

SPECIFICATION

Measuring apparatus, especially for measuring forces acting upon a bearing or the like

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Description

The present invention relates to a new and improved construction of apparatus for measuring and/or controlling the forces which are effective at a bearing, particularly radial forces which act upon a rotatable bearing such as roller, or ball-bearing or the like.

Generally speaking, the apparatus of the invention is of the type comprising two concentric rings inter-connected with one another by means of a radial web. This web constitutes an elastically deformable element which deforms under the influence of a force which is to be measured, and thus, causes an electric signal to be generated.

With such type equipment, there can be measured or monitored for instance, the tension which prevails at rolls rollers, belts, bands, wires and so forth, at processing machines of the textile, paper or plastics industries. Equally, it is possible to control the load conditions prevailing at conveyor belts or bands and so forth. With a heretoforth known measuring apparatus of the described type, there is measured the pivotal movement of the inner ring with respect to a fixed outer ring. This measuring apparatus which basically is extremely compact and simple in design, is however associated with the drawback that, owing to the fact that the bearing which must be housed within the inner ring, its use is limited to certain fields of application, or, however, there are required complicated force transmission systems. To be able to measure or monitor forces which are effective upon rolls and the like there are required two measuring devices, each mounted at one of the roll ends.

Therefore, with the foregoing in mind, it is a primary object of the present invention to provide a new and improved construction of measuring apparatus of the character described, which is not associated with the aforementioned drawbacks and limitations of the prior art proposals.

Yet a further significant object of the present invention aims at providing a new and improved construction of measuring apparatus for measuring the forces acting upon anti-friction bearings, particularly the radial force effective at a roller or ball-bearing or the like, which measuring apparatus is relatively simple in construction and design, extremely reliable in operation, easy to use, and provides accurate measurement results.

Now in order to implement these and still further objects of the invention, which will become more readily apparent as the description proceeds, the invention contemplates that the inner ring is provided with means for its attachment and the other outer ring is structured for receiving or housing the bearing, in order to carry out a pivotal movement with respect to the fixed inner ring under the influence of the force which is to be measured.

That is to say, the measuring apparatus is such that the inner ring is equipped with attachment

means and the bearing, by means of which there is transmitted the force to be measured, is mounted at the outer circumference of the outer ring.

The attachment means comprises an attachment plug or journal which protrudes axially from one or both faces of the inner ring. Such an attachment plug may possess an axial bore for the through passage of a measuring cable. There can be arranged upon the outer ring, for instance a roller or ball-bearing, the race of which carries an element for transmitting the force which is to be measured. This element can be constituted by a ring having a cable groove or the like, a roll cylinder and so forth. Both of the said ring members and said attachment means may be formed in one piece or said attachment means may be a press fit within said inner ring member. Both of said ring members may be arranged in a common housing and connected therewith.

The invention will be better understood and objects other than those set forth above will become apparent when consideration is given to the following detailed description thereof. Such description makes reference to the annexed drawings wherein:

Figure 1 is a side view of a measuring device constructed according to the invention, having a bearing (constituting a cable roll or pulley) mounted upon the external ring; and

Figure 2 is a vertical sectional view through the apparatus shown in *Figure 1*.

Describing now the drawings, the measuring apparatus illustrated by way of example in *Figures 1* and *2* will be seen to comprise a steel disc, generally indicated by reference character 20, which has been machined such that it contains two concentric rings 1 and 2. These concentric rings 1 and 2 are interconnected by a radial web 3 or the like. The inner ring or ring number 2 contains pressed therein an attachment plug or journal 4 or equivalent structure, rendering possible the securement of the ring 2 at, for instance, a housing portion or frame 5 thereof.

Attachment can be accomplished in any suitable manner, for instance by means of a nut (not shown) which can be threaded onto the thread 6 of the ring 2.

Now in the exemplary embodiment under discussion, a ball-bearing 7, upon which there is mounted a cable ring or pulley portion 8, is seated upon the outer circumference of the outer ring 1. The force K which is to be measured should be effective approximately in the direction of the arrow of *Figure 1*, so that there occurs a deformation within the web 3 which as far as possible is directly proportional to the force K to be measured. The measuring apparatus is to be of course mounted in accordance with the direction of the force which is known.

The stresses or forces arising at the web 3 can now be detected in conventional fashion and transmitted to a standard signal transmitter, generally indicated schematically in *Figure 1* by reference character 30. Such electrical signal transmitter 30 can work, for instance, according to capacitive or inductive techniques. However, it is particularly advantageous if the measurement is accomplished by means of strain gauges 12, mounted at the web 3. The detected

signals are then transmitted by means of a measuring cable (not shown) or the like to a display or indicator device, which if desired, can control certain functions of a machine, for instance its drive.

- 5 Now at the gap or space between the inner ring 2 and the outer ring 1 there can be arranged in suitable recesses 40 the bolts 10 and 11 or equivalent structure, protecting the web 3 against overload.

While there are shown and described present preferred embodiments of the invention, it is to be distinctly understood that the invention is not limited thereto, but may be otherwise variously embodied and practised within the scope of the following claims.

CLAIMS

1. An apparatus for measuring and/or controlling the forces, particularly the radial forces acting upon a bearing, especially a rotatable bearing, comprising:

two substantially concentric ring members interconnected by radial web means:

- 25 said web means constituting an elastically deformable element which deforms in the presence of a force which is to be measured and is capable of influencing an electric signal transmitter;

the inner ring member being equipped with attachment means for the fixation thereof and the outer ring member being structured for receiving on its outer circumference the bearing through which there is to be transmitted the force to be measured, said outer ring member, in the presence of the force to be measured, being capable of pivoting with respect to the inner inner ring member upon flexure of the radial web;

said attachment means comprising an attachment plug means which axially protrudes from at least one face of the inner ring member.

2. The apparatus as defined in Claim 1, wherein said attachment means comprise bore means and bolt means coacting therewith.

3. The apparatus as defined in Claim 1 or 2, wherein said bearing constitutes a rotatable bearing arranged at the outer ring member; and said rotatable bearing having a race carrying at least one element for transmitting the force to be measured.

4. The apparatus as defined in Claims 1, 2 or 3 wherein said attachment plug means possesses an axial bore for the through passage of a measuring cable.

5. The apparatus as defined in Claims 1, 2, 3, or 4 wherein both of said ring members and said attachment plug means are formed in one piece.

6. The apparatus as defined in Claims 1, 2, 3, or 4 wherein said attachment plug means is a press fit within said inner ring member.

7. The apparatus as defined in any preceding Claim, wherein both of said ring members are arranged in a common housing means and connected therewith.

8. The apparatus as defined in any preceding Claim, wherein said bearing constitutes a rotatable ball bearing.

9. The apparatus as defined in any of Claims 1 to 7, wherein said bearing constitutes a rotatable roller bearing.

10. An apparatus for measuring and/or controlling the forces acting upon a bearing, as defined in Claim 1, and substantially as hereinbefore described with reference to the accompanying drawings.

11. A machine incorporating an apparatus as defined in any preceding Claim.

12. A machine as defined in Claim 11, wherein the apparatus is arranged to measure and/or control the forces acting upon a rotatable pulley.

13. A machine as defined in Claim 12, wherein the apparatus is arranged to measure and/or control the forces acting upon a roll or roller.

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two substantially concentric ring members interconnected by radial web means:

- 25 said web means constituting an elastically deformable element which deforms in the presence of a force which is to be measured and is capable of influencing an electric signal transmitter;

- the inner ring member being equipped with attachment means for the fixation thereof and the outer ring member being structured for receiving on its outer circumference the bearing through which there is to be transmitted the force to be measured, said outer ring member, in the presence of the force to be measured, being capable of pivoting with respect to the inner inner ring member upon flexure of the radial web;

said attachment means comprising an attachment plug means which axially protrudes from at least one face of the inner ring member.

- 40 2. The apparatus as defined in Claim 1, wherein said attachment means comprise bore means and bolt means coacting therewith.

3. The apparatus as defined in Claim 1 or 2, wherein said bearing constitutes a rotatable bearing arranged at the outer ring member; and

said rotatable bearing having a race carrying at least one element for transmitting the force to be measured.

4. The apparatus as defined in Claims 1, 2 or 3 wherein said attachment plug means possesses an axial bore for the through passage of a measuring cable.

5. The apparatus as defined in Claims 1, 2, 3, or 4 wherein both of said ring members and said attachment plug means are formed in one piece.

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7. The apparatus as defined in any preceding Claim, wherein both of said ring members are arranged in a common housing means and connected therewith.

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