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(11)

EP 0 748 888 A1

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:
18.12.1996 Bulletin 1996/51

(51) Int. Cl.⁶: D04B 15/99

(21) Application number: 96108430.8

(22) Date of filing: 28.05.1996

(84) Designated Contracting States:
DE FR GB IT

(30) Priority: 13.06.1995 IT BO950298

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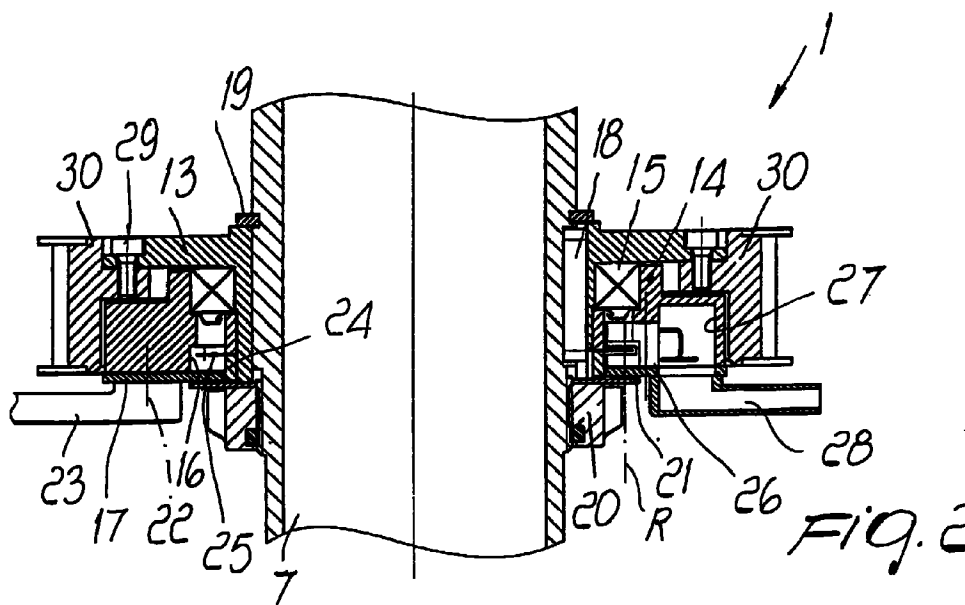
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(54) Annular position transducer, particularly for circular knitting machines for manufacturing stockings

(57) An annular position transducer, particularly for a circular knitting machine for manufacturing stockings, comprising two strong complementary rings (13,14) having a large diameter that are connected one another by an antifriction bearing (15) and between which an annular chamber (16) is formed; the first ring (13) is provided with means (18,19,20,21) for fixing to the rotatable

cylinder support (7) of the machine and the second ring (14) is fixed to the fixed supporting frame of the machine; and a disk (25) provided with notches is rigidly coupled to the first ring (13) and a module for optically reading the notches is rigidly coupled to the second ring (14).



EP 0 748 888 A1

Description

The present invention relates to an annular position transducer, particularly for a circular knitting machine for manufacturing stockings, a device of the type known by the English term "encoder".

In modern knitting machines for manufacturing stockings, the cycle for producing the stocking is entirely supervised by a unit equipped with a programmable microprocessor; the synchronization between the mechanical part and the electronic part of the machine is entrusted to an encoder, which has the task of checking the position of the needle cylinder in the course of time.

The most obvious component to which the encoder might be applied would therefore seem to be the needle cylinder itself, but the usual configuration of knitting machines for manufacturing stockings does not allow this, since other elements, such as the cylinder support, the stocking passage tube, the perforated tube arranged below and known as "antitwist", and so forth, rotate together with the cylinder and have a considerable diameter and inaccessible ends.

Accordingly, in conventional machines the encoder, of a commercial type, is installed by means of a coupling at the end of a shaft the axis whereof is different from the axis of the cylinder and is connected kinematically to the cylinder support. In some cases, a poorly accurate encoder is provided by keying a toothed disk directly on the cylinder support and reading it with one or more optical sensors that are rigidly coupled to a fixed support of the machine; however, this solution has the drawback that it cannot achieve high precision and resolution levels, since fragile and delicate optical components would be located in a region where dirt accumulates: furthermore, maintenance or repair operations as well as tunings of the machine are usually performed in these regions, and one would end up having simultaneous access to components that are mutually incompatible: large and heavy parts, with possibly heavy-duty assembly and disassembly equipment, and small and delicate parts (encoder disks with a resolution of up to 2000 divisions per turn) which require extreme cleanliness, caution, and precision during assembly and disassembly.

A principal aim of the present invention is to obviate the above-mentioned drawbacks of known devices, i.e., to provide an annular position transducer, particularly for a circular knitting machine for manufacturing stockings, that can be mounted so that it is axially aligned with the cylinder, allows easy access to the machine for maintenance, has very high precision and resolution, and the delicate components whereof are placed in a protected and easily accessible position.

Within this aim, an object of the present invention is to achieve the above aim with a structure that is simple, relatively easy to execute in practice, safe in use, effective in operation, and has a relatively low cost.

This aim and this object are both achieved by the

present annular position transducer, particularly for a circular knitting machine for manufacturing stockings, characterized in that it is constituted by two strong complementary rings having a large diameter that are connected one another by an antifriction bearing and between which an annular chamber is formed; in that the first ring is provided with means for fixing to the rotatable cylinder support of the machine and the second ring is fixed to the fixed supporting frame of the machine; and in that a disk provided with notches is rigidly coupled to the first ring and a module for optically reading the notches is rigidly coupled to the second ring.

Further characteristics and advantages will become apparent from the following detailed description of a preferred but not exclusive embodiment of an annular position transducer, particularly for a circular knitting machine for manufacturing stockings, according to the invention, illustrated only by way of non-limitative example in the accompanying drawings, wherein:

figure 1 is a sectional front view, taken along a diametrical plane, of a detail of a knitting machine for manufacturing stockings equipped with a transducer according to the invention;

figure 2 is a sectional front view, taken along a diametrical plane, of an annular position transducer, particularly for a circular knitting machine for manufacturing stockings according to the invention.

With particular reference to the above figures, the reference numeral 1 generally designates an annular position transducer, particularly for a circular knitting machine 2 for manufacturing stockings according to the invention.

The circular machine 2 is of a known type and has a fixed support 3, a fixed supporting plate 4, a cylinder 5 for the needles 6, a rotating cylinder support 7, a tube 8 for the passage of the stocking 9, and a lower perforated tube 10 for the passage of the stocking, which is known as an "antitwist"; the support 3 supports the cylinder support 7 by means of bearings 11 and flanges 12.

The transducer according to the invention is constituted by two strong and complementary rings 13 and 14 having a large diameter (even more than 70 millimeters) and connected one another by an antifriction bearing 15 that is advantageously of the self-lubricating type with rolling balls.

An annular space 16 remains between the rings 13 and 14 and is closed at the bottom by a fixed cover 17.

The first ring 13 is provided with means for fixing it to the rotating cylinder support; said means are constituted by a tab 18, an elastic ring 19, a threaded lower ring 20, and a washer 21; the second ring 14 can be rigidly coupled, by means of screws referenced by the axis 22, to the cover 17 and is connected to the fixed supporting frame of the machine by means of a radial arm 23 for adjusting the angular position (adjustment can occur, for example, by fixing the arm to an arc-shaped

slot by means of a bolt).

A tube 24 is packed together with the rotating ring 13, and a disk 25 is rigidly coupled to said tube; said disk is affected by a plurality of notches (up to two thousand), and a module 26 for optically reading the notches is fixed to the cover; said module is installed in a seat 27 of the second ring 14 and has an optical reading beam the axis whereof is referenced by the line R; the electrical connections of the module 26 exit from a lower tube 28 of the cover.

If the knitting machine for manufacturing stockings is driven by a motor with a hollow shaft that is coaxial to the cylinder support, the transducer according to the invention can be arranged above or below the motor and advantageously has a strong structure and delicate optical components which are in a position in which they are protected against impacts and dirt (the entire transducer can be removed as a single, sturdy block, and access to the delicate components can occur after the block has been removed from the machine and taken to an appropriate environment).

The first rotating ring 13 might also be formed directly on one of the bases of the rotor of the hollow motor for the actuation of the machine, becoming monolithic with said rotor.

If instead the knitting machine for manufacturing stockings is driven by a lateral drive unit, a toothed pulley 30 for a toothed transmission belt 31, or a transmission gear that meshes with a driving gear, can be rigidly coupled to the first ring 13, for example by means of perimetric screws 29.

In this last case, in addition to keeping the components of the encoder protected, the transducer allows to directly detect the angular positions of the cylinder with a structure that is rigidly coupled to the cylinder support and therefore without errors due to the mechanical transfer of information.

Attention is brought to the extreme compactness and good accessibility of the unit.

It has thus been shown that the invention achieves the intended aim and object.

The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept.

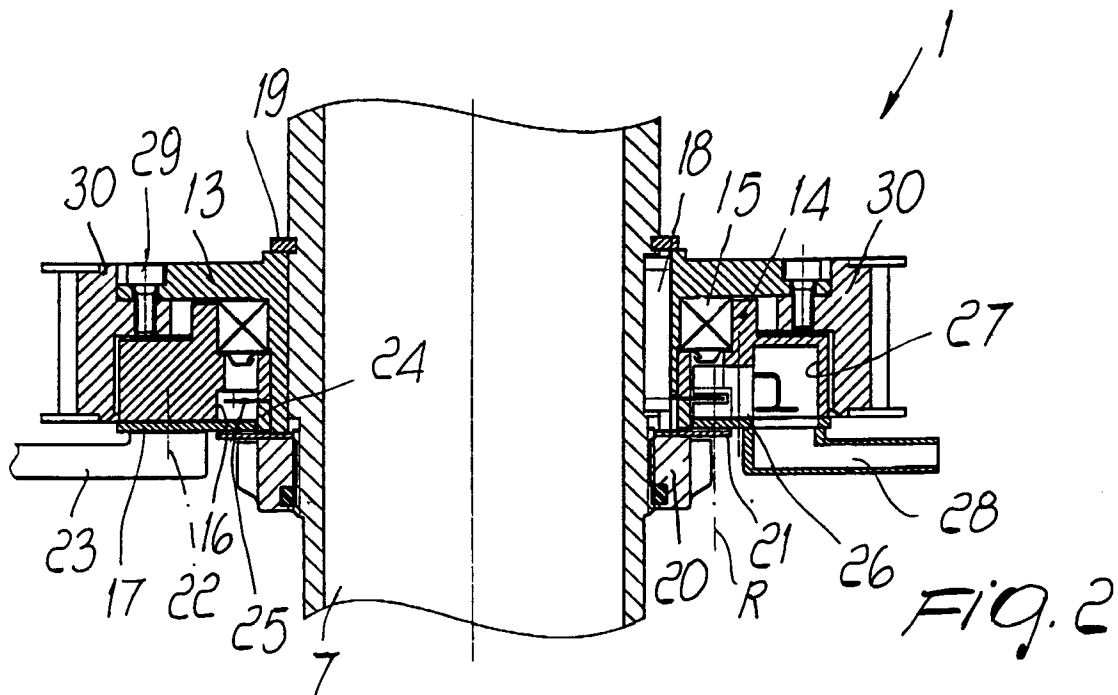
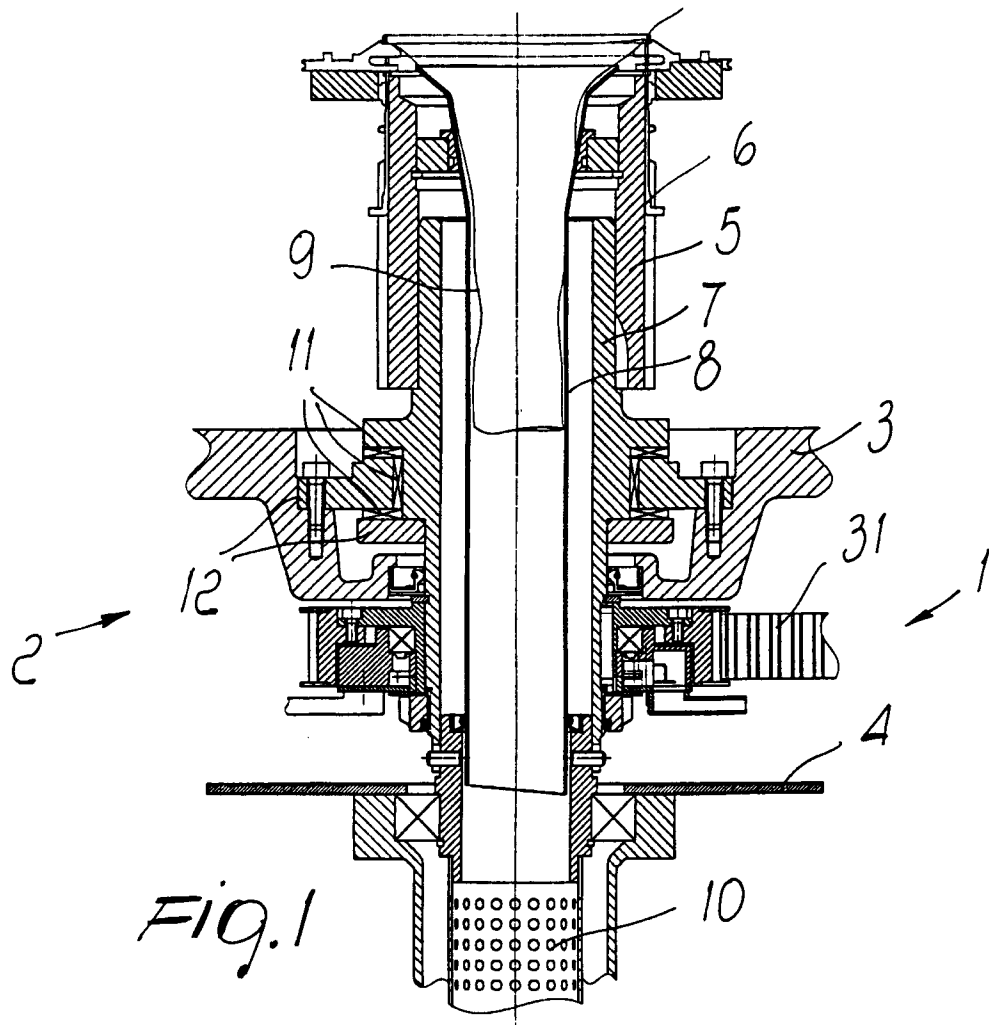
All the details may furthermore be replaced with other technically equivalent ones.

In practice, the materials employed, as well as the shapes and the dimensions, may be any according to the requirements without thereby abandoning the scope of the protection of the appended claims.

Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. An annular position transducer, particularly for a circular knitting machine for manufacturing stockings, characterized in that it is constituted by two strong complementary rings having a large diameter that are connected one another by an antifriction bearing and between which an annular chamber is formed; in that the first ring is provided with means for fixing to the rotatable cylinder support of the machine and the second ring is fixed to the fixed supporting frame of the machine; and in that a disk provided with notches is rigidly coupled to the first ring and a module for optically reading the notches is rigidly coupled to the second ring.
2. A transducer according to claim 1, characterized in that said annular chamber is closed by a cover that is rigidly coupled to the second ring.
3. A transducer according to claim 2, characterized in that said cover is connected to the frame of the machine by an angular adjustment arm.
4. A transducer according to claim 1, characterized in that said first ring has means for direct fixing to the pulley or to the driving gear of the machine.
5. A transducer according to claim 1, characterized in that said first ring is formed directly on one of the bases of the rotor of a hollow motor for the actuation of the machine.
6. An annular position transducer, particularly for knitting machines for manufacturing stockings, according to one or more of the preceding claims and according to what has been described and illustrated for the specified purposes.





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EUROPEAN SEARCH REPORT

Application Number
EP 96 10 8430

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	FR-A-2 266 889 (QUICK ROTAN BECKER & NOTZ KG) * page 5, line 8 - page 6, line 10; figures 1,2 *	1,2	D04B15/99
A	EP-A-0 541 838 (S.F.I.M. S.R.L.) * column 2, line 55 - column 3, line 24; figures 1-4 *	1,5,6	
A	DE-A-39 42 719 (MITSUBISHI DENKI K.K.) * column 4, line 55 - column 5, line 33; figures 7,12 *	1,4	
A	US-A-3 996 772 (GOTTSCHALL ET AL)		
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.6) D04B D05B
Place of search THE HAGUE		Date of completion of the search 26 September 1996	Examiner Van Gelder, P
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