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Uusitalo et al.(10) **Pub. No.: US 2007/0293381 A1**(43) **Pub. Date: Dec. 20, 2007**(54) **BENDABLE CYLINDER****Publication Classification**(76) Inventors: **Pasi Uusitalo**, Tampere (FI); **Tuomo Mantovaara**, Oulunsalo (FI)(51) **Int. Cl.**
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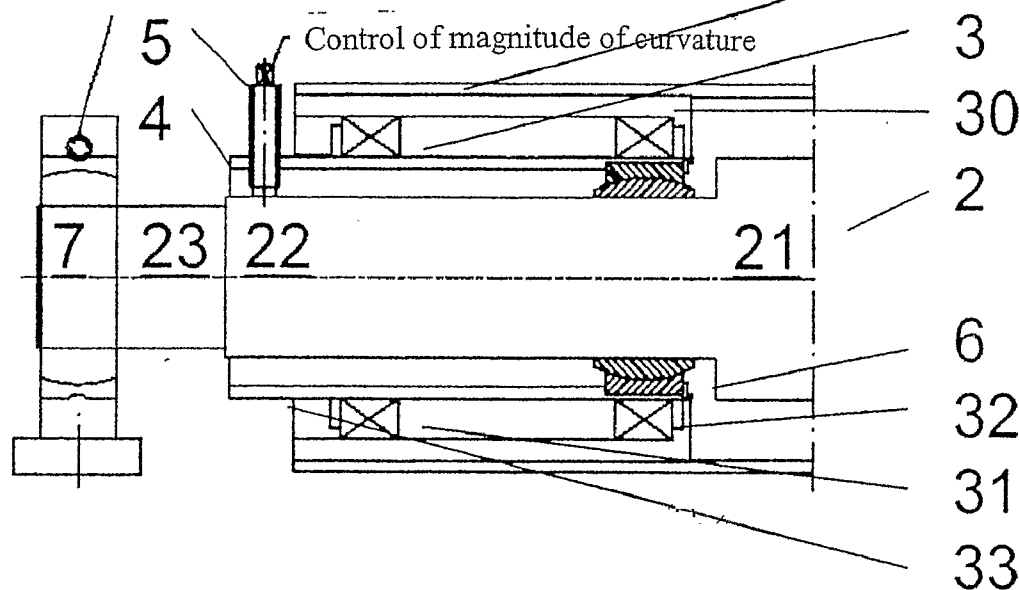
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ABSTRACT

A bendable cylinder (1, 2), especially a spreader for spreading a web-like material, said cylinder comprising a continuous tubular cylinder jacket (1) of composite material and a fixed shaft part (2) on which the cylinder jacket is rotatably mounted with at least two bearings (31, 32) at either end, and said cylinder additionally comprising a bending mechanism provided at either end of the cylinder jacket and comprising an adjusting part (5), such as an adjusting screw, for bending the cylinder jacket, which cylinder has an inner bushing part (33) fitted at least partially inside the cylinder at either end of it, the bending mechanism being fitted in said bushing part, so that, to bend and adjust the cylinder jacket (1), the angular position between a shaft portion (22) and the bushing part (33) is changed, and the bearings (31, 32) at either end are fitted between the inner bushing part (3) and an outer bushing part (30) fixedly arranged inside the cylinder jacket, and the inner and outer bushing parts, the bending mechanism and the bearings form a module (3) that can be mounted as a single unit.

Worm gear by means of which the
direction of the arc can be turned

VERSION NO. 1



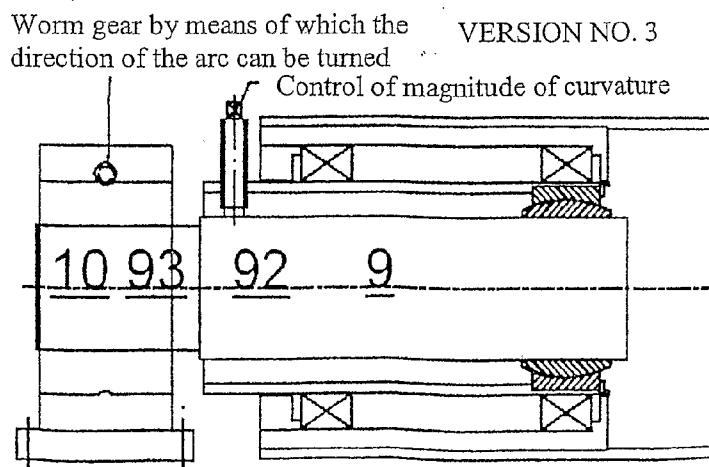
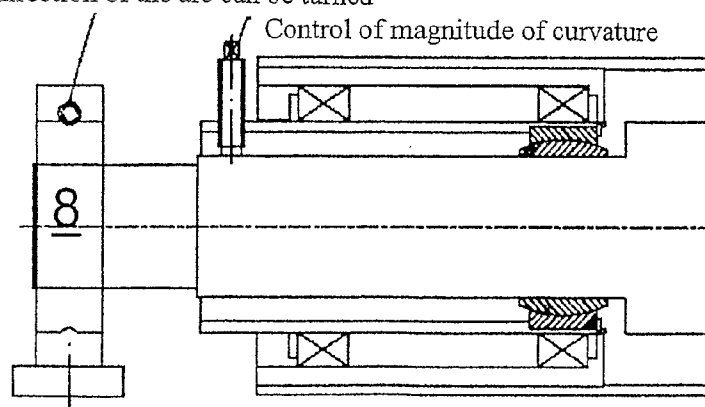
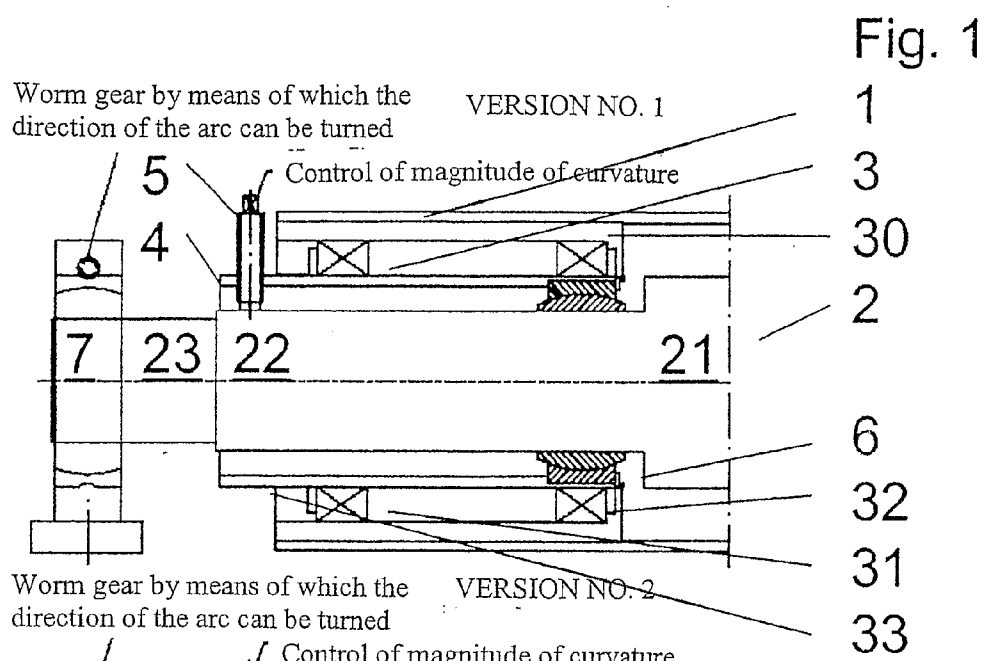


Fig. 2

Fig. 3

BENDABLE CYLINDER**FIELD OF THE INVENTION**

[0001] The present invention relates to a bendable cylinder, especially a spreader for the spreading of a web-like material, said cylinder comprising a continuous tube-like cylinder jacket of composite material and a fixed axle part on which the cylinder jacket is mounted with bearings, and which cylinder additionally comprises a bending mechanism for bending the cylinder jacket.

[0002] Bendable composite cylinders with a jacket of composite material are used especially as spreaders in paper and cardboard machines. A composite cylinder has advantageous material properties, in particular coefficient of elasticity and density, and thus it can be so dimensioned as to make it relatively easily bendable to a desired curvature.

PRIOR ART

[0003] Specification FI-B-103 071 discloses a bendable cylinder for web-like material, comprising a tube-like cylinder jacket of composite material and fixed, i.e. non-rotating spindles attached to either end of the cylinder jacket. The spindles are fastened via two supporting points to a fastening flange structure fixed to the machine frame. The cylinder additionally comprises a bending mechanism placed outside the cylinder jacket and used to bend the spindles and the cylinder jacket to an arched shape, and a control device allowing the angular position of the cylinder arc to be adjusted.

[0004] A drawback with the solution according to this specification is relatively complicated structure and installation. In addition, it takes up a relatively large space at the side of the cylinder jacket. Moreover, in prior-art solutions, implementing the suspension with bearings between the spindle and the cylinder jacket is a complicated and difficult task especially in respect of installation.

BRIEF DESCRIPTION OF THE INVENTION

[0005] The object of the present invention is to overcome the drawbacks of prior art and to achieve a completely new type of composite cylinder construction. In the construction of the invention, both bearings are fitted in a protective sleeve provided inside the cylinder jacket, thus producing a very compact and simple bending system. It can be easily mounted as a unitary module inside the cylinder jacket.

[0006] The features of the solution of the invention are presented in detail in the claims below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] In the following, the invention will be described in detail with reference to an example and the attached drawing, wherein

[0008] FIG. 1 presents a composite cylinder according to the invention,

[0009] FIG. 2 presents a second composite cylinder according to the invention, and

[0010] FIG. 3 presents a third composite cylinder according to the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0011] FIG. 1 presents a cross-sectional side view of an end part of the composite cylinder, which comprises a continuous cylinder jacket 1 of composite material and inside it a central shaft 2 going through the cylinder jacket and having a thicker middle portion 21 and thinner end portions 22 (inner) and 23 (outer).

[0012] Between the inner shaft portion 22 and the jacket 1 is a protective sleeve 30 (outer bushing) fitted nearly completely inside the cylinder jacket, said sleeve being fixedly fitted inside and at the end of the cylinder jacket 1. Fitted inside the protective sleeve 30 at either end of it are bearings 31 and 32 and inside these a bushing or ferrule 33 (inner bushing) fitted nearly completely inside the cylinder jacket. In addition, the cylinder is provided with a bending mechanism arranged in the bushing 33 for bending the bushing 33 and the cylinder jacket 1 and for adjusting the bending action. To this purpose the outer end of the bushing 33 is provided with an adjusting screw 5 connected by threads 4 to the end of the shaft portion. Moreover, the inner end of the bushing 33 is pivotally connected by a ball bearing 6 to shaft portion 22. The bending (magnitude of curvature) of the cylinder is adjusted by turning the adjusting screw 5, thereby changing the angular position between shaft portion 22 and the bushing 33, and as the motion of the bushing 33 is transmitted via the bearings 31, 32 to the jacket part 1, the angular position between the jacket 1 and shaft portion 2 is changed at the same time.

[0013] In the solution of the invention, the other inner bearing 31 is also arranged between the sleeve and the cylinder jacket near the inner edge of shaft portion 22 in a position aligned with the ball bearing 6, the entire bearing and bending system thus forming a single unitary module 3, which can be mounted inside the cylinder jacket.

[0014] In addition, the cylinder comprises a worm gear 7 provided with a rocker bearing, mounted at the end of the shaft, allowing the direction of the arc to be turned. In FIG. 1, the bending forces are received by the shaft. In principle, the other end part is identical except that axial forces in the bearing arrangement are released in the structure in question.

[0015] FIGS. 2 and 3 present other bendable cylinders according to the invention, of which the cylinder in FIG. 2 also has a shaft going through it and a worm gear 8 at its end, whereas the cylinder in FIG. 3 is provided with spindles 9 having a thicker inner portion 92 and a thinner outer portion 93 and additionally a worm gear 10 at the end. In the solution in FIG. 3, the bending forces are completely transmitted to the frame, and in FIG. 2 they are divided between the shaft and the frame.

[0016] It is obvious to the person skilled in the art that different embodiments of the invention are not limited to the example described above, but that they may be varied within the scope of the claims presented below.

1. A bendable cylinder (1,2), especially a spreader for spreading a web-like material,

said cylinder comprising a continuous tubular cylinder jacket (1) of composite material and a fixed shaft part (2) on which the cylinder jacket is rotatably mounted with at least two bearings (31, 32) at either end, and

said cylinder additionally comprising a bending mechanism provided at either end of the cylinder jacket and comprising an adjusting part (5), such as an adjusting screw, for bending the cylinder jacket,

characterized in that

the cylinder has an inner bushing part (33) fitted at least partially inside the cylinder at either end of it, the bending mechanism being fitted in said bushing part, so that, to bend and adjust the cylinder jacket (1), the angular position between a shaft portion (22) and the bushing part (33) is changed, and

the bearings (31, 32) at either end are fitted between the inner bushing part (3) and an outer bushing part (30) fixedly arranged inside the cylinder jacket, and

the inner and outer bushing parts, the bending mechanism and the bearings form a module (3) that can be mounted as a single unit.

2. A bendable cylinder according to claim 1, characterized in that the inner end of the inner bushing part (33) is pivotally mounted via a ball bearing (6) or equivalent on the shaft portion (22).

3. A bendable cylinder according to claim 1, characterized in that the inner bearing (31) is arranged to be in alignment with the ball bearing at the inner end of the shaft part.

4. A bendable cylinder according to claim 1, characterized in that the shaft goes through the jacket and the shaft portion is an end portion (22, 23) of the shaft.

5. A bendable cylinder according to claim 1, characterized in that the shaft portion is a shaft journal (92, 93).

6. A bendable cylinder according to claim 1, characterized in that the modules are substantially identical at both ends, except that axial forces in the bearings are released in the structure at one end.

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