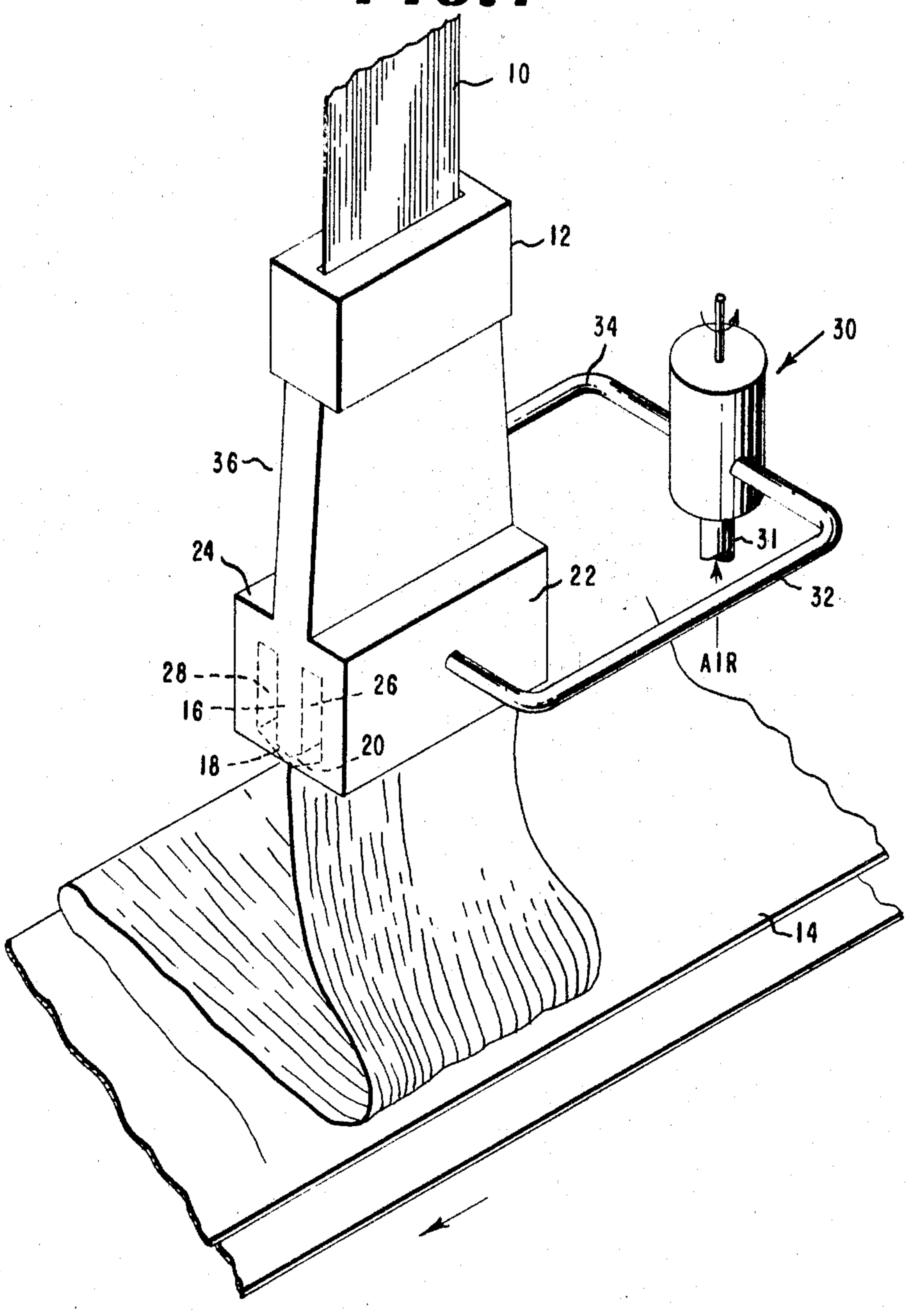
Aug. 12, 1969 H. McCARDELL TROTH, JR 3,460,731

FILAMENT DEFLECTING APPARATUS

Filed July 7, 1967 2 Sheets-Sheet 1

FIG. I



INVENTOR
HENRY McCARDELL TROTH, JR.

BY Howard P. West Jr.
ATTORNEY

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FIG. 2

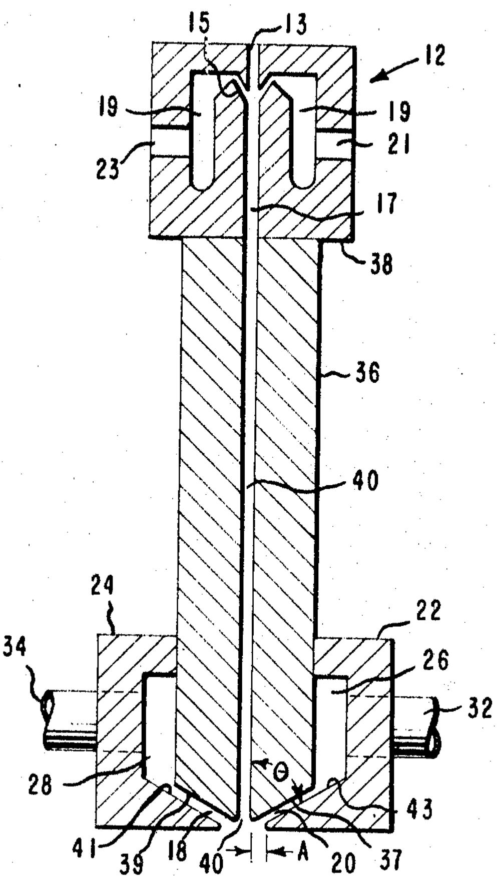
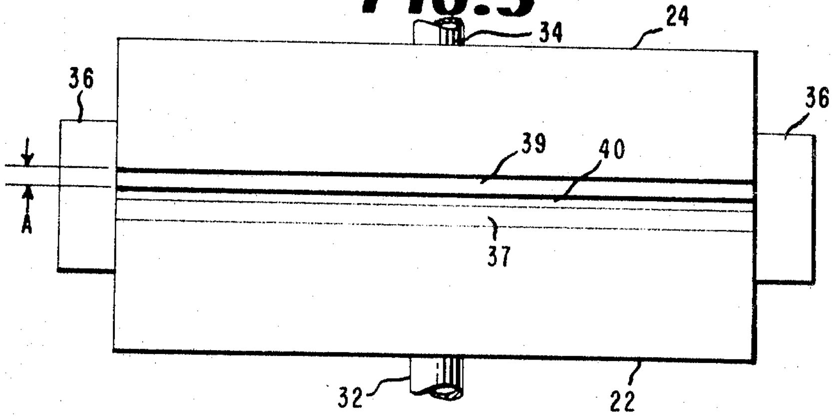


FIG. 3



INVENTOR
HENRY McCARDELL TROTH, JR.

BY Howard P. West Jr.
ATTORNEY

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FILAMENT DEFLECTING APPARATUS

Henry McCardell Troth, Jr., Hendersonville, Tenn., assignor to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware
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U.S. Cl. 226—97 5 Claims

ABSTRACT OF THE DISCLOSURE

An appartus for deflecting filaments emerging from the outlet of a forwarding jet. A housing attached to the outlet end of the jet is periodically supplied with pressurized fluid which discharges onto the filament stream emerging from the jet.

BACKGROUND OF THE INVENTION

This invention relates to modified filament forwarding jet devices and in particular to filament forwarding jet devices suitable for controlling the direction of the jet output by periodic deflection with secondary fluid streams.

Jet devices have been used in the textile industry for many years to effect drawing, texturing, stripping, annealing, crimping, bulking, interlacing, etc. of synthetic yarns. These devices usually have had round cross-sections but recently jet devices with rectangular or slot shaped cross-sections have been developed. Slot jets are particularly useful when used to strip filaments from draw rolls since they conform closely to the shape of the ribbon of filaments coming off the draw roll.

A recently developed process for preparing continuous filament nonwoven fabrics is described in British Patent 932,482. In this process an electrostatically charged multifilament strand of continuous filaments is forwarded by means of a jet device toward a web laydown zone. As the tension on the filaments is released at the exit of the jet device the filaments separate due to the repelling effect of the electrostatic charge on each of the filaments and while thus separated, are collected as a nonwoven web. When draw rolls are used in the above-described process, it is preferred that the filament forwarding jet be of the slot jet type such as that described in Cope et al., U.S. 3,302,237. The Cope et al. jet is especially useful in the above-described process since its design maintains the filaments uniformly spread across the filament passageway and avoids filament entanglement and bunching. Nonwoven webs produced according to the above-described process contain filaments which are disposed in a random loopy configuration. When bonded, non-woven fabrics with physical properties independent of direction are obtained.

It is sometimes desirable to control the direction of output of a slot jet device during preparation of a continuous filament nonwoven web. One reason for controlling the direction of the jet output is to provide for more uniform distribution of fibers across a laydown receiver. Another reason for controlling the direction of the jet output is to introduce fiber directionality into the nonwoven web. Fiber directionality is especially useful in nonwoven fabrics to be used as backing for tufted carpets where resistance to stretch in the machine direction and resistance to neck-down in the cross machine direction after tufting are important.

Uniform control of slot jet output is a necessity during preparation of nonwoven webs. When controlled in an irregular or non-uniform manner, the output of filament forwarding slot jets provides nonwoven webs of non-uniform fabric weight and imperfect fiber alignment when such alignment is desired. It is also desirable to control

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the output of filament forwarding slot jets used in the preparation of nonwoven webs in such a manner so as to minimize fiber entanglement and bunching.

Deflection of fiber containing fluid streams with secondary fluid streams or mechanical deflectors as known in the art have the diadvantage of promoting filament entanglement and bunching.

SUMMARY OF THE INVENTION

The principal objective of this invention is to provide an apparatus for controlling the direction of the output of a filament forwarding slot jet which minimizes filament entanglement and bunching.

This objective is accomplished by providing a housing atttached to the outlet end of a filament forwarding jet. The housing defines a chamber with a discharge slot opening transversely to and adjacent the outlet end of the jet. A source of pulsating pressurized fluid is connected to the chamber and is discharged from the slot for deflecting the filaments emerging from the jet. The slot has a width of from between .005 inch (.012 cm.) and .080 inch (.203 cm.) and presents a fluid discharge angle of from about 60° to 90° with the axis of the passage through the jet.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a schematic isometric view of the modified jet of this invention showing its use in the production of a nonwoven fabric.

FIG. 2 is a cross-sectional end view of the modified jet of this invention.

FIG. 3 is a bottom view of FIG. 2.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1 a ribbon of electrostatically charged continuous filament fibers **10** are forwarded by means of slot jet **12** through a diffuser **36** toward a flexible pervious belt **14**, covering a suction means (not shown). As the tension on the filaments is released at the outlet end **16** of the diffuser **36**, the filaments are deflected alternately by opposed air streams issuing from slots **18**, **20** formed by the end **16** of the diffuser **36** and housings **22**, **24** attached to the opposite longitudinal sides of the outlet end **16** of diffuser **36**. Chambers **26**, **28** defined by housings **22**, **24** respectively, are connected to a rotary valve **30** supplied with compressed air at inlet **31** by means of conduits **32**, **34**.

Referring to FIGS. 2 and 3, slot jet **12** includes an entrance slot **13** projecting into effuser throat **15** and a generally rectangular filament passage **17**. Plenum **19** is supplied with pressurized fluid through ports **21**, **23**. A diffuser section **36** is attached to the outlet end **38** of jet **12** and defines a filament passage **40** of rectangular cross-section in alignment with passage **17** of the jet. The jet shown schematically in FIG. 2 is similar to the slot jets described in Cope et al. U.S. 3,302,237 modified with the diffuser section **36** attached to the outlet end of the jet. The end **39** of the diffuser **36** converges toward filament passage **40** while housing **24** is formed to present an interior surface **41** complimental to and spaced from end **39** thus forming slot **18** which is disposed toward and runs lengthwise of the passage **40**. Slot **20** is formed in the same fashion and is defined by complemental surfaces **37**, **43**.

In operation, pressurized fluid, e.g. compressed air is supplied to rotary valve **30** which is rotated at a constant speed and alternately connects conduits **32**, **34** to the source of compressed air. The resulting pulses of air are fed to chambers **26**, **28** where they discharge from slots **18**, **20** at an angle Θ, and impinge against the ribbon of filaments **10** alternately deflecting them in a uniform pattern.

For maximum efficiency the deflection slots **18**, **20** should be arranged so that the deflecting streams impinge on the fiber stream issuing from outlet **40** of the diffuser at an angle Θ approaching 90°. On balance, the angle should be sufficiently less to avoid any coanda effect that might be caused by the configuration of housing **22** below the diffuser outlet which would tend to hold the filaments in the fully deflected position. Although angles Θ of from 60 to 90° are operable, a useful compromise is to use an angle Θ of 70°. At this angle any aerodynamic effects caused by the shape of the bottom part of the housing **22** are minimized while still maintaining reasonable efficiency in the amount of deflection air consumed. The deflection slots **18**, **20** should be sized to achieve the desired deflection at moderate chamber pressure, e.g., 1 to 5 p.s.i. The preferred slot width is from .015 to .020 inch (.038 to .050 cm.) although slot widths of from about .005 to .080 inch (.012 to .202 cm.) are operable. The length of the chambers **26**, **28** and slots **18**, **20** should correspond to the lengthwise dimension of the diffuser outlet **40**. The exit gap A (FIGS. 2, 3) between the outlet end of the diffuser and housing **22** is preferably between .05 to .50 inch (.12 to 1.2 cm.).

While it is preferred that the deflection housings **22**, **24** be attached to a diffuser section which is in turn attached to the outlet of a slot jet it is not necessary to do so and the deflection housing may be attached directly to the outlet end of a slot jet as disclosed by Cope et al. without a diffuser. Of course it should be understood that the outlet end of the Cope et al. jet would be modified to converge toward the passage to form in cooperation with housings **22**, **24**, the angularly disposed slots. It is not necessary that the deflection device of this invention be positioned on both sides of the jet or diffuser outlet. Control of the jet or diffuser output can be obtained through the use of a single housing **22** on one side of the jet or diffuser. It is apparent that many changes and modifications may be made to the disclosed apparatus without departing from the spirit of the present invention which is intended to be limited only by the scope of the appended claims.

What is claimed is:

1. In a filament forwarding apparatus including a jet having inlet and outlet ends connected by a filament passage of generally rectangular cross-section, a device for transversely deflecting filaments emerging from the passage at said outlet end, said device comprising:

(a) a housing attached to the jet adjacent its outlet end and in cooperation therewith defining a chamber with a discharge slot disposed toward the passage at said outlet end;

(b) a source of pressurized fluid; and

(c) means connected between said source and said chamber for supplying pulses of pressurized fluid to said chamber, said slot being disposed at an angle of from about 60° to 90° with the axis of the filament passage and running lengthwise thereof.

2. The apparatus of claim **1** wherein the width of said slot is between about .005 and .080 inch.

3. The apparatus of claim **1** wherein the outlet end of said jet converges toward said passage, said housing presenting a surface spaced from and complemental to the converging end of the jet.

4. In a filament forwarding apparatus including a jet and a rectangular elongated diffuser each defining an inlet, a passage of generally rectangular cross-section and an outlet, the diffuser being mounted to the outlet end of the jet their passages being in axial alignment, a device for alternately deflecting filaments emerging from the outlet of the diffuser, said device comprising:

(a) a pair of opposed housings mounted to the diffuser adjacent its outlet end, said housings in cooperation with diffuser defining opposed chambers with opposed discharge slots disposed toward the passage at the outlet end of the diffuser said slots running longitudinally of said passage;

(b) a source of pressurized fluid; and

(c) means connected between said source and said chambers for supplying alternating pulses of pressurized fluid to said chambers, said slots being disposed at an angle of about 70° with the axis of said passage, and having a width of between .005 and .080 inch.

5. The apparatus of claim **4** wherein the outlet end of the diffuser converges toward said passage, said housings presenting complemental surfaces spaced from the converging ends of the diffuser.

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ALLEN N. KNOWLES, Primary Examiner