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[54] **DEFECT DETECTOR FOR A MOVING WEB**

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[52] **U.S. Cl.**.....**250/572,** 73/159, 250/219 DF, 356/200

[51] **Int. Cl.** **G01n 21/30**

[58] **Field of Search** ..... 250/219 DF, 219 DE, 250/219 TH, 221, 222 R, 222 PC, 223, 237; 356/159, 200, 160; 33/125 A, 129; 73/159, 88.5

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[57] **ABSTRACT**

An apparatus for detecting irregularities, such as hard defects and varying tension, in a continuous web moving in a path includes a cylinder mounted for eccentric movement about an axis above and transverse to said web and a plate mounted for angular movement about the same axis. The lower edge of the plate is transverse to and engages the web and a guide positioned below the web and adjacent the cylinder directs the web into engagement with the outer surface of the cylinder. Means are provided to detect movement of the cylinder and the plate occasioned by irregularities in the web.

3 Claims, 3 Drawing Figures

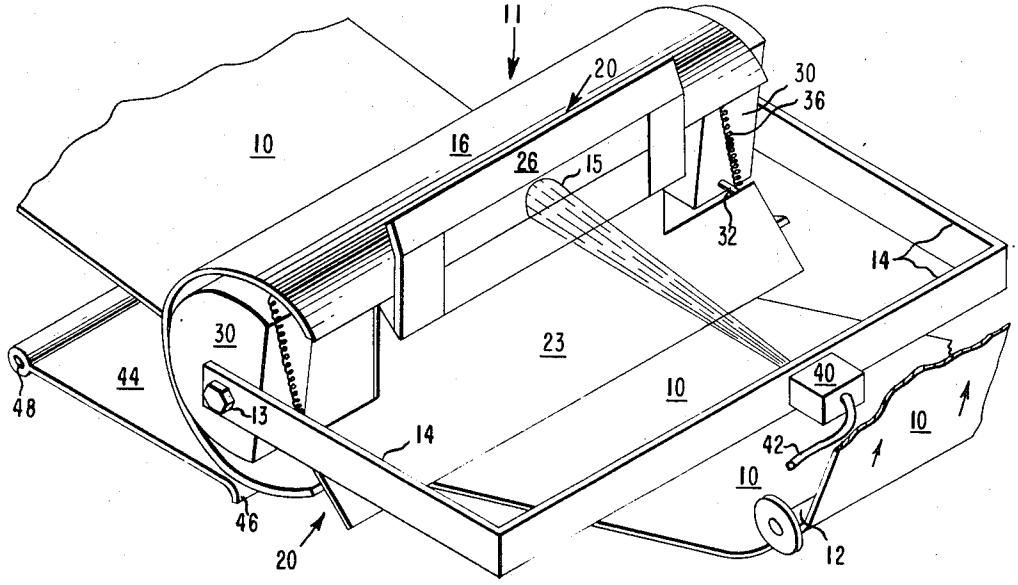


FIG. 1

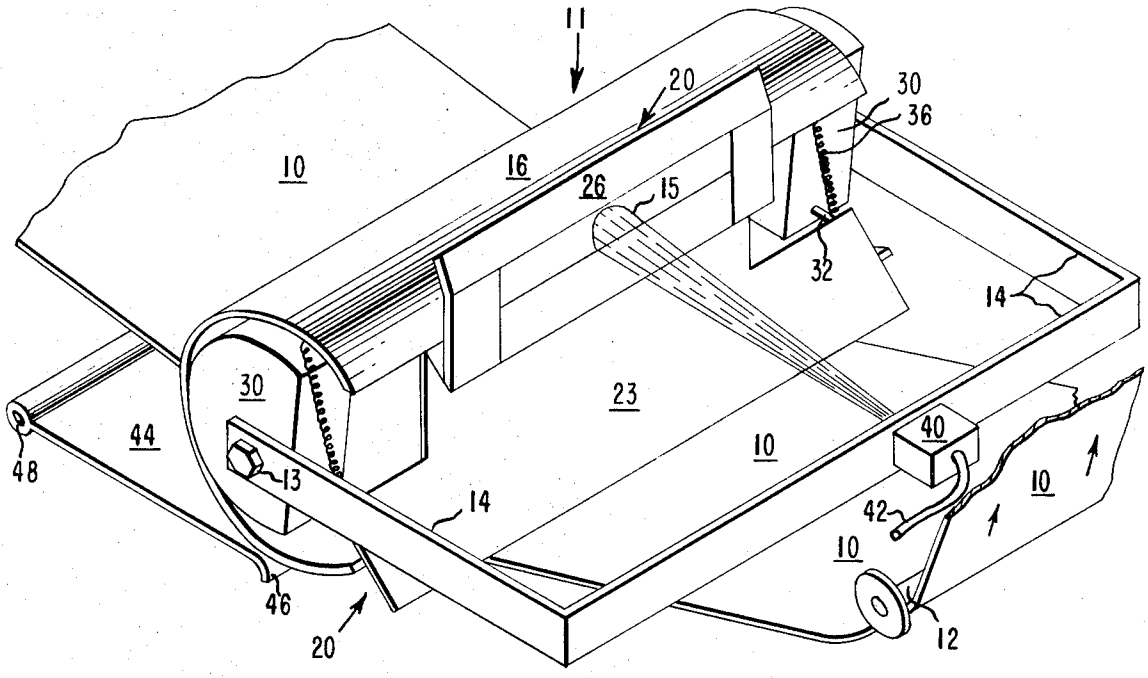


FIG. 2

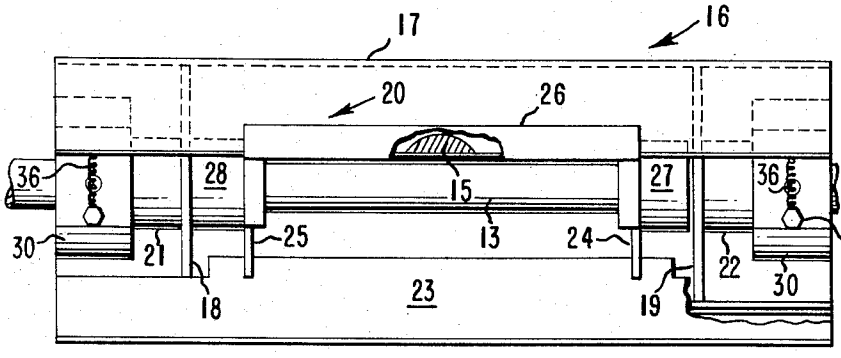
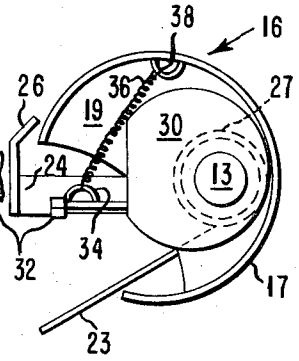


FIG. 3



DEFECT DETECTOR FOR A MOVING WEB

BACKGROUND OF THE INVENTION

This invention concerns apparatus for monitoring irregularities in moving continuous textile materials. More specifically, the apparatus of this invention detects, records and operates machine stop mechanisms in response to occurrences of not only knots, or other hard defects, but also fiber entanglements, varying web tension and product discontinuities, such as runouts and partial or full breaks in a textile ribbon, rope or tow.

By textile ribbon, rope or tow as used in this specification is meant a nontwisted band of numerous parallel continuous filaments gathered together to be processed as an entity such as by drawing, heat treating, crimping and cutting to staple fibers or direct spinning into sliver or spun yarn. In many processing steps the multiple strand is transported in the form of a relatively flat or web-like form. When the strand is in this form, it is in condition for monitoring by the apparatus of this invention. For convenience, these types of materials will be called webs hereafter.

A wide variety of defect detectors for monitoring a moving web is disclosed in the art. Although each may be satisfactory for the detection of a specific type of defect, none provides a consolidated structure capable of simultaneously detecting physical defects in a web as well as undesirable changes in web tension. Formerly, in order to detect these several types of defects, it was necessary to employ more than one type of defect detector. In some processing steps, space limitations dictate the need for a consolidated defect detector. The present invention fulfills this need.

SUMMARY OF THE INVENTION

An apparatus for detecting irregularities in a continuous web moving in a path, said apparatus comprising a shaft positioned above and transverse to said path; a cylinder mounted for eccentric movement about said shaft, said cylinder having an outer surface engaging said web; a guide positioned below said path adjacent said cylinder for directing said web against said outer surface; a plate mounted for angular movement about said shaft, said plate having a lower edge transverse to and engaging said web; and means for detecting movement of said cylinder and said plate occasioned by irregularities in the moving web.

If necessary, the cylinder and plate may be biased against movement occasioned by the movement of the web along the path.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the components which comprise the detector of this invention with relation to a moving web.

FIGS. 2 and 3 are elevation and side views of the web contacting assembly of FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning first to FIG. 1, web 10 is transported by a processing machine from a source not shown under a detector generally designated 11 and around a fixed guide 12 beyond the detector. A cylindrical shaft 13 is attached to a U-shaped bracket 14 which in turn is fastened to the web processing machine. On one case, the detector 11 is used in connection with a textile tow-to-staple cutter. A cylindrical guide 16 is mounted for eccentric movement about shaft 13. Guide 16 is hollow and has part of its wall cut out to receive a combined feeler plate and light shield member 20 whcih is also mounted for angular movement about shaft 13. Two guide motion limiters 30 are attached to shaft 13. These limiters are constructed and arranged to limit the angular movement of cylindrical guide 16 about shaft 13. A bolt 32 is threaded into element 30 and provided with a hook 34 to receive a spring 36 which is stretched and fastened to a second hook 38 fixed to cylindrical guide 16 at an appropriate location on its inner surface. A similar biasing arrangement may be associated with the second guide motion limiter at the other end of shaft 13. Similarly a spring biasing arrangement may be provided for plate member 20 if found necessary although in the preferred embodiment such a biasing mechanism is not needed and member 20 swings freely within limits. A light source and photoelectric receiver combination 40 is mounted centrally on the back member of bracket 14. A cable 42 extends from this combination to a power source and to alarm, recorder and machine drive stop mechanisms not shown.

A base plate assembly 44 is mounted below guide 16 and positioned so that tip 46 urges web 10 toward guide 16. Plate 44 is hinged about shaft 48 and is spring loaded by a mechanism not shown to bias plate 44 toward cylinder 16.

Turning now to FIGS. 2 and 3, the cylindrical guide is seen to comprise a hollow, cylindrical shell 17 cut away to provide an opening for plate member 20. Two webs 18, 19 are welded inside shell 17, perpendicular to its central axis, at symmetrical locations in from the ends of the shell. Two cylindrical bearing housings 21, 22 are welded respectively to webs 18, 19. The axes of these housings are parallel to but displaced from the central axis of the shell. A light reflecting spot 15 is provided on the outer surface of shell 17 approximately midway between the two ends of the shell above the opening. The integrated feeler plate and light shield 20 comprises a shaped plate 23, of length sufficient to approximately span the width of the web being monitored, welded to two frame plates 24, 25 on one sloped edge thereof. A pair cylindrical bearing housings 27, 28 are welded to the outboard surfaces of plates 24, 25, respectively. A light shield 26 of elongated, rectangular shape is mounted on another edge of frame plates 24, 25. Plates 24, 25 are shaped so that plate 23 and shield 26 are fixed at different positions approximately 30° apart around the axis of bearing housings 27, 28. The spacings of frame plates 24, 25 and bearings 27, 28 are arranged so that, when mounted on fixed shaft 13 along with guide 16, housings 27, 28 fit along shaft 13 between housings 21, 22. Bearing inserts of nylon or other low friction material are provided in housings 21, 22 and 27, 28.

Guide motion limiters 30 take the shape of solid partial cylinders. These limiters are mounted to shaft 13 inside guide 16 but outboard of bearing housings 21, 22.

In operation, the defect detector is mounted as shown in FIG. 1 with a guide 12 and companion guide not shown located to introduce the web to be monitored first in between base plate 44 and cylindrical guide 16, thence across feeler plate 23 and on to further processing apparatus such as a staple cutter. When

a knot, entanglement or other hard defect arrives between plate 44 and guide 16, the latter will be forced up and away from its normal position in such a way that the light reflecting spot 15 will be moved out of line with the beam of light from light source 40. This causes an electrical impulse to be generated by the photoelectric detector. If the defect is unusually large, base plate 44 will also be moved against its spring loading and deflect about axis 48. This flexibility also facilitates the stringing up of the web at startup. At the same time, plate 23 rides on the top surface of the web. When the tension in the web decreases or when the web breaks or part of it runs out, plate 23 will fall downward thus causing angular movement of the member 20 about shaft 13. This brings shield 26 downward to mask reflecting spot 15. The resulting change in illumination on the photoelectric detector provides an electrical signal as before. These signals are used in operating alarms, a recorder, and/or shutting down the web transport machine. Likewise, if tension in the web increases due, for example, to the web tangling as it leaves the supply package, plate 23 or guide 16 will be moved in such a way that again a photoelectric signal will be provided to operate alarms, etc.

Thus, a novel means has been provided for monitoring a moving length of textile ribbon, rope or tow in order to detect and provide signals upon the occurrence of several kinds of defects by means of one consolidated defect detector. Hard defects, such as knots and tangles, can be detected. Increases or decreases in tension due either to a web break or a stoppage in the supply or a partial runout of the web structure can be monitored by the same apparatus. Thus, a single detector is able to perform the function which in the past has required three or four monitoring instruments. This invention, therefore, yields not only improved convenience but also decreased cost. In some cases where space restricts the installation to one monitoring device, the present invention permits the monitoring of defects that could not previously be detected in such situations.

What is claimed is:

1. An apparatus for detecting irregularities in a continuous web moving in a path, said apparatus comprising a shaft positioned above and transverse to said path; a cylinder mounted for eccentric movement about said shaft, said cylinder having an outer surface engaging said web; a guide positioned below said path adjacent said cylinder for directing said web against said outer surface; a plate mounted for angular movement about said shaft, said plate having a lower edge transverse to and engaging said web; a light-photocell combination located in a fixed position relative to said cylinder and said plate, said combination illuminating a portion of said cylinder and detecting illumination of said cylinder, said illumination changing with relative movement of said cylinder and said plate occasioned by irregularities in the moving web.

2. The apparatus as defined in claim 1, including means for biasing said cylinder against movement occasioned by the movement of said web in said path.

3. The apparatus as defined in claim 2, including means for biasing said plate against movement occasioned by movement of said web in said path.

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