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PNEUMATIC DENIERING APPARATUS

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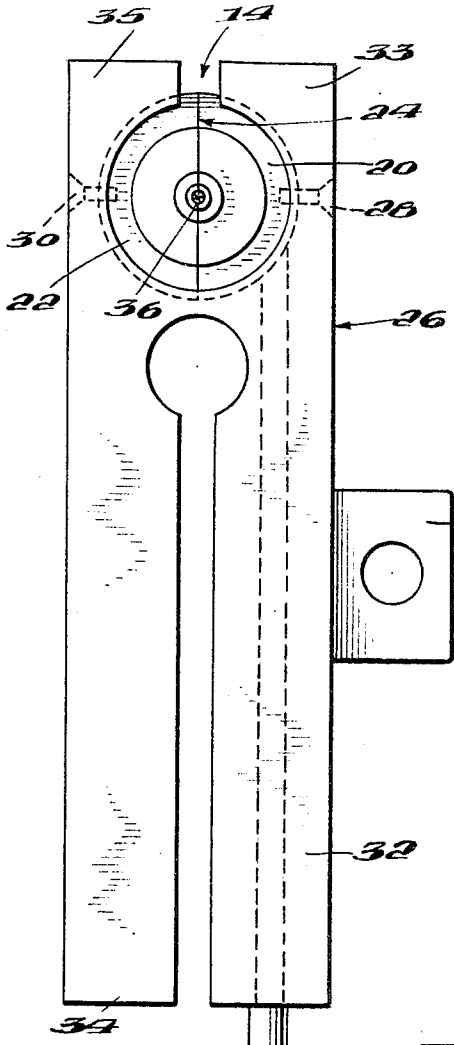
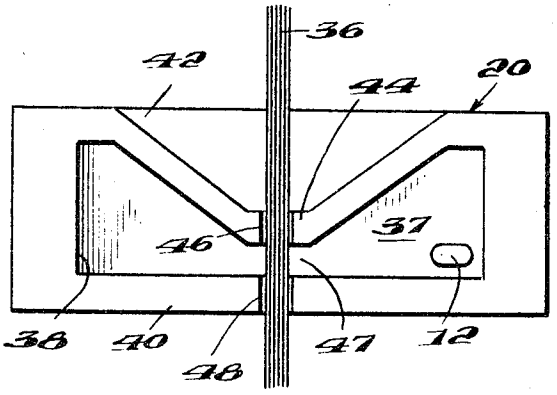


Fig. 1.

Fig. 2.



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PNEUMATIC DENIERING APPARATUS

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This invention relates generally to the production of filamentary structures and, more particularly, to the detection of variations in the cross-sectional area of a wire, filament, yarn or sliver as it is advanced axially between points in a process installation.

A related device has been described by Barrell and Buxton in the Journal of Scientific Instruments, vol. 26, pages 105 to 108, March 1949. Although operable and indicative of yarn denier variations, such a device suffers from several functional disadvantages, including the difficulty involved in stringup and the requirement of a critical guide arrangement in order to avoid contact with the yarn. Furthermore, because of the shape and arrangement of parts, false indications are obtained due to changes in shape but not area in succeeding lengths or in the amount of air pumped through the device by the yarn.

The object of this invention is to provide a pneumatic deniering apparatus which can be strung up with ease, provides for self-centering of the continuously advancing yarn and is relatively insensitive to yarn velocity.

This worthwhile objective is achieved by providing a support adapted for mounting adjacent the path of travel of an axially advancing yarn. On this support, there is a monitoring head which has an interior chamber defined by a substantially cylindrical side wall and opposed end walls. One of the end walls is dish-shaped with a central segment in proximal parallelism with the other end wall, the latter and the central segment having aligned apertures which facilitate the advance of yarn through the chamber. A source of pressurized fluid is connected to the chamber which also is in communication with a pressure sensor.

Other objectives and advantages will be apparent from the following description of a preferred embodiment wherein reference is made to the accompanying drawing. In the drawing,

FIGURE 1 is a plan view of the deniering apparatus; and

FIG. 2 is a side view of one section of the monitoring head shown in FIG. 1.

The illustrated embodiment includes a regulated air supply shown schematically at **10**. Supply **10** is connected by way of a conduit **12** to a monitoring head **14** which also communicates by way of conduit **16** with a pneumatic detector or pressure sensor shown schematically at **18**. Head **14** is fabricated in separate halves or sections **20**, **22** which mate at line **24** and are affixed to a holder or support **26** by fasteners **28**, **30**. Support **26** is made from spring steel and has spaced legs **32**, **34** which can be sprung together to thereby spread the jaws **33**, **35** within which sections **20**, **22** of head **14** are fastened. In this manner, head **14** is opened to facilitate the easy stringup of yarn **36** and returns automatically to the illustrated, closed position upon release of the force previously applied to legs **32**, **34**.

It is apparent from the illustration of section **20** in FIG. 2 that head **14** has an interior chamber **37** defined by a cylindrical side wall **38**, a first end wall **40** and a second end wall **42**, which is dish-shaped and has a central segment **44**. The inner surface of segment **44** is in proximal parallelism with a corresponding portion of the inner surface of wall **40**. Segment **44** and wall **40** are

provided with centrally located, aligned apertures **46**, **48** which facilitate the advance of yarn **36** through chamber **37**. The dish-shaped contour of end wall **42** is such as to present a shallow annular space **47** connecting the outer regions of chamber **37** with apertures **46**, **48**.

When holder **26** has been positioned adjacent the path of travel for yarn **36**, by suitable attachment of mounting pad **50**, the apparatus is placed in operation by admitting pressurized air from supply **10**. To facilitate stringup, jaws **33**, **35** and the mating surfaces of sections **20**, **22** are separated temporarily by springing leg **34** toward leg **32**. The mating surfaces are normally in a plane which includes line **24** (FIG. 1) and also intersects apertures **46**, **48**. Air flows radially from chamber **37** inwardly through annular space **47**, impinges uniformly on yarn **36** and flows outwardly through apertures **46**, **48**. Pneumatic detector **18** is connected over conduits **16** and **12** to chamber **37** so as to sense variations in air pressure caused by changes in the cross-sectional area of yarn **36** as it advances through space **47**. Detector **18** includes a strain gauge pressure transducer marketed by Statham Instruments, Inc., Los Angeles, California, which provides the input to a coupled electronic amplifier and computing readout mechanism. The latter converts area changes to variations in denier.

The radially inward flow of air through annular space **47** beneath segment **44** and against yarn **36** tends to center the yarn within apertures **46**, **48**. This tendency has the distinct effect of reducing sensitivity to shape changes not accompanied by changes in the cross-sectional area of yarn **36**. The centering action also inhibits yarn contact with the boundary surfaces of apertures **46**, **48** and thus reduces abrasion of the yarn, as well as wear on head **14**. It permits wider tolerance in alignment of the yarn and not only reduces monitoring "noise" by being less sensitive to yarn vibrations but also reduces the amount of vibration.

As a related advantage, it has been found that detections of denier variations with the illustrated head are much less sensitive to yarn velocity than those obtained with known pneumatic monitoring heads. This is probably due to the decreased amount of air pumped into chamber **37** by the yarn. In view of the shallow depth of annular space **47**, very short length variations in denier can be determined. Furthermore, the head design lends itself to fabrication in sections which can be assembled and mounted in such a way as to permit separation and stringup, even when the yarn is advancing at high speed.

Various pneumatic detectors and amplifiers, e.g., a simple manometer or a Pure Fluid pneumatic computing readout system marketed by Bowles Engineering, Inc., Silver Spring, Maryland, may be used instead of the Statham strain gauge pressure transducer. Where applicable, such detectors may also be connected to an automatic recorder for readout of denier variations and/or to a process control point. Instead of the illustrated right circular configuration for side wall **38**, other cylindrical shapes, e.g., octagonal or slightly elliptical, can be used if the requirement of a uniform, radial flow to annular space **47** is met. In actual practice, sections **20**, **22** have been attached to jaws **33**, **35** with lock rings and adhesives rather than fasteners **28**, **30**. It is apparent that other modifications and variations of a similar nature may be made without departing from the spirit of the present invention which is accordingly intended to be limited only by the scope of the appended claims.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. An apparatus for detecting variations in yarn denier, said apparatus comprising: a support; a monitor-

ing head on the support, said head having an interior chamber defined by a substantially cylindrical side wall and opposed end walls, one of said end walls being dish-shaped with a central flat segment in close proximity to the other end wall, the latter and said segment each being apertured for the axial advance of yarn through said chamber, said dish-shaped wall being convergent on the other end wall, said flat segment definining a shallow space between it and the other end wall, said shallow space having a height substantially less than the height of said side wall; a source of pressurized fluid; conduit means connecting the source to said chamber; and a pressure sensor in fluid communication with said conduit means.

2. The apparatus of claim **1** wherein said head comprises two sections having mating surfaces and said support is a resilient member having spaced, opposed jaws adapted to clamp the mating surfaces together, each section being fastened to a jaw.

3. A deniering appartus comprising: a support adapted for mounting adjacent the path of travel of an axially advancing yarn; a monitoring head on said support, said head having an interior chamber defined by a substantially cylindical side wall and opposed end walls, one end wall being dish-shaped with a central flat segment in close proximity to a corresponding portion of the other end wall, the latter and said segment having aligned apertures facilitating the advance of said yarn through the chamber, said dish-shaped wall being convergent on the other end wall, said flat segment defining a shallow space between it and the other end wall, said shallow space having a height substantially less than the height of said side wall; a source of pressurized fluid; conduit means

connecting said source to said chamber; and a pressure sensor in fluid communication with said conduit means.

4. The apparatus of claim **3** wherein said head is comprised of two sections having mating surfaces in a plane which intersects said apertures and said support is a resilient member having spaced, opposed jaws adapted to clamp the mating surfaces together, each section being fastened to a jaw.

5. A deniering apparatus comprising a monitoring head having an interior chamber defined by a substantially cylindrical side wall and a pair of end walls, one end wall being dish-shaped with a central flat segment, the other end wall having a plane inner surface in proximal parallelism with said segment, said end walls having aligned apertures adapted for the advance of yarn through said head, said dish-shaped wall being convergent on said plane inner surface, said flat segment defining a shallow space between it and said plane inner surface, said shallow space having a height substantially less than the height of said side wall, said chamber being adapted for connection to a source of pressurized fluid.

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