other end of said cylindrical member, a cap member having an inner face complementally shaped for engagement with said other end of said cylindrical member and secured upon said other end, an aperture extending through said cap member in a direction parallel to the axis of said cylindrical member, the axis of said cap aperture spaced a second predetermined radial distance from the axis of said hollow cylindrical member, a fluid orifice within said cap aperture eccentrically disposed with respect to said cap member, said fluid orifice having a flared passage converging to a restricted opening extending axially through said orifice body with said flared passage circumjacent the tip of said hollow yarn needle with said yarn needle tip extending into said flared passage by said first predetermined distance and whereby the axes of said restricted opening in said fluid orifice and of said yarn needle are laterally spaced apart by said second predetermined distance.

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