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3,609,834

FLUID JET DEVICE

Filed March 11, 1970

FIG. 1.

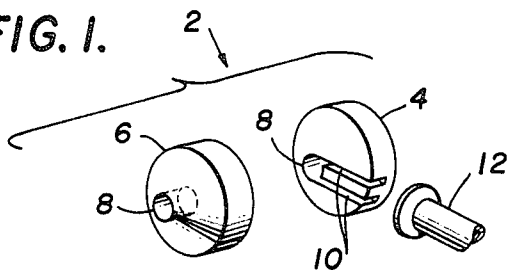
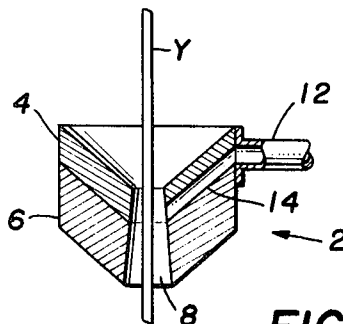


FIG. 2.

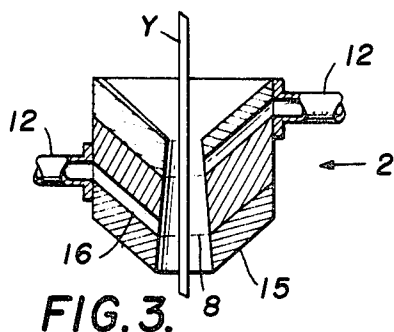


FIG. 3.

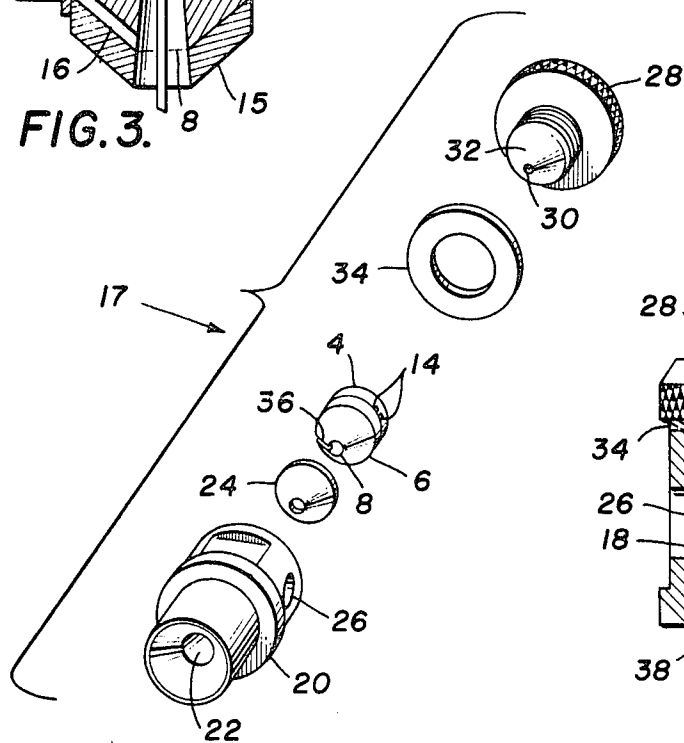


FIG. 4.

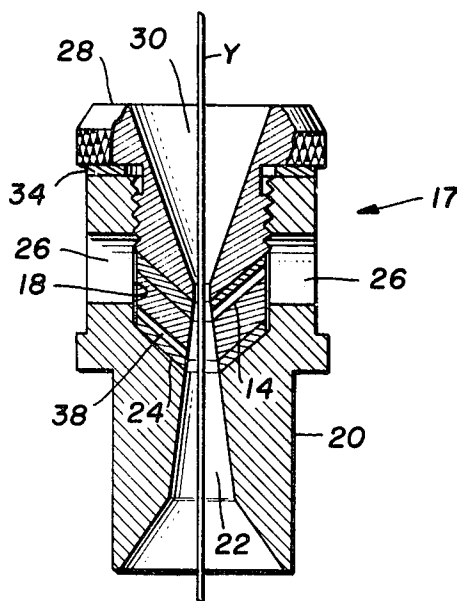


FIG. 5.

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FLUID JET DEVICE

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6 Claims

ABSTRACT OF THE DISCLOSURE

A continuous material, strand, or yarn fluid bulking and conditioning jet device having a superimposed, laminar structure of preferably shaped or non-planar plates with a transverse yarn passage therethrough and a plurality of intersticed orifices leading to the yarn passage therebetween, and the method of manufacturing the jet device by scrolling or milling slots in the shaped plates initially before assemblage to provide precise and maximal reproduction of angled orifices.

BACKGROUND OF THE INVENTION

Filaments and yarns are conventionally bulked, intermingled, interlaced, twisted, tangled and advanced by the use of fluid pressure jet devices. The structure of a typical jet device includes, mainly, a passage for yarn and an orifice leading thereto for delivering fluid under pressure into contact with a filament or filament yarn. Conditioning a yarn with a fluid, steam for example, provides myriad bulking effects. By varying orifice design and by controlling the velocity of the fluid various filament displacement patterns within a yarn bundle are achieved. Whereas in the past filament bundles were mainly ring twisted to provide filament bundle integrity and interfilament attachment, it is common in present textile practice to obtain filament attachment by subjecting a yarn bundle to a zone of turbulent fluid flow from a jet device for admixing and interlacing the filaments to the extent that the filaments adhere to one another.

A problem in the manufacture of the jet devices is the duplication of jet orifices from device to device so that uniform yarn conditioning and treatment results could be attained. Currently, jet orifices are drilled. A disadvantage in drilling the orifices is that the drilling procedure requires boring blindly into a material to intersect with a yarn passageway at a precise point. Because it is difficult to observe any deviation of the end of the drill from a desired path as it bores into a jet body, the location of the inner ends of the orifices often varies from device to device. The drilling operation also deposits burrs in the intersection of bores and passages that are difficult to remove.

Accordingly, the present invention provides a laminar plate jet device, and a method for manufacturing the jet device to provide maximal reproduction of angled jet orifices.

SUMMARY OF THE INVENTION

The jet device embodying the invention has a stacked plate structure provided with a transverse yarn passage and at least one orifice but, preferably, a plurality of orifices opening into the yarn passage at different stacked plate strata. The orifices are open to a source of fluid under pressure and are defined between the interfaces of the plates. In manufacture, each plate is provided with a transverse yarn hole while a single or several slots or grooves are scrolled or milled in at least one face of one plate extending radially from the yarn hole through the outer periphery of the plate. The plates are then

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stacked and joined in tight interfacial registry with the groove means intersticed between plate faces and with the yarn holes in the plates axially aligned to form a single yarn passage.

In use, a yarn is laced through the yarn passage and fluid, i.e. steam, is delivered into contact with the yarn through the jet orifice. The jet device is simple in structure and is easily fabricated from plates, particularly, shaped plates such as conical discs or washers. Milling the slots permits many different slot configurations to be made and to be readily duplicated from device to device. The shaped, superimposed plate structure particularly is advantageous in forming a plurality of orifices at different levels.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is an exploded view of one embodiment of the jet device,

FIG. 2 is a cross-section view of the jet device of FIG. 1 assembled and having a yarn passing there-through,

FIG. 3 is a cross-section view of another embodiment of the jet device illustrating plurality of angular orifices at different levels,

FIG. 4 is a perspective, exploded view of still another embodiment of the jet device, and

FIG. 5 is a cross-section view of the device shown in FIG. 4 with the components assembled and with a yarn being processed through the jet device.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

For convenience and simplicity reasons, like components in the several figures in the drawing are identified by the same reference numerals.

FIGS. 1 and 2 in the drawing illustrate one embodiment of the jet device comprising a pair of conical plates 4 and 6, upper and lower respectively, that are juxtaposed interfacially and joined by welds in close, tight and sealed relation. Prior to being joined, centrally located transverse yarn holes 8 are formed in each plate 4 and 6, and at least one surface slot or groove 10 is formed at one face of plate 4 (two grooves 10 are shown in FIG. 1). Grooves 10 extend radially from hole 8 in plate 4 through the outer margin thereof. In assembly, the unslotted plate 6 is placed in mating registry with the grooved face of plate 4 and with the holes 8 aligned. Plates 4 and 6 are joined in tight sealed relation by welds. A coupling 12 is affixed adjacent the outer end of grooves 10, and the coupling is normally coupled to a source of fluid under pressure. Preferably, holes 8 are tapered to provide a continuous tapered passage which is also identified by reference numeral 8. Tapered passage 8 permits the fluid entering the passage to expand and to escape from the bottom of the jet device 2.

In use, a yarn Y to be bulked or comingled is laced to extend through passage 8 as shown in FIG. 2. Steam supplied to coupling 12 flows through restricted orifice 14 and into yarn passage 8. By shaping the wall contour of orifice 14 and by varying the pressure of fluid, various bulking, tangling, mixing and intermingling filament yarn effects and patterns may be produced. The method described of milling grooves 10 and laminating the conical plates 4 and 6 assures accuracy, precision and duplication of angular orifices 14 from device to device.

The jet device 2 may be constructed with more than two plates, as illustrated in FIG. 3, wherein plate 15 has been added, an additional orifice 16 formed, and a fluid delivery coupling 12 provided. Thus, jet device 2 may be constructed with a plurality of orifices at

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different heights or levels, at different positions, and at different angles. It will be understood that the orifices 14 may also be formed by channeling separate slots or grooves in opposed, registering faces of juxtaposed plates. Operatively, the jet device 2 of FIG. 3 having opposed orifices 14 and 16 at different heights is preferred to the jet device 2 of FIG. 1 because the yarn passing through the yarn passage 8 is subjected to opposed fluid forces and thus provided greater stability in traveling through passage 8.

FIG. 4 illustrates another embodiment of a jet device 17. In this embodiment the jet device 2 illustrated in FIGS. 1 and 2 with two plates and with coupling 12 deleted, serves as an insert although other similar jets as that shown in FIG. 3 could be used as the insert. The insert 2 having conical upper and lower surfaces is seated in a cavity 18 of a holder or housing 20. Cavity 18 has a conical bottom surface complementary to the conical bottom surface of insert 2. The yarn passage 8 in insert 2, when the latter is positioned in cavity 18, is in longitudinal alignment with a yarn exit passage 22 extending outwardly from the bottom of cavity 18. Exit passage 22, preferably, is tapered to conform with the taper in passage 8 of insert 2 so that one continuous outwardly spreading tapered passage is provided. Preferably, a wear plate 24 of complementary conical construction is interposed between insert 2 and the bottom of cavity 18. The sidewalls of insert 2, preferably, have a slight clearance from the cavity 18 walls so that fluid can surround the insert 2. Housing 20 has opposite ports 26 that are normally connected to a source of fluid under pressure for admitting fluid to cavity 18 and to the jet orifices of insert 2.

The upper end of cavity 18 is threaded to receive a cap screw 28 having a tapered passage 30 extending there-through and a threaded shank 32 that threads into cavity 18. The tip of shank 32 has a conical surface complementary to the conical upper surface of insert 2. A gasket 34 is provided as a seal between the head of cap screw 28 and housing 20, and threaded shank 32 has a length such that its tapered tip applies a compressive and sealing force on insert 2 to press the insert sealingly against wear plate 24 while the latter sealingly abuts against the wall of cavity 18. The tapered passage 30 is axially aligned with yarn passage 8 of insert 2 so that the cap screw 28, the insert 2, the wear plate 24 and the housing 20 cooperate to form one continuous yarn passage. As illustrated in FIG. 4, the cap screw passage 30, preferably, is conical with the taper decreasing from the outer end thereof to condense the filaments of a yarn upon entry into the device 17.

In FIG. 5, the embodiment of FIG. 4 is assembled and is shown in cross-section with a yarn Y passing there-through. The insert 2 of the embodiment shown in FIG. 4 is modified with a slot 36 on plate 6 to form an extra orifice 38, FIG. 5, between plate 6 and wear plate 24 similarly to the orifice 16 formed in FIG. 3.

The advantage of using shaped or non-planar, non-flat plates such as the conical plates is that there is a built-in inherent angle in the plates. The grooves or slots 10 and 36 may be formed of uniform linear shape while the conical plate provides the angle desired relative to the yarn passage and are easily reproduced to provide duplicating orifices and thus manufacturing and operating advantages.

We claim:

1. A yarn processing jet assembly comprising in combination:

(a) a housing having a bore extending axially there-through with a yarn receiving end and a yarn exiting end;

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(b) a plurality of stacked concentric mating plates of substantially the same uniform diameter securely positioned within said housing bore and having an axial bore forming part of the yarn passage through said housing;

(c) at least one orifice extending generally radially along the length of at least two different interfaces of the plates; and

(d) means defining a port in said housing providing sole communication between a source of fluid and the axial bore in the said plates via said at least one interfacial orifice.

2. The device of claim 1 wherein said at least one interfacial orifice is cut in only one of the mating plate surfaces.

3. A yarn processing jet assembly comprising in combination:

(a) a housing having a bore extending axially there-through with a yarn receiving end and a yarn exiting end;

(b) a plurality of stacked concentric mating conical plates of substantially the same uniform diameter securely positioned within said housing bore, having surfaces sloping in the direction of yarn exit from the housing, and having an axial bore forming part of the yarn passage through said housing and radially expanding toward the yarn exiting end;

(c) at least one orifice extending generally radially along the length of at least two different interfaces of the plates; and

(d) means defining a transverse port in said housing providing sole communication between a source of fluid and the axial bore in the said plates via said at least one interfacial orifice.

4. The device of claim 3 wherein said at least one interfacial orifice is cut in only one of preselected mating plate surfaces.

5. A yarn processing jet assembly comprising in combination:

(a) a housing having a bore extending axially there-through with a yarn receiving end and a yarn exiting end;

(b) three stacked concentric mating conical plates of substantially same uniform diameter securely positioned within said housing bore, having surfaces sloping in the direction of yarn exit from the housing, and, having an axial bore forming part of the yarn passage through said housing and radially expanding toward the yarn exiting end;

(c) two closely spaced orifices extending generally radially along the length of the interface of a first and second plate;

(d) an orifice in general diametric opposition to the two closely spaced orifices extending generally radially along the length of the interface of a first and second plate; and

(e) means defining a transverse port in said housing providing sole communication between a source of fluid and the axial bore in the said plates via the interfacial orifices.

6. The device of claim 5 wherein the interfacial orifices are cut in only one of preselected mating plate surfaces.

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