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(54) Yarn-processing roller

(57) The present invention relates to a yarn-processing roller that comprises a drive motor 1 and a roller body 3 attached to the rotating shaft 2 of the drive motor 1 and that has a heater 4 inside, a vibration sensor is provided to detect vibrations. It is thus possible to detect promptly and accurately rotation errors in the rotating shaft of a yarn-processing roller to make it possible to promptly service the yarn-processing roller, as by replacing the rotating shaft.

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Description

Field of the Invention

[0001] The present invention relates to an improvement on yarn-processing rollers for thermally treating yarn such as synthetic fiber. The invention comprises a drive motor and a roller body attached to the rotating shaft of the drive motor and having a heater inside.

Background of the Invention

[0002] In a conventional yarn-processing roller, because a roller body is continuously rotated at a high speed, the bearings of the rotating drive-motor shaft are likely to become worn. If no measures are taken to prevent bearing fatigue, the rotating shaft my seize, causing damage to the yarn-processing roller. Alternatively, the rotating shaft my be deflected during rotation, causing the thermally treated yarn to be of poor quality. Thus, an object of the present invention is to promptly and accurately detect rotation errors in the rotating shaft of the yarn-processing roller so that the yarn-processing roller can be properly serviced, as by replacing the rotating shaft.

Summary of the Invention

[0003] To achieve this object, the present invention provides a yarn-processing roller comprising a drive motor and a roller body attached to the rotating shaft of the drive motor and heated by a heater, characterized in that a vibration sensor is provided to detect vibrations.

[0004] In this configuration, the vibration sensor is preferably provided in a rotating section that rotates with the rotating shaft of the drive motor and the vibration sensor is preferably provided opposite to the roller body, with the drive motor sandwiched between the roller body and the vibration sensor.

[0005] In addition, preferably, a noncontact signal transmission mans is provided to transmit a signal from the rotating section to a locking section that is stationary relative to the rotating section.

[0006] Further, the vibration sensor is attached to a substrate provided on the rotating section side so that the noncontact signal transmission means sends a detection signal from the vibration sensor to the locking section.

Brief Description of the Drawing

[0007]

Figure 1 shows a general configuration of one embodiment of a yarn-processing roller according to the present invention.

Figure 2 shows a general configuration of that part of the yarn-processing roller in Figure 1 which is opposed to a roller body, with a drive motor sandwiched between the roller body and this part.

Figure 3 is a circuit diagram of a signal transmission circuit 7 and a signal reception circuit 12 for the yarn-processing roller shown in Figure 1.

Detailed Description of the Preferred Embodiments

[0008] The preferred embodiment of the present invention is described below with reference to the drawings. Figure 1 shows a general configuration of one embodiment of a yarn-processing roller according to the present invention. Figure 2 shows a general configuration of that part of the yarn-processing roller in Figure 1 which is opposed to a roller body with a drive motor sandwiched between the roller body and this part.

[0009] In Figure 1, 1 is a drive motor, and 2 is a rotating shaft of the drive motor 1. According to this embodiment, the rotating shaft 2 is disposed in such a way as to penetrate a housing of the drive motor 1. A roller body 3 is attached to one end of the rotating shaft 2 of the drive motor 1. As is apparent from Figure 1, the roller body 3 is shaped like a cylinder with one of its ends closed, its central shaft corresponds to the rotating shaft 2 of the drive motor 1, and a circumferential wall 3a is attached to the rotating shaft 2 in such a way as to encompass the rotating shaft 2 at a specified interval therefrom.

[0010] A heater 4 that is fixed to the housing of the drive motor 1 and that projects from the housing and is parallel with the rotating shaft 2 at an interval therefrom is disposed in the gap between the circumferential wall 3a of the roller body 3 and the rotating shaft 2 of the drive motor 1. The roller body 3 is heated by the heater 4, and a yarn is also heated when wound around the outer circumferential surface of the roller body 3.

[0011] In addition, a temperature sensor 5a for controlling the heater 4 and a temperature sensor 5b for issuing an alarm upon the detection of an error are embedded in the circumferential wall 3a of the roller body 3. The temperature sensors 5a and 5b are each connected to a signal transmission circuit 7 attached to the other end of the rotating shaft 2 via a lead 26 that passes through the rotating shaft 2 of the drive motor 1. The signal transmission circuit 7 will be described below.

[0012] As shown in Figure 2, a flange 6 is provided at the other end of the rotating shaft 2 of the drive motor 1 and has a first substrate 8 firmly screwed thereto. That is, when the rotating shaft 2 of the drive motor 1 is rotated, the first substrate 8 rotates at the same speed as the rotating shaft 2. The first substrate forms a rotating section of the drive motor 1 together with the roller body 3. A printed circuit board comprising electronic devices that constitute the signal transmission circuit 7 is mounted on the first substrate 8.

[0013] In addition, a highly sensitive vibration sensor 9 is mounted on the first substrate 8 near its outer circumference, together with other surface-mounted parts. The vibration sensor 9 detects only vibrations (centrifugal force) in the radial outward direction of the first substrate 8.

[0014] As the housing of the drive motor 1, a cylindrical protective cover 10 with both ends open projects from the body of the drive motor 1 along the rotating shaft 2 and coaxially therewith in such a way that the rotating shaft 2, the flange 6 and first substrate 8, and the parts mounted on the first substrate 8 are enclosed in the protective cover 10. Of course, the protective cover 10 does not prevent the rotating shaft 2 from rotating.

[0015] The opening end of the protective cover 10 is closed by a circular fixing plate 27. A second substrate 11 is screwed to the inside of the fixing plate 27 and disposed in front of the first substrate 8 at an interval therefrom. A printed circuit board comprising electronic devices that constitute a signal reception circuit 12 is mounted on that surface of the second substrate 11, which is opposed to the first substrate 8.

[0016] The fixing plate 27 and the second substrate 11 are covered and protected by a cap 13 attached to the protective cover 10.

[0017] A secondary coil 14 of a transformer used as a power source is securely mounted on the rotating shaft 2 of the drive motor 1, and a primary coil 15 of the transformer used as a power source is mounted on the inner surface of the protective cover 10 opposite to the secondary coil 14. The transformer supplies power to the rotating section of the drive motor.

[0018] Figure 3 is a circuit diagram of the signal transmission circuit 7 and signal reception circuit 12 for the yarn-processing roller shown in Figure 1.

[0019] In Figure 3, the signal transmission circuit 7 is composed of a multiplexor 16, an amplifier 17, a voltage-frequency converter 18, and an optical transmission section 19. Detection signals from each of the temperature sensors 5a and 5b embedded in the roller body 3 and from the vibration sensor 9 are input to the multiplier 16, provided to the optical transmission section 19 through the amplifier 17 and voltage-frequency converter 18, and then transmitted through a light-emitting element 20 in the optical transmission section 19.

[0020] The signal reception circuit 10 is composed of a light reception section 22 that comprises a light-receiving element 21, a CPU (Central Processing Unit) 23, a gate circuit 24, and a power element 25 such as a thyristor. An optical signal from the light-emitting element 20 of the signal transmission circuit 7 is received by the light-receiving element 21, and the received signal is converted by the light receiving section 22 into an electric signal, which is then input to the CPU 23.

[0021] In this case, the multiplier 16 of the signal transmission circuit 7 is switched based on predetermined clock signals, and in response to this switching, an offset voltage from the amplifier 17 is switched to allow signals from the sensors 5a, 5b, and 9 to be identified by the signal reception circuit 10.

[0022] In this manner, the yarn-processing roller is operated to wind a yarn around the outer circumferential surface of the roller body 3, where the yarn is heated. While the yarn is thermally treated, based on the detection signals from the temperature sensors 5a and 5b, the CPU 23 controls the heater 4 through the gate circuit 24 and the power element 25 so as to maintain the temperature of the rotor body 3 within a preset temperature range.

[0023] Furthermore, when the detection signal from the vibration sensor 9 indicates that the vibrations exceed a preset vibration tolerance, the CPU 23 issues an alarm to indicate that a rotation error has occurred, and stops the rotation of the roller body 3. The cause of the rotation error is determined so that repairs of the yarn-processing roller can be effected.

[0024] As described above, in the yarn-processing roller according to the present invention, the vibration sensor 9 is attached to the rotating section (the first substrate 8) which rotates together with the rotating shaft 2 of the drive motor 1. Thus, the vibration level of the rotating shaft 2 can be directly detected to promptly and accurately detect rotation errors caused by bearing fatigue.

[0025] In addition, since the vibration sensor 9 is disposed at that end of the rotating shaft 2 which is opposed to the end to which the roller body 3 is attached, it can accurately detect rotation errors without being affected by the heater 4.

[0026] Furthermore, since the vibration sensor 9 is attached to the first substrate 8, no wiring for the vibration sensor 9 from outside the first substrate 8 is needed, and so all wiring work is easily performed.

[0027] According to the invention as set forth in Claim 1, the vibration sensor is provided in the rotating section, and the vibration level of the rotating shaft can be directly detected. Thus, rotation errors in the rotating shaft of the yarn-processing roller can be promptly and accurately detected so that the yarn-processing roller can be promptly repaired, as by replacing the bearing.

[0028] According to the invention as set forth in Claim 2, the rotating shaft of the drive motor is positioned in such a way as to penetrate the drive motor; in other words, the rotating shaft extends to the position opposed to the roller body via the drive motor without the use of a rotation transmission means such as a coupling. Thus, the vibration sensor can accurately detect vibrations at the position opposed to the roller body via the drive motor.

[0029] According to the invention set forth in Claim 3, the vibration sensor is attached to the substrate on the rotation section side that constitutes the noncontact signal transmission means, thereby eliminating the need to provide wiring to obtain detection signals from outside the substrate.

[0030] According to the invention as set forth in Claim 4, the protective cover can prevent foreign matter from accumulating on the substrate on the rotation section side and the vibration sensor provided on this substrate.

[0031] According to the invention as set forth in Claim 5, since the temperature sensor that rotates with the roller body to control the sensor is provided inside the circumferential wall of the roller body, the surface temperature of the roller body can be accurately detected and maintained. In addition, since the vibration sensor is opposed to the roller body via the drive motor, the vibration sensor is prevented from being affected by the heater and can detect rotation errors accurately.

[0032] According to the invention as set forth in Claim 6, detection signals from the vibration and temperature sensors can be transmitted from the rotating section to the locking section using a simple configuration.

[0033] According to the invention as set forth in Claim 7, the cotton central processing unit can process detection signals front the vibration and temperature sensors, thereby simplifying the configuration. When a rotation error is detected based on a detection signal from the vibration sensor, an alarm signal is issued to inform an operator of the error, thereby enabling corrective measures to be taken promptly. The drive motor is then stopped immediately so as to prevent the roller from incurring serious damage and minimize the amount of unacceptable yarn produced on account of vibrations.

Claims

1. A yarn-processing roller comprising a drive motor and a roller body attached to the rotating shaft of the drive motor, characterized in that a vibration sensor for detecting vibrations is provided in a rotating section that rotates with the rotating shaft of said drive motor.

2. A yarn-processing roller as in Claim 1, characterized in that the rotating shaft of said drive motor is disposed in such a way as to penetrate said drive motor from said roller body, and in that said vibration sensor is provided in a rotating section opposed to said roller body via the drive motor.

3. A yarn-processing roller as in Claim 1 or Claim 2, characterized in that the roller comprises a noncontact signal transmission means for transmitting a signal from said rotating section to a locking section opposed to the rotating section, and in that said vibration sensor is attached to the substrate on the rotating section side constituting the noncontact signal transmission means so that said noncontact signal transmission means transmits a detection signal from said vibration sensor to said locking section.

4. A yarn-processing roller as in Claim 3, characterized in that it comprises a protective cover surrounding said substrate on the rotation section side and said vibration sensor provided on this substrate.

5. A yarn-processing roller as in Claim 3 or Claim 4, characterized in that a heater is provided inside said roller body and a temperature sensor rotating with the roller body to control a heater is provided inside the circumferential wall of the roller body so that said noncontact signal transmission means transmits a detection signal from the temperature sensor to said locking section.

6. A yarn-processing roller as in Claim 5, characterized in that a common noncontact signal transmission means transmits detection signals from said vibration and temperature sensors to said locking section in a time-sharing manner.

7. A yarn-processing roller as in Claim 6, characterized in that detection signals obtained from said vibration and temperature sensors via said noncontact signal transmission means are input to a cannon central processing unit on the locking section side, in that the central processing unit controls the heater based on a detection signal from the temperature sensor and determines a rotation error based on a detection signal from the vibration sensor, and in that upon detecting a rotation error, the central processing unit issues an alarm signal while stopping said drive motor.

FIG. 1

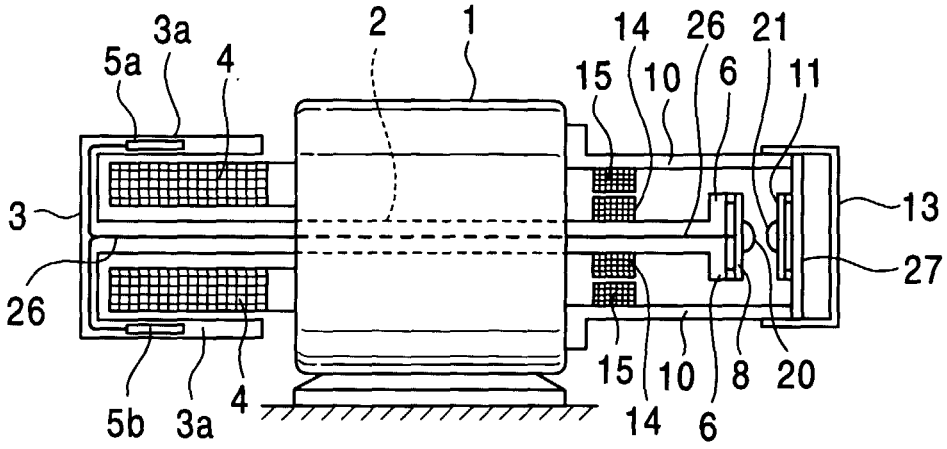
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FIG. 2

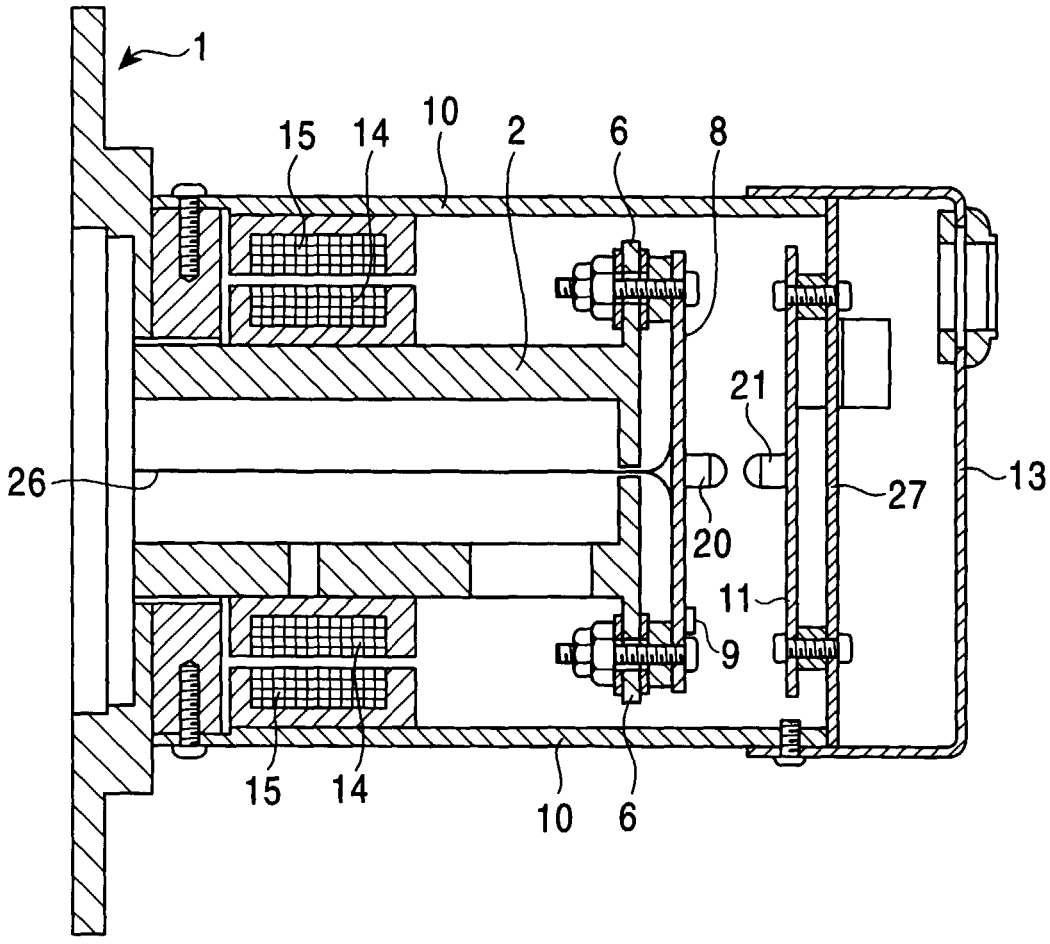
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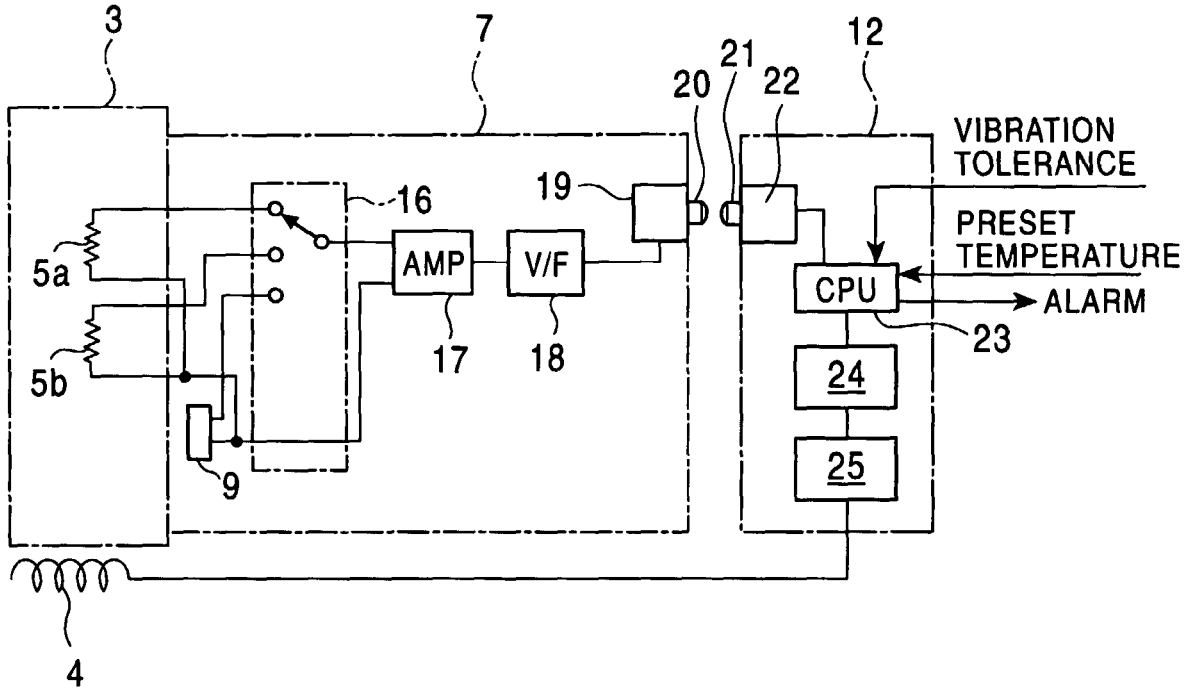
FIG. 3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EUROPEAN SEARCH REPORT

Application Number
EP 99 11 8546

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	7 February 2000	Barathe, R

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