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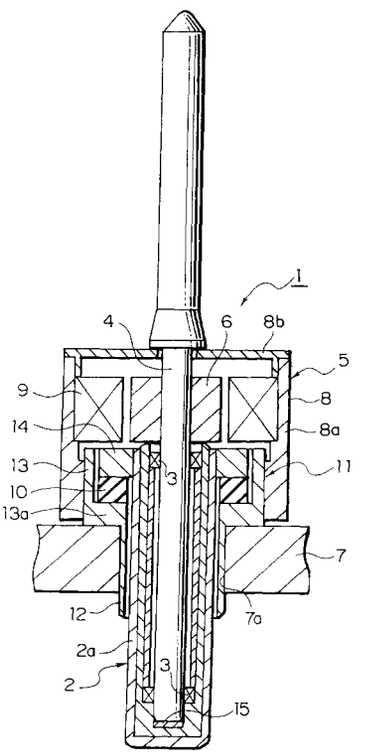
## (54) Single spindle driving device with vibration damping meams

(57) To provide a spindle device for driving a single spindle which is capable of preventing the vibration of a bolster from being directly transferred to a motor housing and in which it is easy to incorporate a buffer member. A spindle device (1) for driving a single spindle is provided with a rotor (6) and a stator (9). The rotor (6) is fixed to a spindle (4) in a manner that allows the rotor (6) to rotate together with the spindle (4) that is rotatably supported in a bolster (2). The stator (9) is fixed inside a motor housing (8) supported on a spindle rail (7). A buffer member (10) having a damper effect is placed between a housing (2a) of the bolster (2) and the motor housing (8) such that the buffer member (10) is fixed to a motor housing attaching portion (13) and a bolster attaching portion (14) only on its laterally extending faces. The buffer member (10) is fixed to the attaching portions (13 and 14) by thermal fusion. The buffer member (10) is shaped into a ring and placed such that it is sandwiched between the attaching portions (13 and 14).

FIG. 1




EP 1 156 141 A1

## Description

### BACKGROUND OF THE INVENTION

1. Field of the Invention

**[0001]** The present invention relates to a spindle device for driving a single spindle in a spinning machine which is used to drive spindles separately in a spinning machine such as a ring spinning frame or a ring twisting machine.

2. Description of the Related Art

**[0002]** Some recently proposed spinning frames have instead of only one motor for driving all the spindles in the spinning frame, a plurality of spindle-driving motors so that each spindle can have its own motor. This is aimed at making it possible to set a large number of spindles in the spinning frame, or to increase the rotational speed of the spindles.

**[0003]** As shown in Fig. 8, the motor for driving a single spindle is provided with a rotor 33 and a stator 35. The rotor 33 is fixed to the middle of a spindle 32 in a manner that allows the rotor 33 to rotate together with the spindle 32 that is rotatably supported in a bolster 30 through a bearing 31. The rotor 33 is positioned relative to the stator 35, which is fixed inside a motor housing 34. The motor housing 34 is fixed to the upper outer peripheral surface of a housing 30a of the bolster 30. The motor housing 34 has on its bottom a supporting tube 38 fixed thereto through a rubber damper 37. The bolster 30 is fitted to a spindle rail 36 by inserting the supporting tube 38 into an insertion hole 36a of the spindle rail 36 and fastening it with a nut (not-shown). The rubber damper 37 may be replaced by a flange formed in an upper part of the housing 30a. In this case, the housing 30a is inserted into the insertion hole 36a and then fastened and fixed by the flange and a nut.

**[0004]** Another structure is disclosed in Japanese Patent Application Laid-open No. 3-59120, where a rubber metal element is fitted between the outer race of a bearing of a spindle to which a rotor is fixed and the inner surface of a spindle housing. A motor housing in this case is fixed to the spindle housing.

**[0005]** In the structure of Fig. 8 where the housing 30a of the bolster 30 and the motor housing 34 are not separated from each other, the vibration of the spindle 32 is transferred to the motor housing 34 through the bolster 30 despite the rubber damper 37 being provided between the motor housing 34 and the spindle rail 36. As a result, solder or the like of electric components provided in the motor housing 34 breaks from fatigue to reduce the durability of the motor for driving a single spindle. Furthermore, the motor housing 34 vibrates together with the housing 30a of the bolster 30 to multiply the vibration, thereby putting a great load on the bearing 31.

**[0006]** On the other hand, the structure disclosed in Japanese Patent Application Laid-open No. 3-59120 transfers the vibration of the spindle to the motor housing with the vibration attenuated, owing to the rubber metal element (buffer member) provided between the spindle and the spindle housing. However, if the buffer member made of an elastic member such as rubber is to be attached between two cylindrical members, there are difficulties in firmly fixing the buffer member to both of the two cylindrical members.

**[0007]** This is because, in an attempt to firmly fix the buffer member to the two cylindrical members with an adhesive where the adhesive is applied to the opposing surfaces of the cylindrical members and then the rubber-made buffer member is inserted and fitted to the gap between the cylindrical members, the adhesive is scraped off by the rubber, failing to provide the necessary degree of adhesion.

**[0008]** Accordingly, in order to obtain the necessary degree of adhesion, heat melted rubber has to be poured into the gap between the two cylindrical members whose opposing surfaces are already coated with the adhesive and the rubber has to be sulfurized simultaneously. In this case, however, the melted rubber shrinks when it is cooled, which leaves a large residual stress within the rubber. The residual stress is a hindrance in obtaining desired damping characteristics. In addition, the rubber is placed between the two cylindrical members with a tension applied thereto and hence when the rubber is damaged the damage is great.

**[0009]** There are two methods to solve this disadvantage. One method is to pour the heat melted rubber into the gap between the two cylindrical members with the outer one having a larger diameter and to sulfurize the rubber simultaneously. The diameter of the outer member is then reduced so as not to leave any residual stress in the rubber. The other method is to pour the heat melted rubber in the gap between the two cylindrical members with the inner one having a smaller diameter and to sulfurize the rubber simultaneously. The diameter of the inner member is then increased so as not to leave any residual stress in the rubber. However, both methods are complicated.

### SUMMARY OF THE INVENTION

**[0010]** The present invention has been made in view of the above problems, and an object of the present invention is to therefore provide a spindle device for driving a single spindle in a spinning machine which can prevent the vibration of a bolster from being transferred directly to a motor housing and which is easy to incorporate a buffer member into.

**[0011]** In order to attain the above object, the main aspect of the present invention provides a spindle device for driving a single spindle in a spinning machine, comprising a spindle and a motor that drives the spindle, the spindle being rotatably supported in a bolster, the motor having a rotor and a stator, the rotor being fixed

to the spindle in a manner that allows the rotor to rotate together with the spindle, the stator being fixed inside a motor housing that is supported on a spindle rail,

characterized in that a buffer member having a damper effect is provided between a housing of the bolster and the motor housing such that the buffer member is fixed to the housings, or to their respective attaching portions, only on its laterally extending faces.

**[0012]** This structure transfers the vibration of the spindle to the motor housing not directly but attenuated, for the buffer member having a damper effect is provided between the housing of the bolster and the motor housing. Accordingly, breakage from fatigue of solder or the like of electric components provided in the motor housing can be controlled, thereby improving the durability of the motor for driving a single spindle. Moreover, the buffering member, which is fixed to the housings, or to their respective attaching portions, only on its laterally extending faces, does not scrape any adhesive off to provide the necessary degree of adhesion when the adhesive is used alone. The present invention is advantageous also in the case where heat melted rubber is poured into the gap between the housings, or between their attaching portions, and placed in a mold to sulfurize the rubber upon manufacturing. A specific advantage given by the invention in this case is obtainment of a desired damping characteristic because the invention can prevent residual stress that could be generated when the rubber is cooled and affect the device.

**[0013]** The buffer member is fixed to the housings, or to their respective attaching portions, preferably by thermal fusion. This enhances the degree of adhesion as compared with the case where the buffer member is fixed to the housings, or to their respective attaching portions, by an adhesive alone. The term thermal fusion herein means bonding that involves heat melting a material of the buffer member, such as rubber, once. Thermal fusion includes, in addition to sulfurizing bonding, post-bonding in which rubber is sulfurized in advance and only the bonding face of the rubber is heat melted to be bonded.

**[0014]** Preferably, the spindle device for driving a single spindle in a spinning machine further comprises a separating buffer member for separating the spindle rail and the motor housing from each other. In addition to the vibration of the spindle being transferred to the motor housing with the vibration attenuated, the spindle device that has the separating buffer member for separating the spindle rail and the motor housing from each other can prevent the spindle rail from transferring its vibration to the motor housing.

**[0015]** The buffer member may be shaped into a ring and placed such that it is sandwiched between the attaching portion for the housing of the bolster and the attaching portion for the motor housing. This simplifies the structure for attaching the buffer member to the housings.

**[0016]** Preferably, the housings are attachable to the spindle rail through a supporting body provided with the ring-shaped buffer member; the supporting body is provided with a spindle rail attaching portion for attaching the spindle rail and a motor housing attaching portion integrally formed on top of the spindle rail attaching portion; the buffer member is fixed on the motor housing attaching portion; and a bolster attaching portion that is shaped into a ring and is fixed to the top face of the buffer member. This simplifies the structure of the supporting body for attaching the housings to the spindle rail.

**[0017]** Desirably, the housings are attachable to the spindle rail through a supporting body provided with the ring-shaped buffer member; the supporting body is provided with a spindle rail attaching portion for attaching the spindle rail, a motor housing attaching portion that is shaped into a ring and placed on the spindle rail attaching portion outside of the buffer member, and a bolster attaching portion that is shaped into a ring and placed inside of the buffer member; and the buffer member serves also as the separating buffer member. The components in this structure are smaller in number than the case where the buffer member and the separating buffer member are separate components, thereby simplifying the manufacture.

**[0018]** The bolster attaching portion may be formed so as to be integrated with the housing of the bolster. It is also desirable to form the buffer member from layers of viscous elastic bodies a partitioning plate sandwiched between each layers. In this case, the plural viscous elastic bodies may be formed of different materials. Also, the plural viscous elastic bodies may form layers coupled with one another on their inner periphery side or outer periphery side.

## BRIEF DESCRIPTION OF THE DRAWINGS

**[0019]** In the accompanying drawings:

Fig. 1 is a schematic sectional view showing a spindle device for driving a single spindle according to Embodiment 1 of the present invention;

Fig. 2 is a partial schematic sectional view showing a spindle device for driving a single spindle according to Embodiment 2 of the present invention;

Fig. 3 is a partial schematic sectional view illustrating Embodiment 3 that is a modification example of Embodiment 2;

Fig. 4 is a partial schematic sectional view showing a buffer member according to another embodiment of the present invention;

Fig. 5 is a partial schematic sectional view showing a buffer member according to still another embodiment of the present invention;

Fig. 6 is a partial schematic sectional view showing a buffer member according to yet still another embodiment of the present invention;

Fig. 7 is a partial schematic sectional view showing a buffer member according to yet still another em-

bodiment of the present invention; and
Fig. 8 is a schematic sectional view showing a conventional spindle device for driving a single spindle.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

### Embodiment 1

**[0020]** Embodiment 1 that embodies the present invention will be described below with reference to Fig. 1. A spindle device 1 for driving a single spindle is provided with a motor 5 for driving a spindle 4. The spindle 4 is rotatably supported in a bolster 2 through radial bearings 3. The motor 5 is provided with a rotor 6 and a stator 9. The rotor 6 is fixed to the spindle 4 in a manner that allows the rotor 6 to rotate together with the spindle 4. The stator 9 is fixed inside a motor housing 8 that is supported on a spindle rail 7.

**[0021]** The motor housing 8 is attachable to the spindle rail 7 through a supporting body 11 that is provided with a buffer member 10 having a damper effect. The buffer member 10 is formed of sulfurized rubber and shaped into a ring. The supporting body 11 is provided with a spindle rail attaching portion 12 for attaching the spindle rail 7, a motor housing attaching portion 13 integrally formed on top of the spindle rail attaching portion 12, the buffer member 10, and a bolster attaching portion 14 that is shaped into a ring. The motor housing attaching portion 13 is formed into a cylinder having a flange 13a on its lower part. The inner diameter of the cylindrical part of the motor housing attaching portion 13 is larger than the outer diameter of the buffer member 10. The inner diameter of the buffer member 10 is the same as or larger than the inner diameter of the spindle rail attaching portion 12 so that the buffer member 10 does not contact with a housing 2a of the bolster 2. The buffer member 10 is fixed on the flange 13a inside the motor housing attaching portion 13 such that the buffer member 10 is coaxial with the spindle rail attaching portion 12. The bolster attaching portion 14 is fixed to the top face of the buffer member 10. In other words, the buffer member 10 is placed such that it is sandwiched between the motor housing attaching portion 13 and the bolster attaching portion 14 and it is fixed to the attaching portions 13 and 14 only on its laterally extending faces. The bolster attaching portion 14 has the same outer diameter as the buffer member 10 and has an inner diameter smaller than that of the buffer member 10.

**[0022]** The motor housing 8 is comprised of a cylindrical main body 8a and a cover 8b for covering the upper opening thereof. The inner surface of the main body 8a has a stepped portion for positioning the stator 9 when the stator 9 is to be incorporated. The stator 9 is incorporated with an inner upper part of the motor housing 8 with its lower end engaging with the stepped portion and its upper end engaging with the lower end of the cover 8b.

**[0023]** The lower part of the main body 8a is engagingly fitted to the outer peripheral surface of the motor housing attaching portion 13. The main body 8a is fixed to the motor housing attaching portion 13a such that the lower end of the main body is positioned above the lower end of the flange 13a of the motor housing attaching portion 13. Therefore the main body 8a is not in contact with the spindle rail 7 when the supporting body 11 is attached to the spindle rail 7. The supporting body 11 is attached to the spindle rail 7 by fitting the spindle rail attaching portion 12 into an insertion hole 7a formed in the spindle rail 7.

**[0024]** The bolster 2 has a housing 2a that is formed into a bottomed cylinder. The housing 2a is engagingly fitted to the bolster attaching portion 14 on its upper outer periphery. The housing 2a is attached to the bolster attaching portion 14 of the supporting body 11 in a manner that makes the housing to pierce through the supporting body 11 without touching the spindle rail attaching portion 12. The radial bearings 3 are placed inside the bolster 2 with one bearing positioned in an upper part of the bolster 2 and another bearing positioned in a lower part thereof. A thrust bearing 15 abutting against the bottom of the spindle 4 is placed in an inner lower part of the bolster 2.

**[0025]** In manufacturing the supporting body 11, the attaching portions 12, 13 and 14 are placed in their respective positions in a mold, and a spacer is arranged to prevent rubber from entering into the gap between the inner peripheral surface of the motor housing attaching portion 13 and the outer peripheral surface of the bolster attaching portion 14. An adhesive for rubber is then applied to the surfaces of the motor housing attaching portion 13 and the bolster attaching portion 14 to which the buffer member 10 is to be fixed. In this state, the mold and rubber having sulfur or other sulfurizing substances mixed therein are pressurized and heated, and the heat melted rubber is poured into the mold with pressure to thereby sulfurize the rubber. After the rubber is cooled, the molded supporting body 11 is removed from the mold. The melted rubber is firmly fixed (adhered) only to the surfaces that have been coated with the adhesive. That is, the buffer member 10 is fixed to the attaching portions 13 and 14 only on its laterally extending faces. The rubber shrinks when it is cooled, but only a little residual stress is generated because the motor housing attaching portion 13 and the bolster attaching portion 14 can move in the axial direction of the supporting body 11.

**[0026]** To assemble the spindle device 1 for driving a single spindle, the housing 2a of the bolster 2 is fixed by press fitting to the bolster attaching portion 14 of the supporting body 11 manufactured as above. At the same time, the main body 8a of the motor housing 8 is fixed by press fitting to the motor housing attaching portion 13.

**[0027]** Described next is the operation of the thus structured spindle device 1 for driving a single spindle.

**[0028]** The spindle device 1 for driving a single spindle is incorporated with the spindle rail 7 by engagingly fitting the spindle rail attaching portion 12 of the supporting body 11 to the insertion hole 7a of the spindle rail 7. The spindle rail attaching portion 12 may have a threaded portion so that it can be fixed to the spindle rail by fastening a nut.

**[0029]** The motor 5 is driven to rotate the spindle 4 while a spinning machine is running. With the rotation of the spindle 4, thread is wound onto a not-shown bobbin mounted to the spindle 4. The vibration accompanying the rotation of the spindle 4 is transferred through the radial bearings 3 to the bolster 2, and the vibration of the bolster 2 is then transferred through the supporting body 11 to the motor housing 8. The motor housing attaching portion 13 and the bolster attaching portion 14 that constitute the supporting body 11 have the buffer member 10 interposed therebetween, so that the vibration of the bolster 2 is transferred to the motor housing 8 after the vibration is largely attenuated by the damper effect of the buffer member 10. Accordingly, only a very small amount of vibration acts on solder or the like of the electric components provided in the motor housing 8. The motor housing 8 is also prevented from vibrating badly as a unit with the housing 2a of the bolster 2, thereby reducing the load imparted to the radial bearings 3.

**[0030]** The following effects can be obtained from Embodiment 1.

(1) As the buffer member 10 provided between the housing 2a of the bolster 2 and the motor housing 8 has a damper effect, the vibration of the spindle 4 is not transferred directly to the motor housing 8 from the bolster 2 but is attenuated first. Therefore breakage of from fatigue of the solder or the like of the electric components provided in the motor housing 8 can be prevented from, resulting in improved durability of the motor 5.

(2) The buffer member 10 is fixed to the motor housing attaching portion 13 and the bolster attaching portion 14 only on its laterally extending faces. Therefore, when the buffer member is manufactured by pouring under pressure the heat melted rubber into the gap between the motor housing attaching portion 13 and the bolster attaching portion 14 that are placed in the mold to sulfurize the rubber, there is no fear of generating harmful residual stress after the rubber is cooled. As a result, the buffer member 10 can have a desired damping characteristic. Embodiment 1 is advantageous also in the case of using an adhesive alone, for the adhesive is not scraped off by the rubber during bonding work and hence the degree of adhesion is not impaired.

(3) The buffer member 10 is fixed to the attaching portions 13 and 14 by thermal fusion and hence the adhesion is larger than the case where an adhesive is used alone to fix the attaching portions 13 and 14. Therefore it is easy to secure the necessary degree of adhesion.

(4) The buffer member 10 is shaped into a ring and is placed such that it is sandwiched between the motor housing attaching portion 13 and the bolster attaching portion 14. This simplifies the structure for attaching the buffer member 10 to the housings 8 and 2a.

(5) The housings 8 and 2a are attachable to the spindle rail 7 through the supporting body 11 provided with the ring-shaped buffer member 10. The supporting body 11 is provided with the spindle rail attaching portion 12 for attaching the spindle rail 7, the motor housing attaching portion 13 integrally formed on top of the spindle rail attaching portion 12, and the bolster attaching portion 14 that is shaped into a ring and is fixed above the attaching portion 13 with the buffer member 10 interposed therebetween. This simplifies the structure of the supporting body 11 for attaching the housings 8 and 2a to the spindle rail 7.

(6) The supporting body 11 for attaching the housings 8 and 2a to the spindle rail 7 is manufactured separately from the housings 8 and 2a. Then the housings 8 and 2a are incorporated with the separately manufactured supporting body 11. Therefore, compared with the case where the housings 8 and 2a are formed so as to be integrated with the attaching portions 13 and 14, the manufacture mold for fixing the buffer member 10 to the attaching portions 13 and 14 by thermal fusion can be made smaller. This is favorable in keeping manufacturing costs low.

Embodiment 2

**[0031]** Embodiment 2 will be described next with reference to Fig. 2. The big difference between this embodiment and Embodiment 1 is that a spindle device 1 for driving a single spindle of this embodiment has a separating buffer member that separates the spindle rail 7 and the motor housing 8 from each other. The same components as those in Embodiment 1 are denoted by the same reference symbols to omit detailed descriptions thereof.

**[0032]** In the supporting body 11, a spindle rail attaching portion 22 for attaching the spindle rail 7 is formed separately from a motor housing attaching portion 23. A buffer member 20 is placed between the attaching portions 22 and 23, and is fixed on a flange 22a of the spindle rail attaching portion 22. The motor housing attaching portion 23 is shaped into a ring. A bolster attaching portion 24 is formed into a cylinder that has on its lower part a flange 24a. The motor housing attaching portion 23 is placed outside of the buffer member 20 and the bolster attaching portion 24 is placed inside of the buffer member 20. That is, the buffer member 20 serves as the buffer member for attenuating the vibration transferred to the motor housing attaching portion 23 from

the bolster attaching portion 24 and also as the separating buffer member for separating the motor housing 8 and the spindle rail 7 from each other.

**[0033]** The motor housing attaching portion 23 is fixed to the buffer member 20 on its bottom face. The bolster attaching portion 24 is fixed to the buffer member 20 on the top and bottom faces of the flange 24a. In short, the attaching portions 23 and 24 are fixed to the buffer member 20 only on their laterally extending faces.

**[0034]** The motor housing 8 is attached to the supporting body 11 by engagingly fitting a lower part of the main body 8a to the outer peripheral surface of the motor housing attaching portion 23.

**[0035]** In manufacturing the supporting body 11, the attaching portions 22, 23 and 24 are placed in their respective positions in a mold. An adhesive for rubber is then applied to the surfaces of the motor housing attaching portion 23 and the bolster attaching portion 24 to which the buffer member 20 is to be fixed. Specifically, the surfaces to be coated with the adhesive are a lower inside surface of the attaching portion 23 and the top and bottom faces of the flange 24a of the bolster attaching portion 24. In this state, the mold and rubber having sulfur or other sulfurizing substances mixed therein are pressurized and heated, and the heat melted rubber is poured into the mold under pressure to thereby sulfurize the rubber. After the rubber is cooled, the molded supporting body 11 is removed from the mold. The melted rubber is firmly fixed (adhered) only to the surfaces that have been coated with the adhesive. Therefore the rubber is not fixed to the inner peripheral surface of the motor housing attaching portion 23, the outer peripheral surface of the cylindrical part of the bolster attaching portion 24, and the outer peripheral surface of the flange 24a. As a result, the shrinkage of the rubber when it is cooled is not restricted in the axial direction of the supporting body 11 by the motor housing attaching portion 23 and the bolster attaching portion 24. Embodiment 2 is thus successful in reducing the residual stress in the buffer member 20 as in Embodiment 1 described above.

**[0036]** Accordingly, Embodiment 2 can provide the following effects in addition to the effects (1) to (4) and (6) of Embodiment 1.

(7) Owing to the separating buffer member for separating the spindle rail 7 and the motor housing 8 from each other, the vibration of the spindle rail 7 can be prevented from being transferred to the motor housing 8. As a result, it is possible to block transfer of the vibration of the spinning machine to the motor housing 8 through the spindle rail 7.

(8) The buffer member 20 also serves as the separating buffer member. Therefore the number of components is reduced in comparison with the case where the buffer member interposed between the bolster 2 and the motor housing 8 and the separating buffer member are separate components. This simplifies the manufacture.

Embodiment 3

**[0037]** Embodiment 3 will be described next with reference to Fig. 3. In Embodiment 3, the structure of the supporting body 11 according to Embodiment 2 is modified. The motor housing attaching portion 23 in this embodiment is formed into a cylinder having a flange 23a on its lower part, and the bolster attaching portion 24 in this embodiment is shaped into a ring. In short, the forms of the attaching portions 23 and 24 of Embodiment 2 are switched in this embodiment. This structure is capable of providing the same effects as Embodiment 2.

Embodiment 4

**[0038]** Embodiment 4 will be described next with reference to Fig. 4. Embodiment 4 is identical with Embodiment 1 except for the structure of the buffer member. Therefore, the same components as those in Embodiment 1 will be denoted by the same reference symbols to omit detailed descriptions thereof.

**[0039]** A buffer member 100 comprises layers of viscous elastic bodies 101 sandwiching a partitioning plate 102 between each layer. In this embodiment, there are two layers of viscous elastic bodies 101. The viscous elastic bodies 101 and partitioning plate 102 are each formed into a flat ring and are arranged horizontally. The partitioning plate 102 is formed of a rigid body (e.g., a steel plate). The viscous elastic bodies 101 are formed of sulfurized rubber. The buffer member 100 is manufactured, for instance, by placing the partitioning plate 102 at a given position in a mold, pressurizing and heating the mold and rubber having sulfur or other sulfurizing substances mixed therein, and pouring the heat melted rubber into the mold under pressure to sulfurize the rubber.

**[0040]** As described above, the buffer member 100 has layers (two layers, in this embodiment) of viscous elastic bodies 101 sandwiching a partitioning plate between each layer. Thus the buffer member 100 has a superior damper effect compared to Embodiment 1 in which a single layer viscous elastic body is used to form the buffer member. Furthermore, the partitioning plate 102 interposed between the viscous elastic bodies 101 functions as a dummy mass. To elaborate, the partitioning plate 102 vibrates instead of the spindle 4 to thereby increase the attenuation constant in the shearing direction. As a result, the vibration of the spindle 4 can effectively be attenuated even when the spinning machine is operated at high speed, thereby keeping the vibration of the spindle 4 from multiplying. This makes the load of the bearings 3 smaller.

**[0041]** Embodiment 4 provides the following effects.

(9) The buffer member 100 comprises layers of viscous elastic bodies 101 sandwiching a partitioning plate 102 between each layer. Therefore the attenuation constant is larger than in the structure where

a single layer viscous elastic body is used, if the volume of the buffer member thereof is the same as the buffer member 100. The large attenuation constant can prevent the vibration of the spindle 4 from multiplying even when the spinning machine is operated at high speed.

(10) The buffer member 100 is used with the plural viscous elastic bodies 101 arranged horizontally. Therefore the spring constant in the compression direction of the buffer member 100 can be increased while the spring constant in the shearing direction of the buffer member 100 is kept constant.

(11) The viscous elastic bodies 101 and the partitioning plate 102 are fixed to one another by thermal fusion. Therefore, as compared with the case where an adhesive is used to fix the bodies and the plate, the adhesion is larger and the required degree of adhesion can be readily ensured.

Embodiment 5

**[0042]** Embodiment 5 will be described next with reference to Fig. 5.

**[0043]** In Embodiment 5, the buffer member 100 comprises two layers of viscous elastic bodies with the partitioning plate 102 sandwiched therebetween as in Embodiment 4. However, viscous elastic bodies 101a and 101b of this embodiment are formed of different materials. In this case, adjustment for setting the vibration preventive characteristic of the buffer member 100 and the dimension thereof to a value required for the spindle can be made relatively easy without increasing the cost. To clarify the definition of the "different materials" mentioned above, not only different kinds of rubber (or elastomers) are regarded as different materials but also different degrees of rubber sulfurization constitute different materials.

Embodiment 6

**[0044]** Embodiment 6 will be described next with reference to Fig. 6.

**[0045]** Embodiment 6 is similar to Embodiment 4 in that the buffer member 100 comprises layers of viscous elastic bodies 101 sandwiching a partitioning plate 102 between each layer. However, this embodiment has three layers of viscous elastic bodies 101 that constitute the buffer member 100. Four or more layers of viscous elastic bodies may also be used. In this case, all layers may be formed of either the same material or different materials, or two layers out of all the layers may be formed of the same material.

Embodiment 7

**[0046]** Embodiment 7 will be described next with reference to Fig. 7.

**[0047]** Embodiment 7 is similar to the foregoing embodiments in that a buffer member 110 comprises layer of viscous elastic bodies 111 sandwiching a partitioning plate 112 between each layer. The plural viscous elastic bodies 111 are each shaped into a ring and, as shown in Fig. 7, are coupled to one another on their outer periphery side. Alternatively, the viscous elastic bodies 111 may be coupled to one another on their inner periphery side. In this case, the structure of a mold used in manufacturing the buffer member 110 by insertion molding is simplified, to thereby reduce the manufacturing cost.

**[0048]** When a buffer member comprises a multi-layer structure, an adhesive may be used to fix to one another the viscous elastic bodies 101 and the partitioning plate 102 that constitute the buffer member 100, or the viscous elastic bodies 111 and the partitioning plate 112 that constitute the buffer member 110.

**[0049]** The partitioning plate 102 or 112 is not limited to a metal plate such as a steel plate or an aluminum plate but may be a resin plate or a ceramic plate. The thickness of the partitioning plate may be suitably modified.

**[0050]** The mode for carrying out the present invention is not limited to the embodiments above. For example, the present invention may be embodied as follows.

(a) The buffer member interposed between the bolster 2 and the motor housing 8 and the separating buffer member may be separate components. For instance, in Embodiment 1, the separating buffer member may be interposed between the flange 13a of the motor housing attaching portion 13 and the spindle rail 7. Alternatively, the separating buffer may be interposed between the spindle rail attaching portion 12 of the supporting body 11 and the motor housing attaching portion 13 thereof which are formed as separate components.

(b) The faces of the buffer member 10 which are to be fixed to the housings 8 and 2a or to their respective attaching portions 13 and 14 (or the faces of the buffer member 20 which are to be fixed to the housings 8 and 2a or to their respective attaching portions 23 and 24) need not necessarily be perpendicular to the axial direction of the spindle 4. The faces may extend in the direction that intersects with the spindle axial direction obliquely. In other words, the faces extending in the lateral direction include not only the horizontal faces but also somewhat slanted faces.

(c) The motor housing attaching portion 13 or 23 may be formed so as to be integrated with the motor housing 8. The bolster attaching portion 14 or 24 may be formed so as to be integrated with the housing 2a of the bolster 2. That is, the motor housing attaching portion 13 or 23 and the bolster attaching portion 14 or 24 are substantially eliminated, and the buffer member 10 or 20 is fixed between the motor housing 8 and the housing 2a of the bolster 2. If the buffer member 10 or 20 is set between the hous-

ings 2a and 8 by thermal fusion here, the mold used in the manufacture thereof is increased in size but the number of steps in assembling the spindle device 1 for driving a single spindle is reduced.

(d) The housing 2a of the bolster 2 is formed so as to be integrated with the bolster attaching portion 14 or 24. The motor housing 8 is formed separately from the motor housing attaching portion 13 or 23. In this case, the assembly of the spindle device 1 for driving a single spindle is less troublesome and the maintenance is facilitated as well because the motor 5 can be removed while the bolster 2 is kept fixed to the spindle rail 7.

(e) The buffer member 10 is not limited to the ring shape. A plurality of buffer members may instead be used to together form a shape approximate to a ring.

(f) An adhesive may be used alone, instead of using the adhesive in combination with the thermal fusion, to fix the buffer member 10 to the housings 8 and 2a, or to their respective attaching portions 13 and 14 (or to fix the buffer member 20 to the housings 8 and 2a, or to their respective attaching portions 23 and 24).

(g) The buffer member 10 or 20 may be formed of materials having a damper effect other than rubber. For instance, elastomer may be used.

(h) Threaded portions may be formed in the attaching portions 13 and 14 (or 23 and 24) and in the housings 8 and 2a. Then the housings 8 and 2a can be fixed to the attaching portions 13 and 14 (or 23 and 24) through engagement.

## Claims

**1.** A spindle device (1) for driving a single spindle in a spinning machine, comprising a spindle (4) and a motor (5) that drives said spindle (4), said spindle (4) being rotatably supported in a bolster (2), said motor (5) having a rotor (6) and a stator (9), said rotor (6) being fixed to said spindle (4) in a manner that allows said rotor (6) to rotate together with said spindle (4), said stator (9) being fixed inside a motor housing (8) that is supported on a spindle rail (7),

wherein a buffer member (10 or 20) having a damper effect is provided between a housing (2a) of said bolster (2) and said motor housing (8) such that said buffer member (10 or 20) is fixed to said housings (2a and 8), or to their respective attaching portions (13 and 14, or 23 and 24), only on its laterally extending faces.

**2.** A spindle device for driving a single spindle in a spinning machine as claimed in claim 1, wherein said buffer member (10 or 20) is fixed to said housings (2a and 8), or to their respective attaching portions (13 and 14, or 23 and 24), by thermal fusion.

**3.** A spindle device for driving a single spindle in a spinning machine as claimed in claim 1 or 2, further comprising a separating buffer member (20) for separating said spindle rail (7) and said motor housing (8) from each other.

**4.** A spindle device for driving a single spindle in a spinning machine as claimed in any one of claims 1 to 3, wherein said buffer member (10 or 20) is shaped into a ring and is placed such that it is sandwiched between said attaching portion (14 or 24) for said housing (2a) of said bolster (2) and said attaching portion (13 or 23) for said motor housing (8).

**5.** A spindle device for driving a single spindle in a spinning machine as claimed in claim 4, wherein:

said housings (2a and 8) are attachable to said spindle rail (7) through a supporting body (11) provided with said ring-shaped buffer member (10);

said supporting body (11) is provided with a spindle rail attaching portion (12) for attaching said spindle rail (7) and a motor housing attaching portion (13) integrally formed on top of the spindle rail attaching portion (12);

said buffer member (10) is fixed on the motor housing attaching portion (13); and

a bolster attaching portion (14) that is shaped into a ring and is fixed to the top face of said buffer member (10).

**6.** A spindle device for driving a single spindle in a spinning machine as claimed in claim 4, wherein:

said housings (2a and 8) are attachable to said spindle rail (7) through a supporting body (11) provided with said ring-shaped buffer member (20);

said supporting body (11) is provided with a spindle rail attaching portion (22) for attaching said spindle rail (7), a motor housing attaching portion (23) that is shaped into a ring and placed on the spindle rail attaching portion (22) outside of said buffer member (20), and a bolster attaching portion (24) that is shaped into a ring and placed inside of said buffer member (20); and

said buffer member (20) serves also as said separating buffer member (20).

**7.** A spindle device for driving a single spindle in a spinning machine as claimed in claim 5 or 6, wherein said bolster attaching portion (14 or 24) that is shaped into a ring is formed so as to be integral with said housing (2a) of said bolster (2).

**8.** A spindle device for driving a single spindle in a

spinning machine as claimed in any one of claims 1 to 7, wherein said buffer member (100) comprises layers of viscous elastic bodies (101 or 111) sandwiching a partitioning plate (102 or 112) between each layer.

**9.** A spindle device for driving a single spindle in a spinning machine as claimed in claim 8, wherein said plural viscous elastic bodies (101) are formed of different materials.

**10.** A spindle device for driving a single spindle in a spinning machine as claimed in claim 8, wherein said plural viscous elastic bodies (111) form layers coupled with one another on their inner periphery side or outer periphery side.

FIG. 1

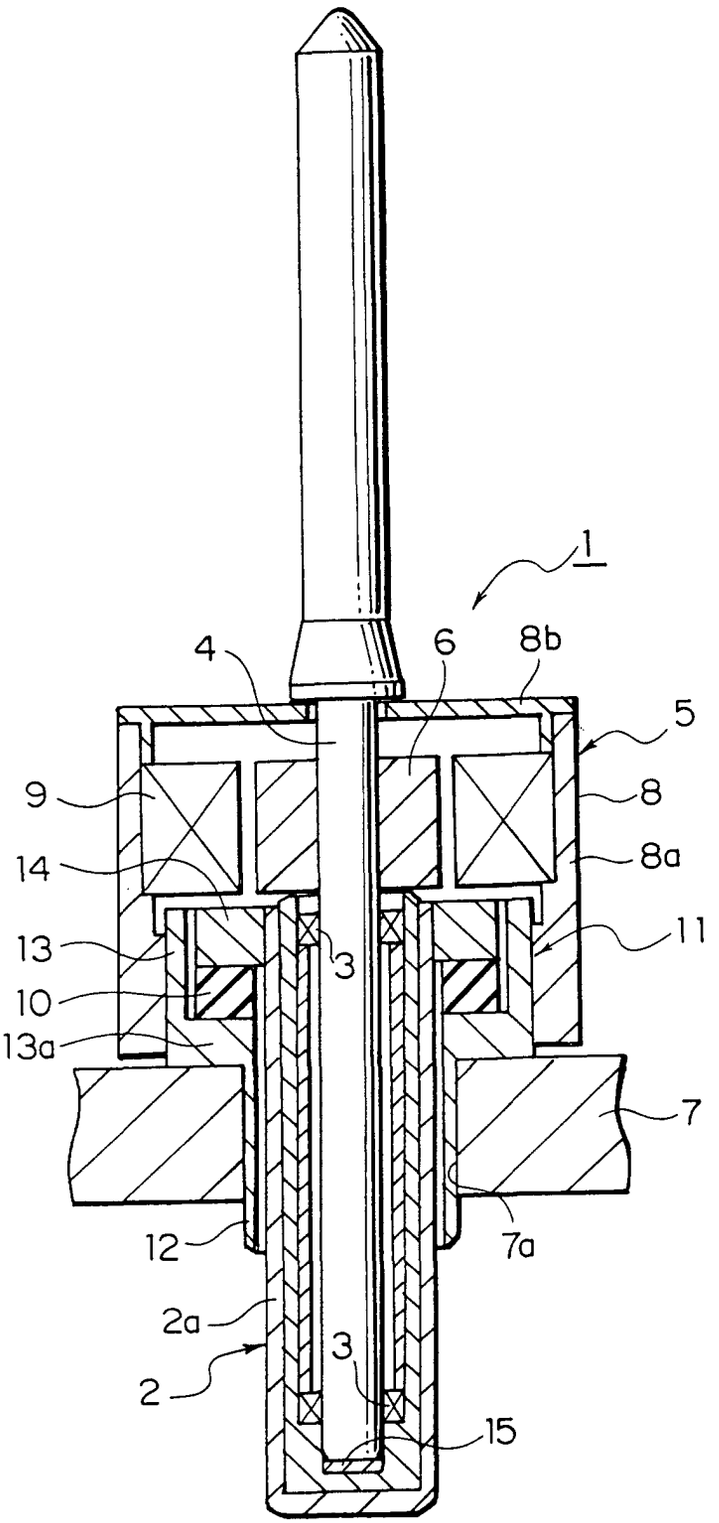


FIG. 2

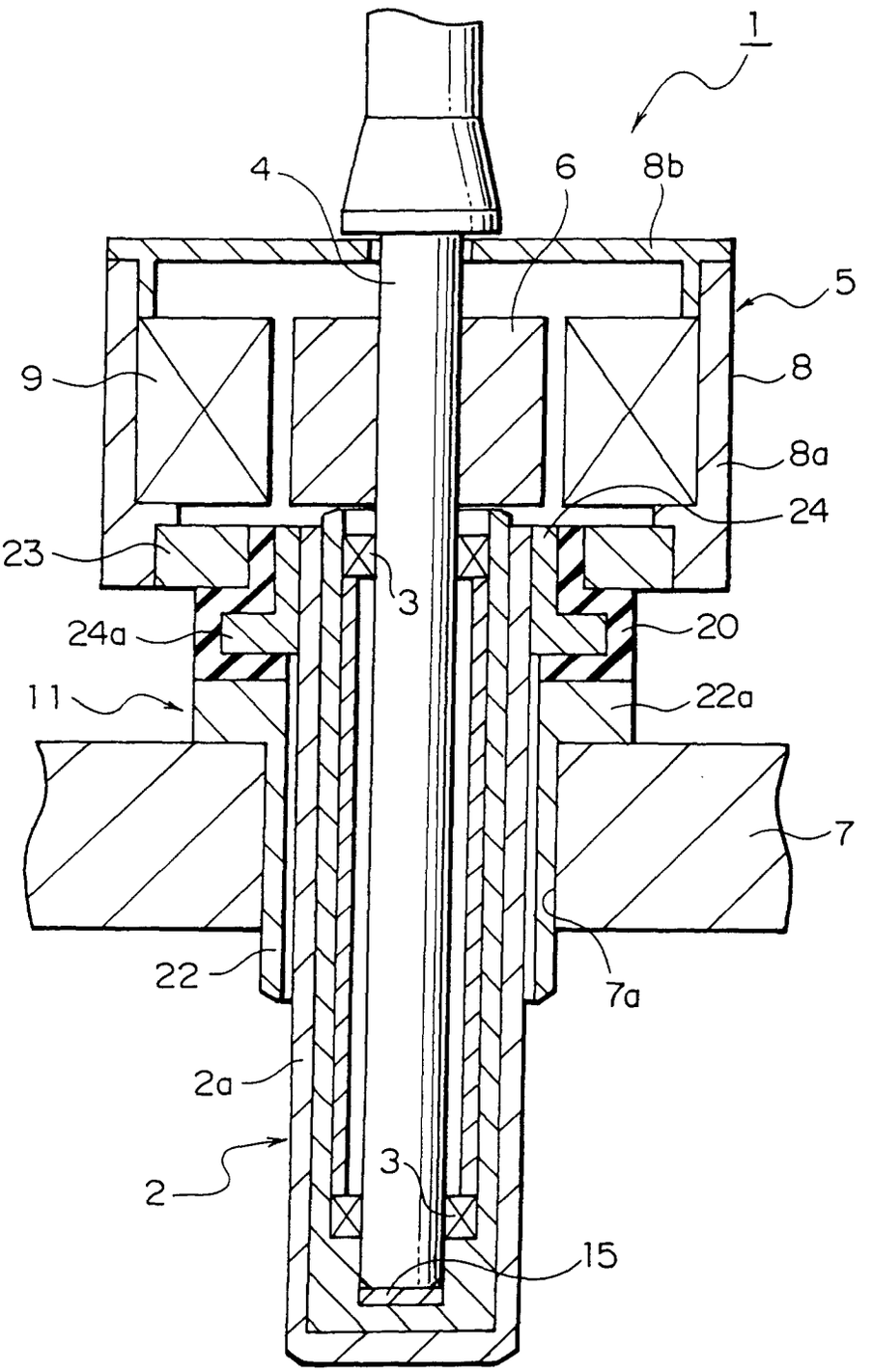


FIG. 3

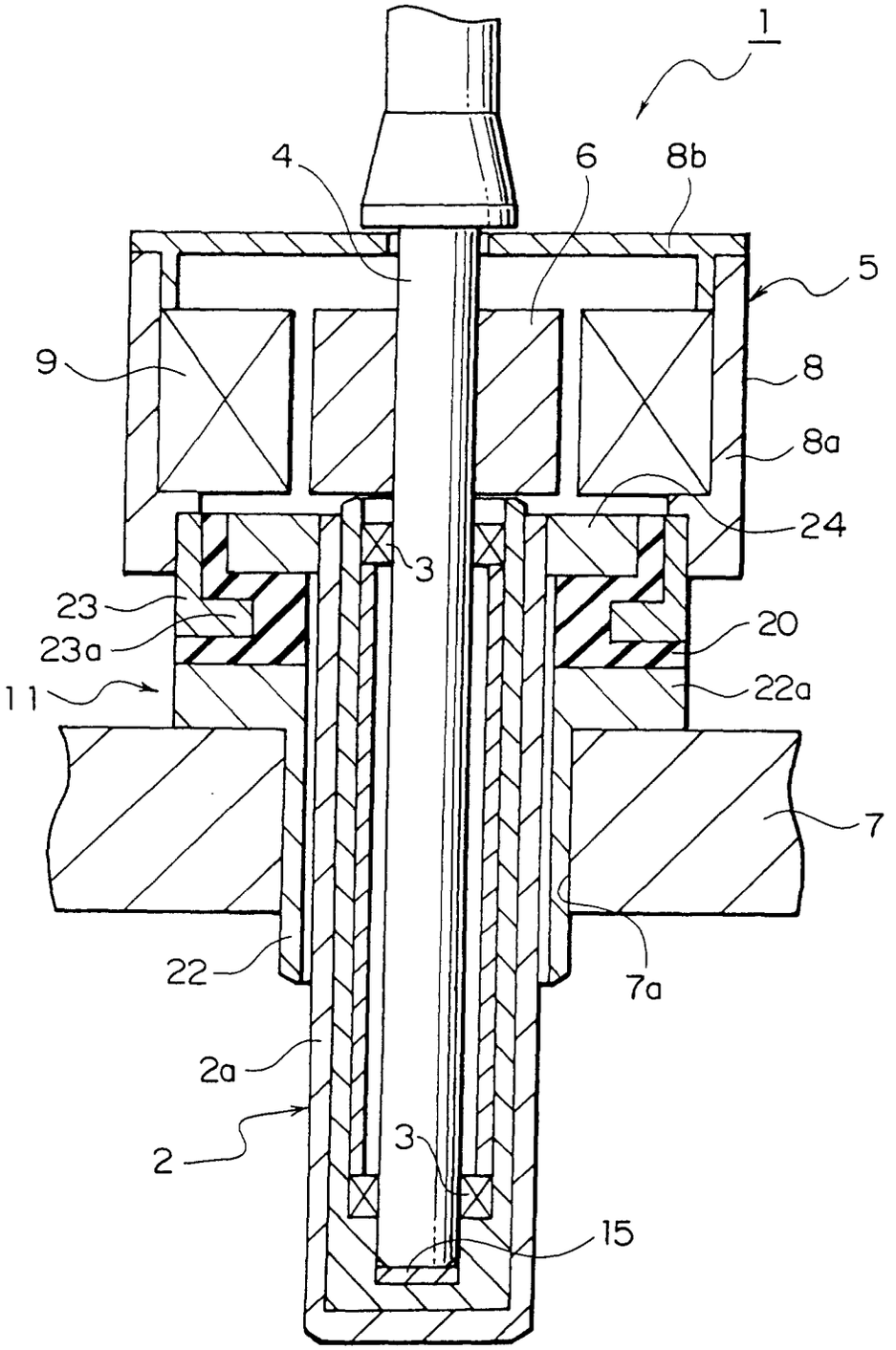


FIG. 4

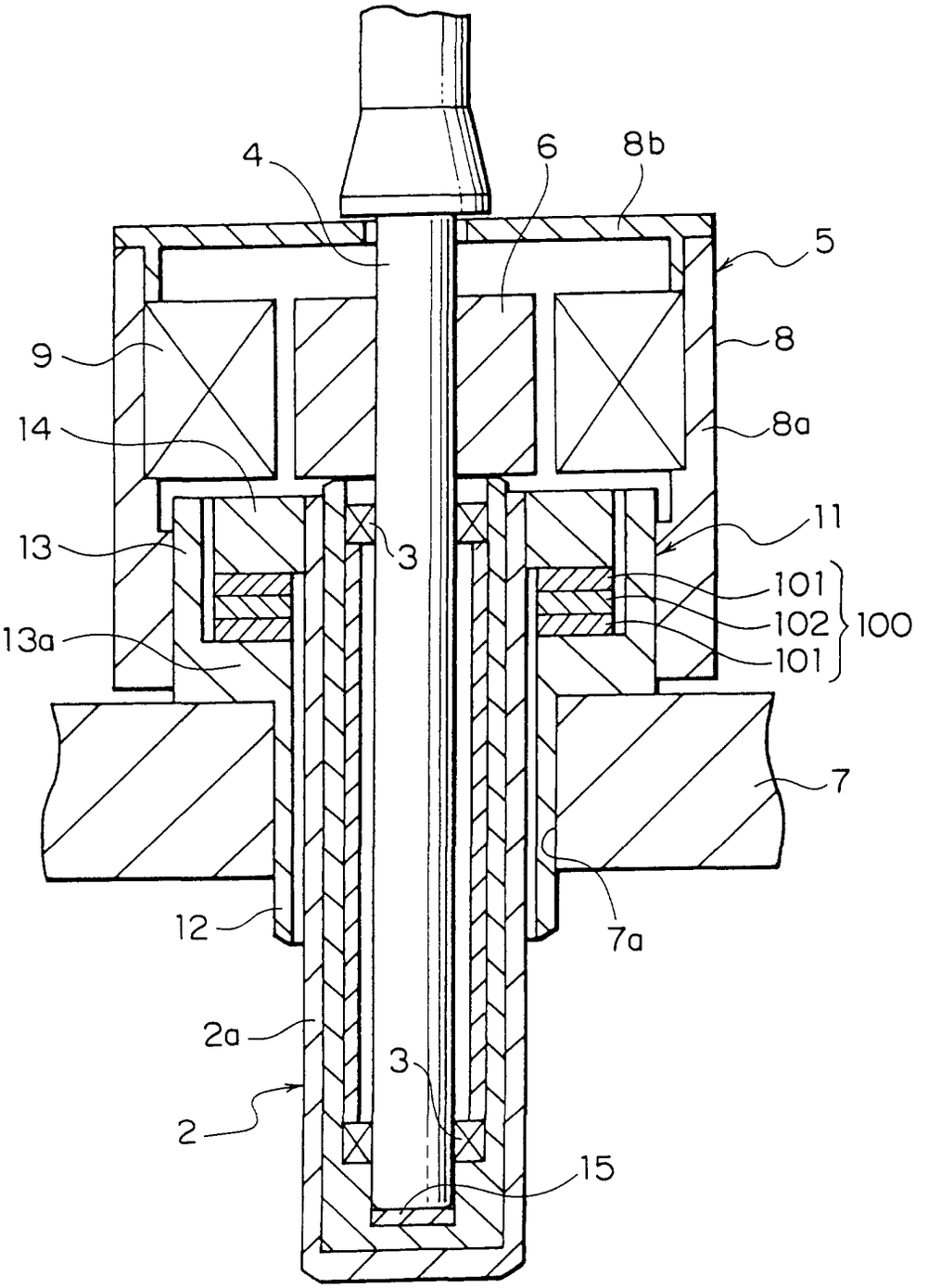


FIG. 5

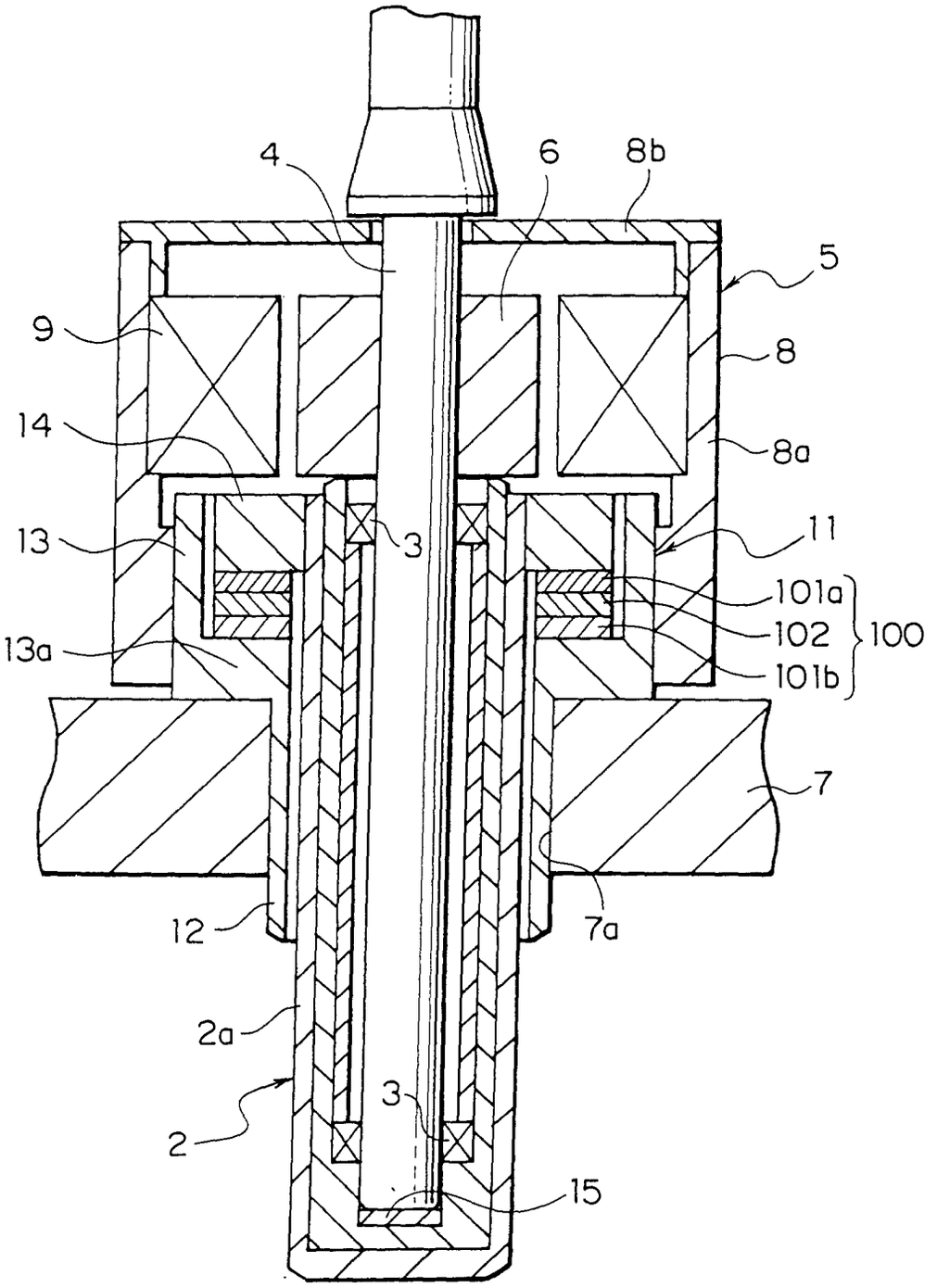


FIG. 6

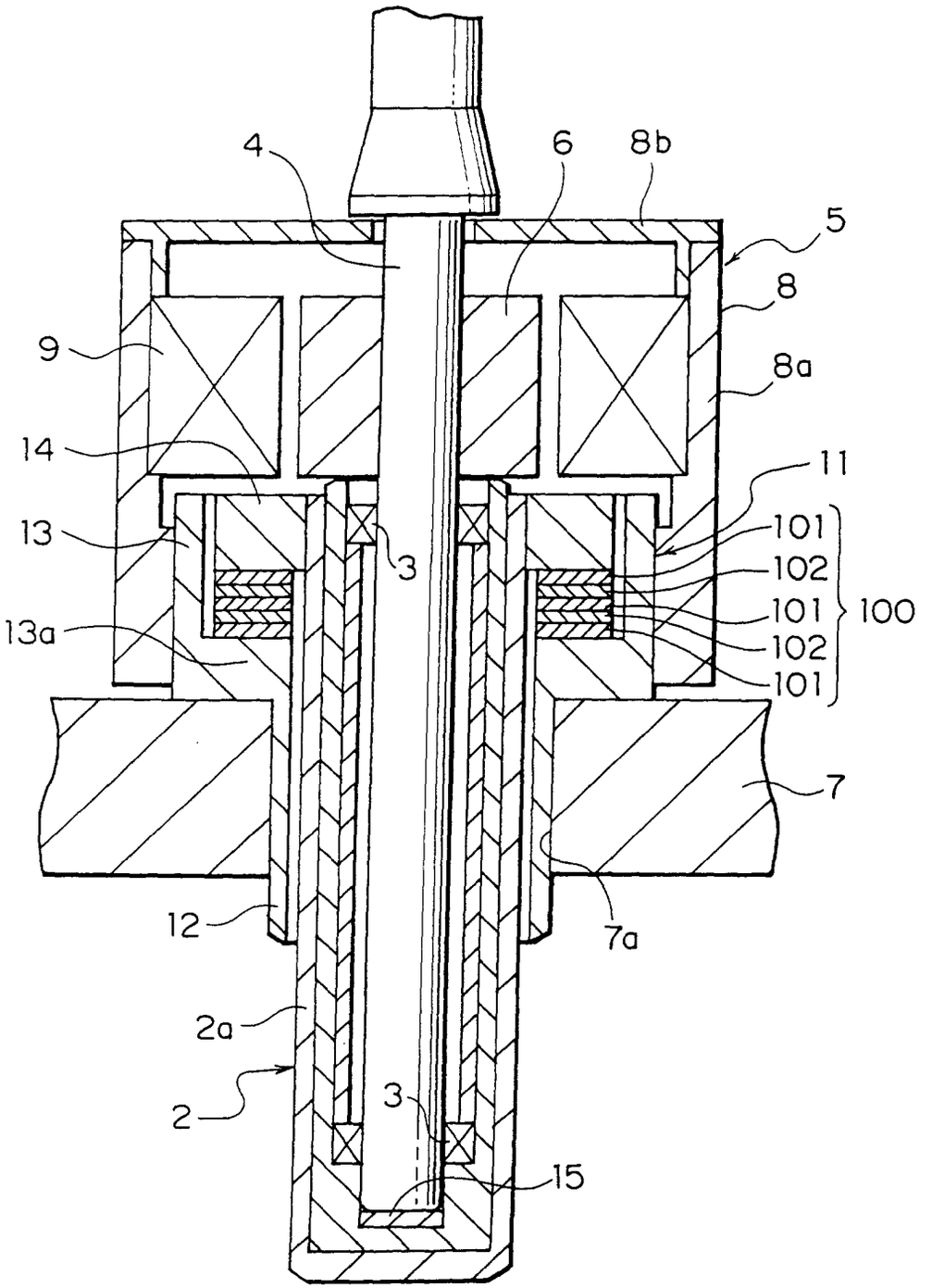


FIG. 7

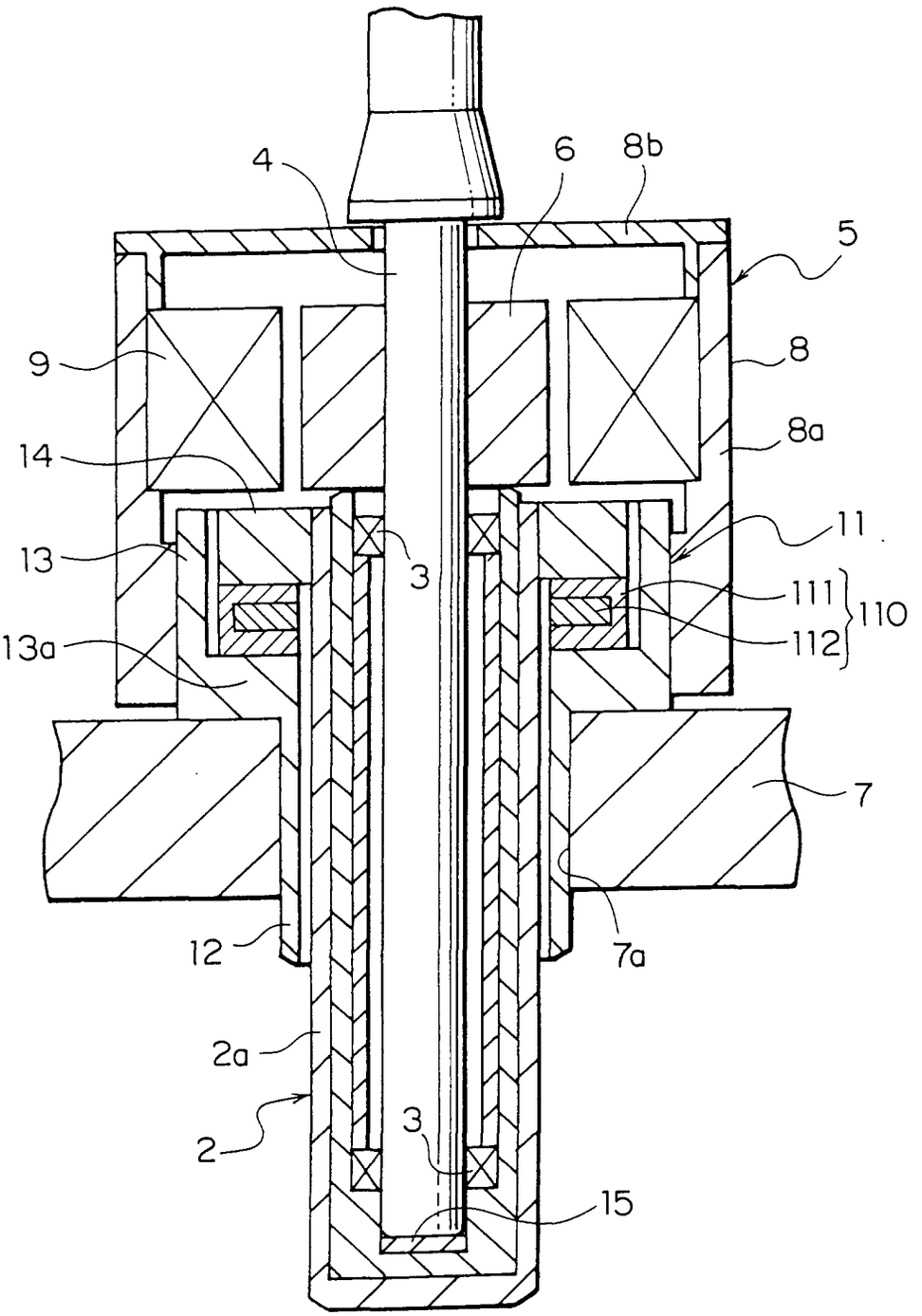
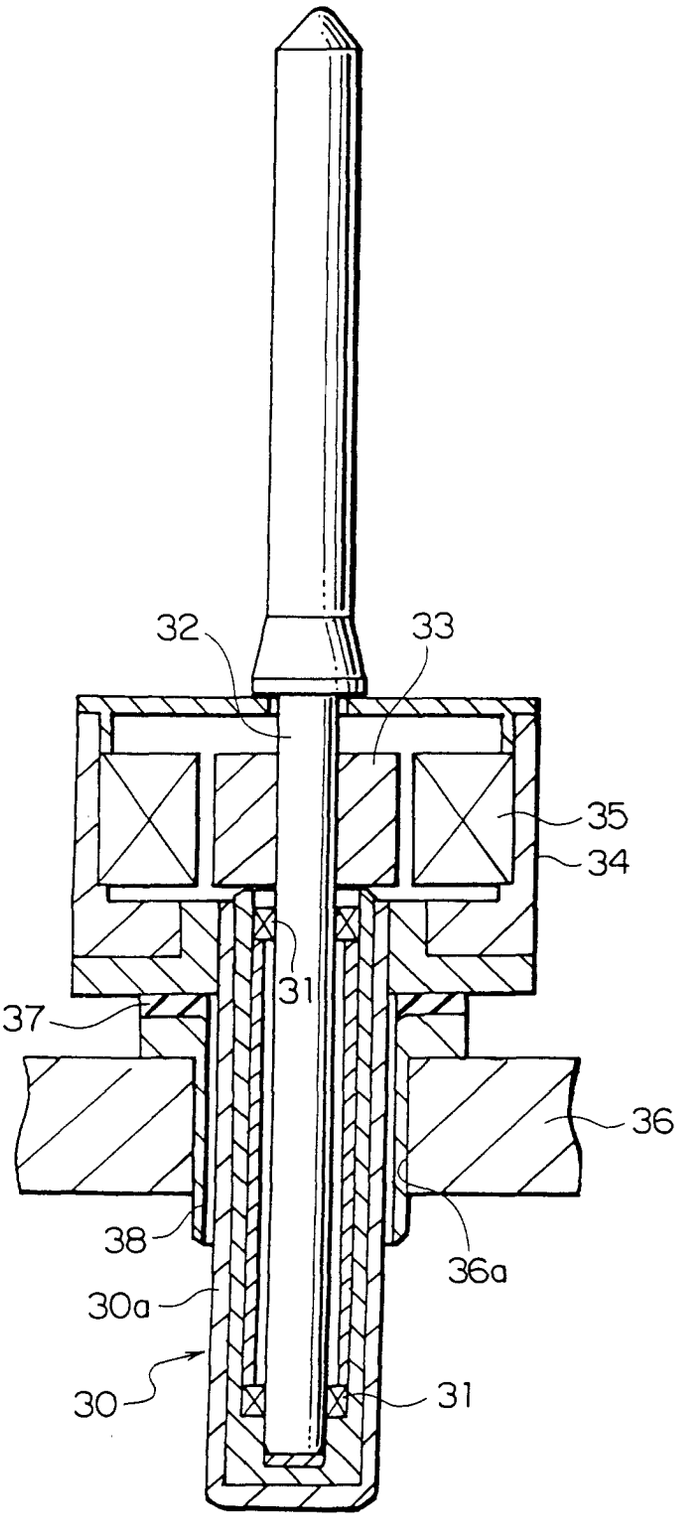


FIG. 8
(PRIOR ART)



European Patent Office

# EUROPEAN SEARCH REPORT

Application Number
EP 01 11 1106

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| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.7) |
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D01H
H02K

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| THE HAGUE | 13 September 2001 | Henningsen, O |

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13-09-2001

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