United States Patent [19]

Price

[11] **3,863,309**

[45] **Feb. 4, 1975**

[54] **YARN TEXTURING AIR JET**

[75] Inventor: **Samuel T. Price,** Kennedyville, Md.

[73] Assignee: **Enterprise Machine and Development Corporation,** New Castle, Del.

[22] Filed: **Jan. 25, 1974**

[21] Appl. No.: **436,532**

[52] **U.S. Cl.** **28/1.4**

[51] **Int. Cl.** **D02g 1/16**

[58] **Field of Search** ..... 28/1.4, 1.3, 72.12; 57/34 B, 157 F; 302/25, 63; 226/7, 97

[56] **References Cited**

UNITED STATES PATENTS

3,097,412	7/1963	Becher	28/1.4
3,577,614	5/1971	Price	28/1.4
3,688,358	9/1972	Kashima et al.	28/72.12

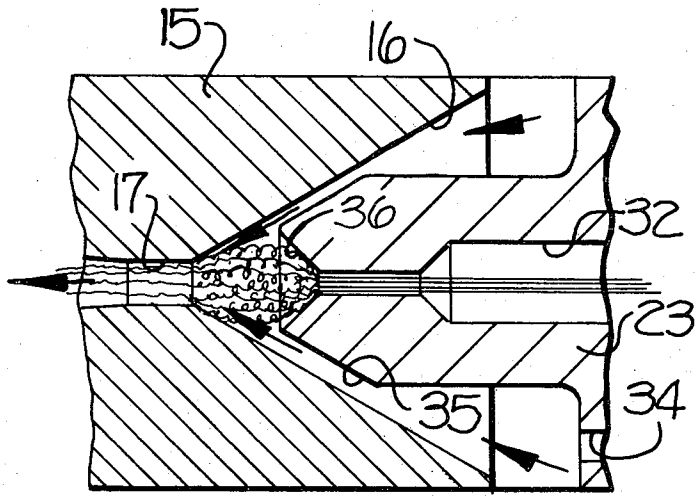
Primary Examiner—Louis K. Rimrodt

Attorney, Agent, or Firm—Parrott, Bell, Seltzer, Park & Gibson

[57] **ABSTRACT**

A yarn texturing air jet having a venturi supported in the exit end of the jet with a yarn guiding needle positioned in the entrance end of the jet and with the space between the venturi and the inner end of the needle defining a turbulence chamber. In accordance with the present invention, a conical opening is provided in the exit end of the needle to increase the size and change the usual shape of the turbulence chamber so that the agitation of the filaments of the yarn is increased in the turbulence chamber to enhance the crimps, curls and loops imparted to the yarn in the turbulence chamber.

6 Claims, 6 Drawing Figures



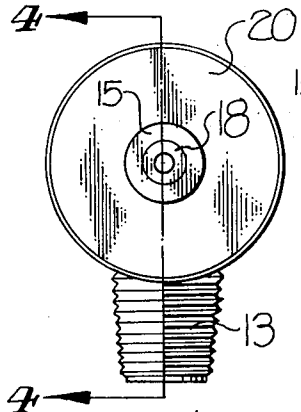


Fig-2

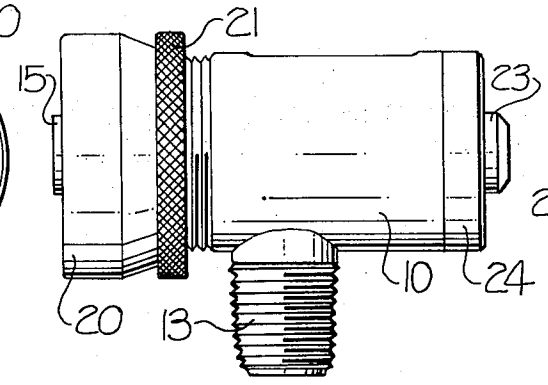


Fig-1

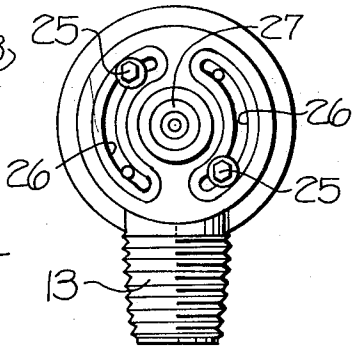


Fig-3

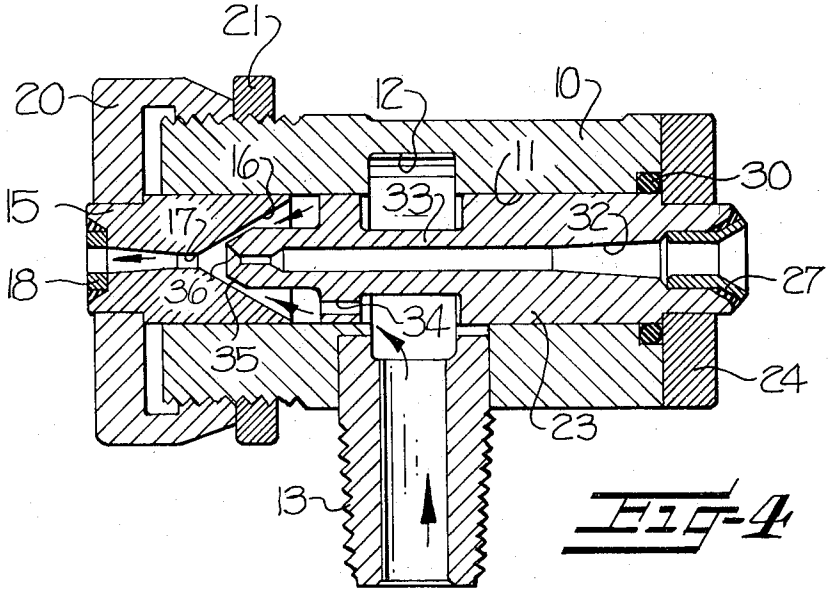


Fig-4

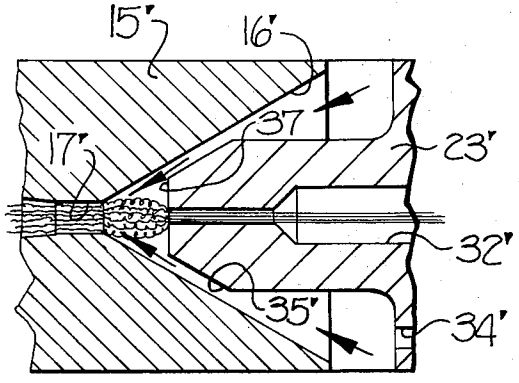


Fig-5
(PRIOR ART)

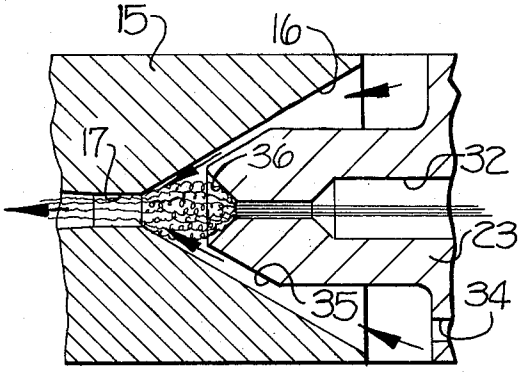


Fig-6

YARN TEXTURING AIR JET

This invention relates generally to a yarn texturing air jet and more particularly to an improvement in the turbulence chamber of the air jet to enhance the crimps, curls and loops produced in the filaments of the yarn and to permit a faster and more economical operation.

The present invention is concerned particularly with yarn texturing air jets of the type having an elongate housing with a venturi supported in one end and a yarn guiding needle positioned in the other end. The exit end of the needle terminates closely adjacent the inwardly tapering conical surface on the inner or entrance end of the venturi. In this type of jet, the pressurized air usually enters the housing at right angles and through an inlet located near the center of the housing to create a turbulent texturing chamber or zone between the exit end of the needle and the entrance end of the venturi so that crimp, curls and loops are formed in a ramdon fashion in the filaments of the yarn. In all known air jets of this type, the inner or exit end of the needle is substantially flat or square and this restricts the size and shape of the turbulence chamber and thereby limits the speed of operation and the size and configuration of the crimps, curls and loops formed in the filaments of the yarn. This type of air jet is disclosed in U.S. Pat. Nos. 3,545,057; 3,381,346; 3,328,863; and 2,994,938.

With the foregoing in mind, it is an object of the present invention to provide a yarn texturing air jet which permits the yarn to be textured or bulked at a substantially higher speed than heretofore possible, provides a more effective use of the pressurized air, and enhances the crimps, curls and loops imparted to the filaments of the yarn.

In accordance with the present invention, the inner end of the needle of the air jet is provided with a conical opening extending from the inner or exit end of the needle and iwnardly to the yarn guiding channel extending through the needle so that the normal size and shape of the turbulence chamber is changed. The conical opening in the exit end of the needle extends the entrance end of the turbulence chamber toward the entrance end of the jet and the pressurized air passing over the end of the needle forms vorticies thereby increasing the agitation in the turbulence chamber and creating pressure drag on the yarn as it passes through the turbulence chamber. This change in the size and shape of the entrance end of the turbulence chamber creates a positive separation of the individual filaments of the yarn to permit the formation of well-defined crimps, curls and loops in the filaments of the yarn.

Other objects and advantages will appear as the description proceeds when taken in connection with the accompanying drawings, in which

FIG. 1 is a side elevational view of the yarn texturing air jet of the present invention;

FIG. 2 is an end elevational view of the air jet, looking at the left hand end of FIG. 1;

FIG. 3 is an end elevational view of the air jet, looking at the right hand end of FIG. 1;

FIG. 4 is an enlarged vertical sectional view through the air jet, taken substantially along the line 4—4 in FIG. 2;

FIG. 5 is an enlarged fragmentary vertical sectional view of a conventional prior art type of air jet illustrating the manner in which the turbulence chamber is formed between the flat inner or exit end of the needle and the inwardly tapering conical surface in the entrance end of the venturi; and

FIG. 6 is a view similar to FIG. 5 but illustrating the air jet of the present invention and illustrating the conical opening in the inner or exit end of the needle which increases and changes the usual shape of the turbulence chamber.

The air jet of the present invention includes an elongate housing **10** having a central bore **11** (FIG. 4) extending therethrough and from the entrance end to the exit end thereof. The central bore **11** is of the same diameter throughout except for an enlarged groove **12** in the central portion which defines a part of a plenum chamber. Means is provided for directing pressurized air or gas into the plenum chamber and the central bore **11** and includes a fluid inlet nipple **13**, the inner end of which is fixed in the housing **10** and the outer end of which is adapted to be connected to any suitable source of pressurized gas or air, not shown.

A venturi **15** is supported for longitudinal adjustment in the central bore **11** and in the exit end of the housing **10.** An inwardly tapering conical surface **16** is provided on the inner or entrance end of the venturi **15** and terminates in an exit orifice **17** which extends through the outer end of the venturi **15.** The inwardly tapering conical surface **16** defines the exit end of the turbulence chamber. A yarn guide eyelet **18** is suitably fixed in the outer or exit end of the venturi **15** for providing a wear resistant surface at the exit end of the air jet. The outer end portion of the venturi **15** is fixed in a venturi cap **20** which is threadably supported on the threaded exit end portion of the housing **10** so that the venturi **15** may be longitudinally adjusted along the central bore **11** by rotation of the venturi cap **20.** A lock ring **21** is threadably supported on the threaded exit end of the housing **10** and adjacent the venturi cap **20** so that the venturi **15** may be locked in adjusted position.

A yarn guiding needle **23** is positioned in the central bore **11** of the housing **10** and its outer or entrance end is fixed in an end flange **24.** Means is provided for securing the end flange **24** to the entrance end of the housing **10** for rotational adjustment of the needle **23** within the housing. This securing means includes lock screws **25** (FIG. 3) which are threaded into the housing **10** and which penetrate elongate slots **26** formed in the end flange **24.** A ceramic yarn guide eyelet **27** is fixed in the entrance end of the needle **23** for providing a wear resistant surface on the entrance end of the needle **23,** where the yarn enters the air jet. A suitable O-ring seal **30** (FIG. 4) is provided around the needle **23** and beneath the end flange **24** to prevent escape of air air through the entrance end of the air jet.

An axial yarn guiding channel **32** extends throughout the length of the needle **23** for directing multifilament yarn through the needle **23** and the venturi **15.** A circular groove **33** is provided in the needle **23** and is aligned with the enlarged bore **12** in the housing **10** to form the plenum chamber into which the pressurized air is introduced as it enters the air jet through the inlet nipple **13.** One or more air passageways **34** are provided to permit air to pass from the plenum chamber and through the turbulence chamber, in a manner to be presently described.

The inner or exit end portion of the needle **23** is reduced in diameter and is beveled as at **35** so that it tapers inwardly at an angle corresponding to the inwardly

tapering conical surface 16 on the inner end of the venturi 15. The conical surface 16 on the inner end of the venturi 15 defines an angle of approximately 30° with the longitudinal center of the air jet and the beveled outer surface 35 of the inner end of the needle 23 also defines an angle of approximately 30 degrees with the longitudinal center of the air jet.

In accordance with the present invention, means is provided for improving the turbulence and enhancing the crimps, curls and loops imparted to the filaments in the yarn in the turbulance chamber. To this end, a conical opening 36 is provided on the inner surface and in the inner or exit end of the needle 23. This conical opening 36 extends inwardly toward the entrance end of the needle 23 and terminates at the axial yarn guiding channel 32 extending through the needle. Thus, the entrance end of the turbulence chamber is defined by the conical opening 36 in the inner or exit end of the needle 23 and the exit end of the turbulence chamber is defined by the inwardly tapering conical surface 16 on the inner or entrance end of the venturi 15.

Since the parts of the prior art type of air jet shown in FIG. 5 are similar to the parts of the air jet of the present invention, corresponding parts of the two air jets will bear like reference numerals with the prime notation added to the parts of the prior art type of air jet. It will be noted that the inner or exit end of the needle 23′ (FIG. 5) is not provided with an inwardly extending conical opening but is flat, as indicated at 37, across the free end thereof so that the entrance end of the turbulence chamber is defined by the flat end 37 of the needle 23′ and the exit end of the turbulence chamber is defined by the inwardly tapering conical surface 16′ on the inner or entrance end of the venturi 15′.

In texturing yarn with the prior art type of air jet shown in FIG. 5, the pressurized air passes from the plenum chamber through the passageways 34′ and between the beveled inner end 35′ of the needle 23′ and the inwardly tapering conical surface 16′ of the venturi 15′, through the turbulence chamber and outwardly through the exit orifice 17′ to impart crimps, curls and loops to the filaments of the yarn, as schematically illustrated in FIG. 5. However, the filaments of the yarn cannot separate to any appreciable extent until they clear the flat end portion 37 of the needle 23′, therefore the size of the turbulence chamber is rather restricted and the degree of crimping, curling and looping which is imparted to the filaments is limited with a given amount of air passing between the inner end of the needle 23′ and the venturi 15′.

In texturing yarn with the air jet of the present invention, the pressurized air also passes from the plenum chamber into and through the passageways 34, (FIG. 6) between the inwardly tapering conical surface 16 of the venturi 15 and the beveled inwardly tapering surface 35 of the needle 23, through the turbulence chamber, and outwardly through the exit orifice 17. However, the conical opening 36 provided in the inner or exit end of the needle 23 changes the size and shape of the entrance end of the turbulence chamber and causes positive separation of the filaments of the yarn before they clear the exit end of the needle 23. The conical opening 36 in the inner or exit end of the needle 23 causes the pressurized air moving over the end of the needle 23 to form vorticies in the conical opening 36 which tend to cause a positive outward separation of the filaments as they leave the axial yarn guiding channel 23 and increase the agitation in the turbulence chamber so as to enhance the crimps, curls and loops imparted to the filaments of the yarn. The vorticies in the conical opening 36 at the entrace end of the turbulence chamber also impart a pressure drag to the yarn as it moves through the air jet.

Thus, a more efficient use of the air is accomplished in the jet of the present invention than has heretofore been possible with prior art types of air jets in which the inner or exit end of the needle is flat. The conical opening 36 in the inner end of the needle 23 defines an angle of approximately 45° with the longitudinal center of the air jet, as illustrated in FIGS. 4 and 6. It is to be understood that the length of the turbulence chamber may be increased or decreased by correspondingly decreasing or increasing the angle of the conical opening 36, if desired. Also, the angle of the inwardly tapering conical surface 16 on the venturi 15 and the beveled inwardly tapering surface 35 on the inner end of the needle 23 may be varied from the 30° angle described.

In the drawings and specification, there has been set forth a preferred embodiment of the invention, and although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.

That which is claimed is:

1. In a yarn texturing air jet of the type including an elongate housing having a central bore therethrough, a venturi supported in the central bore and in the exit end of said housing, an inwardly tapering conical surface on the inner end of said venturi and terminating in an exit orifice extending through the exit end of said venturi, a yarn guiding needle positioned in the central bore of said housing and having an inner end portion positioned closely adjacent said inwardly tapering conical surface on the inner end of said venturi, said needle having an axial yarn guiding channel extending therethrough for directing multifilament yarn through said needle and toward said venturi, said inwardly tapering conical surface of said venturi defining the exit end of a turbulence chamber, and means for directing pressurized gas into the central bore of said housing and along said inner end portion of said needle whereby the gas passes through said turbulence chamber and outwardly through said exit orifice of said venturi to impart crimps, curls and loops to the filaments as the yarn passes through said turbulence chamber; the combination therewith of means for improving the turbulence and enhancing the crimps, curls and loops imparted to the yarn in said turbulence chamber, said means comprising a conical opening extending from the inner end of said needle and inwardly toward the entrance end and terminating at the yarn guiding channel extending through said needle whereby the entrance end of said turbulence chamber is defined by said conical opening in the inner end of said needle.

2. A yarn texturing air jet according to claim 1 wherein the outer surface of said inner end portion of said yarn guiding needle tapers inwardly at an angle corresponding to the angle of said inwardly tapering conical surface on the inner end of said venturi.

3. A yarn texturing air jet according to claim 2 including a venturi cap supporting the outer end of said venturi, said venturi cap being threadably supported on said exit end of said housing so that the distance between said inner end portion of said yarn guiding nee-

dle and said inwardly tapering conical surface on the inner end of said venturi may be adjusted.

4. A yarn texturing air jet according to claim 3 including a lock ring threadably supported on said exit end of said housing and adjacent said venturi cap so that said venturi may be locked in adjusted position.

5. A yarn texturing air jet according to claim 1 wherein said inwardly tapering conical surface on the inner end of said venturi defines an angle of approximately 30° with the longitudinal center of said air jet, and wherein said conical opening in said needle defines an angle of approximately 45° with the longitudinal center of said air jet.

6. A yarn texturing air jet according to claim 1 including an end flange supporting the entrance end of said yarn guiding needle, and means securing said end flange to the entrance end of said housing for rotational adjustment of said needle within said housing.

* * * * *