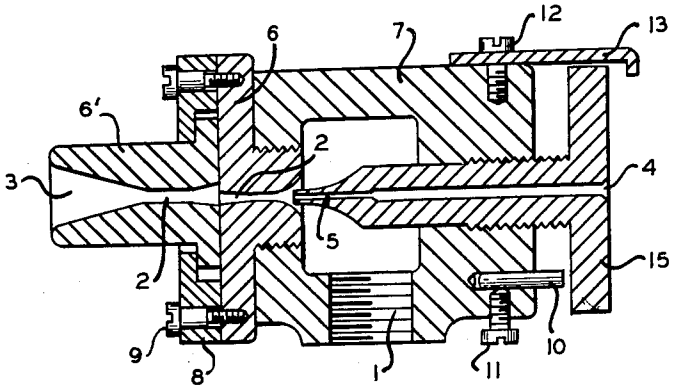
Nov. 19, 1963 MAKOTO YAMAMOTO 3,110,950

BULKING NOZZLE FOR TREATING YARN

Filed April 17, 1961

FIG. 1



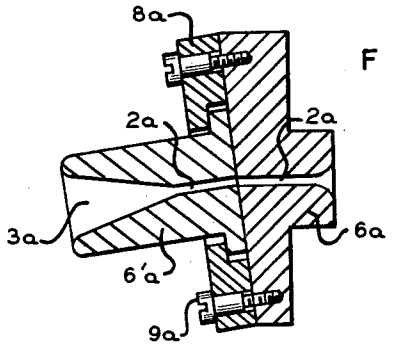


FIG. 2

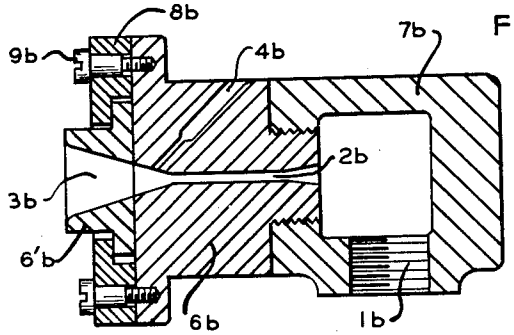


FIG. 3

INVENTOR.
MAKOTO YAMAMOTO

BY Maynard L. Yaeger

ATTORNEY

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BULKING NOZZLE FOR TREATING YARN

Makoto Yamamoto, Kurashiki City, Japan, assignor of three-fourths to Kurashiki Rayon Co., Ltd., Kurashiki-shi, Japan, a corporation of Japan, and one-fourth to Air Reduction Company, Incorporated, New York, N.Y., a corporation of New York

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This invention relates to devices useful for treating filamentary materials, and, more particularly, this invention is concerned with jet or nozzle apparatus useful in treating filaments of yarn to impart increased bulkiness and other desirable properties to the yarn and to fabrics made therefrom.

In the textile industry there are many instances wherein devices of the character indicated are utilizable in the handling and in the treatment of filamentary material such as filaments, fibers, yarn, thread, tows and the like. For example, bulking nozzles or jets are used to provide an air jet which imparts a curl to yarn filaments and air jets are employed to fluff up and loosen up, or "bulk," a bundle of filaments.

The function of a bulking nozzle or jet is to bring yarn or the like composed of multiple filaments into contact with a turbulent fluid stream, e.g. a gas stream, whereby numerous ring-like loops, entanglements and curls are produced in the filaments which make up the yarn.

This type of operation is effected most efficiently when a nozzle has a funnel-shaped discharge opening which is based on the principle of a venturi tube, a Laval nozzle, or a diffuser. When such a funnel-shaped opening is used, it is desirable to cause the principal stream of the gaseous fluid to be jetted into the center, or approximately into the center, of the venturi passage. In order for the principal stream of the gaseous body to be jetted substantially into the center of the venturi passage, the parts forming the nozzle have been constructed with ultra-high precision with no provision for any adjustment. Only with such precision construction have textured or bulked yarns of satisfactory quality been obtained. However, a precision-constructed nozzle is very expensive and need has existed for a satisfactory nozzle which does not require high precision construction, yet which is adjustable with ease to provide the desired micro-adjustment. Moreover, even when an adjustable nozzle is provided, since the yarn goes through the nozzle, such a nozzle must be of a durable and sturdy construction with high stability. In a nozzle satisfying such requirements, textured or bulked yarn can be produced with satisfactory stability and high efficiency.

It is accordingly an object of this invention to provide an improved device for use in treating filamentary material.

It is another object of the invention to provide a jet device which is particularly useful for applying a stream of air or similar gaseous fluid upon yarn or like material.

It is a more particular object of the invention to provide a jet device that is especially adapted for use in producing bulked or textured yarn.

In accordance with the present invention there is provided a nozzle for the manufacture of textured or bulked yarn which is effective to form numerous loops, entanglements and curls in a yarn consisting of multiple filaments and which is characterized by the provision of the venturi passage, or the jet passage, or the venturi passage and jet passage from a plurality of relatively adjustable component members so that, by adjusting the positions of the joints between the component members, the nozzle

can conveniently be adjusted, and after such adjustment is once effected, the adjustment remains firm and secure.

FIG. 1 is a sectional view of a jet device embodying features of the present invention;

FIG. 2 is a similar view of a modified form of nozzle for the device of FIG. 1; and

FIG. 3 is another embodiment of the jet device of the invention.

Referring to the drawing, and more particularly to FIG. 1, in the embodiment illustrated, compressed air is conducted into the device through the inlet 1 disposed in the lower portion of the device as shown, and passes through the jet passage 2, and is then jetted out through the venturi passage 3 which has a cross-sectional area larger than that of the jet passage. In the meantime, the yarn to be treated, and consisting of multiple filaments, is fed through the yarn guide 4, passes through the jet passage 2 via the inlet pipe 5 contained in the rotatable inlet plug 15 and is exposed to the turbulence of the air jet in the venturi passage, thereby forming the bulked or textured yarn. In accordance with the invention, the jet passage is provided in the two component parts of the jet outlet 6 and 6'. The smaller part 6 is secured to the body 7 of the device by a threaded engagement, and the part 6' is adjustably secured to the part 6 by means of an annular clamping ring 8 and the screws 9, which are tightened after the part 6' has been adjusted in relation to the part 6. As seen in FIG. 1, a substantial clearance between the part 6' and the ring 8 is provided to permit a relatively wide range of adjustment. It is thus possible easily to adjust the relative positions of the small parts 6' and 6 which make up the component parts of the jet outlet, so as to regulate the flow of the compressed air to be jetted into the venturi passage, thereby insuring optimum production of textured yarn. The parts 6 and 6' can be accurately fixed by means of the clamping ring 8 and the screws 9 in their positions after the necessary adjustment has been effected. Thus a nozzle with good stability can be obtained, which will not become misaligned after it has once been adjusted. The adjustment of the nozzle aims at supplementing the precision of design and workmanship. Therefore, by effecting the adjustment of the nozzle by use of the mechanism of the present invention, even when the venturi passage and the jet passage are constructed with a somewhat lower degree of precision, perfect operational conditions can be established. However, when the venturi passage and the jet passage are desired as perfect bodies of revolution, they can be so constructed with a fairly high degree of precision with relative ease. Even with such a nozzle, textured yarn of a fairly fine quality can be produced without making any adjustment at all. But in this case the principal flow of the air jetted from the jet passage will usually be in the center or approximately in the center of the venturi passage. However, the bulking process can be performed with the highest efficiency and highest stability when the textured yarn is led out at the point and in directions which are somewhat displaced from the perfect central position of the principal flow of the jetted air in the venturi passage in relation to the center of the venturi passage. Hence, by making a slight adjustment of this nature, the operating capacity will be greatly increased, and the working stability will also be heightened. This is possible with the construction of this invention.

Referring again to the bulking device illustrated in FIG. 1, the right and left ends of the jet passage of part 6 are not limited to definite diameters. They can be either of funnel-shape or in the form of a pointed tip. The same applies to the right end of the part 6', which

faces the part **6**. When the relationship between the right end of the part **6** and the left end of the pipe **5** is suitably adjusted, by suitable rotation of plug **15**, in relation to the adjustment between the component parts **6** and **6'** of the jet outlet, textured or bulked yarn of highly satisfactory quality can be produced. It is also possible to produce textured yarn of satisfactorily good quality by the adjustment of the component parts **6** and **6'** of the jet outlet alone, i.e. when the pipe **5** is considered solely as a guide to lead the yarn to the component parts of the jet outlet, and no particular attention is paid to precise adjustment of the relationship between the pipe and the component parts of the jet outlet.

The relative relationship between the left end of the pipe **5** and the component parts **6** and **6'** of the jet outlet is most suitably selected so that the air is sucked in from the yarn guide at the right end of the nozzle by jetting the compressed air through the nozzle, and the desired relative position is established by means of the pin **10** and the set screw **11** in the body **7** of the device. When this position has been established and yarn is inserted into the yarn guide **4**, the yarn will be caused to pass through the nozzle easily. However, when the relationship between the left end of the pipe **5** and the component parts of the jet outlet are not properly related with respect to the relative adjustment between the component parts of the jet outlet themselves, textured yarn may not be manufactured satisfactorily. Even when the proper adjustment has been made, if the position of the left end of the pipe is interfered with by clogging with fluffs, naps, knots, or the like contained in the starting yarn, the production of the textured yarn undergoes variations. As a result, it is sometimes desirable to exclude the effect of the relative position of the left end of the pipe **5**. In this case, after passing the yarn through the nozzle, the pipe **5** is moved towards the right by moving the plug **15** to the position established by the lock bar **13** secured to the body **7** by the screw **12**, in order to exclude the effect of the relative position of the left end of the pipe **5** in relation to the jet outlet. Under these conditions, the pipe **5** merely serves to guide the yarn to the jet outlet or nozzle, and the compressed air will be jetted out of the nozzle and air will be drawn through the yarn guide by way of the pipe. The relationship between the jetted air velocity and the jetted air volume through the jet passage and the venturi passage, and the volume of the jetted air flow through the yarn guide by way of the pipe, including the relationship of the diameter of the jet passage to the inside diameter of the pipe, and the like, can vary but preferably have the relative relationships illustrated. The yarn is of relatively fine denier, e.g. 300 denier or below, and even though the yarn comprises knots, the yarn in the nozzle can be easily drawn and the yarn will easily enter from the yarn guide and exit from the venturi passage, when the pipe **5** is of small diameter but sufficiently large to permit the knotted yarn to pass. Thus there is provided a nozzle with satisfactory stability and high efficiency, this being achieved by precise adjustment of the component parts of the jet outlet which is possible by reason of the construction of the jet outlet in accordance with this invention.

However, the joint between the component parts **6** and **6'** of the jet outlet or nozzle is not necessarily perpendicular to the jet passage as shown in FIG. 1. This joint may be oblique with respect to the axis of the device, as illustrated in FIG. 2, so as to displace or bend the principal stream of the jetted air in passing towards the venturi passage. Thus, as seen in FIG. 2, wherein parts corresponding to those shown in FIG. 1 are given the same reference numerals to which *a* has been added, the outlet parts **6***a* and **6'***a* have oblique mating faces held together by clamping ring **8***a* and screws **9***a*. As a result of this construction, the yarn moves through the first part of the jet passage **2***a* along the axis of the device and its direction is then suddenly changed as it passes into the second portion of the passage **2***a* in moving toward the venturi outlet **3***a*.

It will be understood that other variations may be made in the adjustable nozzle construction of the invention while retaining its characteristic features. Thus, referring to FIG. 3, wherein parts corresponding to those shown in FIG. 1 have been given like reference numerals to which *b* has been added, the device has no inlet plug like the plug **15** of FIG. 1 and the yarn is introduced through a yarn inlet passage **4***b* which discharges directly into the forward end of the jet passage **2***b* in the nozzle part **6***b* which is the beginning of the venturi outlet **3***b* which is completed in the outer nozzle part **6'***b*, which is adjustably secured to part **6***b* by means of the ring **8***b* and the screws **9***b*. As in the previous embodiment, the body **7***b* contains the air inlet **1***b* and is threadedly engaged with the part **6***b*.

The component parts of the jet outlet need not necessarily be limited of two in number, and they may consist of more than two parts or they may be provided with more than two adjustable elements. In short, the bulking device of the invention is characterized by the fact that the venturi passage, or the jet passage, or the venturi passage and jet passage, are composed of a plurality of component parts which are relatively adjustable in relation to each other, to provide a construction by means of which textured yarn of excellent quality can be produced.

It will, of course, be understood that the nozzle device of this invention is intended to be used with conventional apparatus, both upstream and downstream of the device, commonly employed in yarn-bulking operations as shown, for example, in Breen U.S. Patent 2,869,967.

It will also be understood that various other changes and modifications in addition to those indicated above may be made in the embodiments herein described and shown in the drawing without departing from the scope of the invention as defined in the appended claims. It is intended, therefore, that all matter contained in the foregoing description and in the drawing shall be interpreted as illustrative only and not as limitative of the invention.

I claim:

1. A nozzle for the production of bulked yarn effective to form ring-like loops, entanglements and curls in a yarn consisting of multiple filaments, comprising a body portion having an inlet for a gaseous fluid, a first nozzle member defining at least part of a jet passage communicating with said inlet, at least one second nozzle member defining at least part of a venturi outlet communicating with said jet passage, said second nozzle member having a radial flange at one end constructed to bear against the outer surface of the first nozzle member, and means defining an inlet for introducing the yarn to be treated for contact with the gaseous fluid, said nozzle members being removably secured to each other by clamping means comprising a disc having a central recess adapted to receive the radial flange of said second nozzle member, said recess having a greater radial dimension than the radial dimension of said flange, whereby said flange is adjustable radially in said recess, whereby said nozzle members are relatively adjustable in a direction generally perpendicular to the flow of gaseous fluid.

2. A nozzle for the production of bulked yarn effective to form ring-like loops, entanglements and curls in a yarn consisting of multiple filaments, comprising a body portion having an inlet for a gaseous fluid, a first nozzle member defining part of a jet passage communicating with said inlet, at least one second nozzle member defining the remainder of the jet passage and a venturi outlet communicating with said jet passage, said second nozzle member having a radial flange at one end constructed to bear against the outer surface of the first nozzle member, and means defining an inlet for introducing the yarn to be treated for contact with the gaseous fluid, said nozzle members being removably secured to each other by clamping means comprising a disc having

a central recess adapted to receive the radial flange of said second nozzle member, said recess having a greater radial dimension than the radial dimension of said flange, whereby said flange is adjustable radially in said recess, whereby said nozzle members are relatively adjustable in a direction generally perpendicular to the flow of gaseous fluid.

3. A nozzle for the production of bulked yarn effective to form ring-like loops, entanglements and curls in a yarn consisting of multiple filaments, comprising a body portion having an inlet for a gaseous fluid, a first nozzle member defining a jet passage communicating with said inlet and at least part of a venturi outlet communicating with said jet passage, at least one second nozzle member defining the remainder of said venturi outlet, said second nozzle member having a radial flange at one end constructed to bear against the outer surface of the first nozzle member, and means defining an inlet for introducing the yarn to be treated for contact with the gaseous fluid, said nozzle members being removably secured to each other by clamping means comprising a disc having a central recess adapted to receive the radial flange of said second nozzle member, said recess having a greater radial dimension than the radial dimension of said flange, whereby said flange is adjustable radially in said recess, whereby said nozzle members are relatively adjustable in a direction generally perpendicular to the flow of gaseous fluid.

4. A nozzle as defined in claim 1, wherein said first nozzle member has an outer surface which is oblique with respect to the axis of said venturi outlet.

5. A nozzle as defined in claim 2, wherein said first nozzle member has an outer surface which is oblique with respect to the axis of said venturi outlet.

6. A nozzle as defined in claim 3, wherein said first nozzle member has an outer surface which is oblique with respect to the axis of said venturi outlet.

7. A nozzle as defined in claim 1, wherein said means defining an inlet for said yarn comprises an axially bored member threadedly engaged in said body portion and having an inner end positioned at the entrance of the jet passage in said first nozzle member, means on said body portion for limiting the innermost position of said axially-bored member, and means on said body portion for limiting the outermost position of said axially-bored member.

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