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Assembly of a motor for a tube of a screen and a set of adaptable plugs for engaging the inner surface of the tube

Abstract

The invention relates to an assembly (**1**) of a motor (**2**) for a tube (**101**) of a screen and a set of plugs for engaging an inner surface of the tube. The set of plugs comprises a drive plug (**10**) for driving the tube, which drive plug is arranged to be connected to a drive shaft (**3**) of the motor. The set of plugs comprises a crown plug (**30**), which crown plug is arranged to be connected to an outer end of the motor for forming a first bearing at one end of the tube. The set of plugs comprises an end plug (**20**) arranged to be inserted into the tube at an opposite outer end of the tube for forming a second bearing, wherein each plug is provided with adapter means for adapting the outer diameter of the plug to the inner diameter of the tube.

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Background/Summary

(1) The present invention relates to an assembly of a motor for a tube of a screen, for example a roller blind tube, and a set of plugs for engaging an inner surface of the tube, wherein the set of plugs comprises a drive plug for driving the tube, which drive plug is arranged to be connected to a drive shaft of the motor, wherein the set of plugs comprises a crown plug, which crown plug is

arranged to be connected to an outer end of the motor for forming a first bearing at a first outer end of the tube, wherein the set of plugs comprises an end plug arranged to be inserted into the tube at a second outer end of the tube for forming a second bearing, wherein each plug is provided with adapter means for adapting the outer diameter of the plug to the inner diameter of the tube.

(2) The assembly according to the invention provides the possibility to provide a universal motorized control for screen tubes. The plugs have adaptive outer dimensions that allow the assembly to be used for a wide variety of known screens having tubes with different dimensions. It is especially suitable as a retrofit kit to motorize any known roller blind system.

(3) According to a preferred embodiment the adapter means comprise one or more engaging elements for engaging the inner surface of the tube that are movable between a minimal position in which the dimensions of the outer diameter of the plug are at a minimum and an extreme position in which the dimensions of the outer diameter of the plug are at a maximum. By using engaging elements, the optimal dimensions for the outer diameter of the plug can be easily set as only a few engaging elements suffice.

(4) According to a first preferred embodiment the engaging elements are slidable over the plug and the adapter means further comprise pushing means to push the engaging elements radially outward towards the extreme position. Advantageously hereby a stepless adaptation of the dimensions of the plug outer diameter is achieved.

(5) According to an elegant, preferred embodiment one or more of the plugs comprise a base part and a cover part that is slidable over the base part, wherein the cover part and the base part enclose the engaging elements and the cover part forms part of the pushing means. The integration of the engaging elements in the plug renders this embodiment compact and robust. The pushing cover part renders this embodiment suitable for plugs that are hard to access for a user, such as the drive plug and the end plug.

(6) According to a practical preferred embodiment the pushing means further comprise pretensioning means, such as a spring. Preferably the adapter means further comprise operating means for the pretensioning means. In a first variant the pretensioning means are arranged to pretension the engaging elements in the minimal position and the operating means comprise retaining means that are arranged to retain the pretensioning means in a pressed position and the operating means are arranged to release the pretensioning means. The first variant is perfectly suitable for the drive plug and allows a user to release the pretensioning means when the drive plug is at least partly inserted in the tube. The outer diameter of the drive plug will then automatically adapt to the inner diameter of the tube. In a second variant the operating means are arranged to move the engaging elements towards the extreme position against the force of the pretensioning means. In the second variant the operating means may comprise a suitable tool, such as a hex key or a screwdriver. The second variant is perfectly suitable for the end plug and allows a user to adapt the outer diameter of the end plug to the inner diameter of the tube when the end plug is at least partly inserted in the tube.

(7) According to a second preferred embodiment the engaging elements are provided on one or more inserts and the adapter means comprise connection means for releasable connection of the inserts to the outer circumference of the plug in two or more different positions. The second embodiment is perfectly suitable for plugs that are accessible for a user, such as the crown plug.

(8) In a first variant of the second preferred embodiment the inserts are open rings. The rings allow for a simultaneous connection of all engaging elements to the plug and consequently for a fast adaptation of the outer diameter of the plug to the inner diameter of the tube.

(9) In a second variant of the second preferred embodiment, the inserts are pins. The position of the pins can be easily changed to adapt the outer diameter of the plug to the inner diameter of the tube. Several pins of different sizes can be provided.

(10) In an optimal preferred embodiment, the engaging elements are provided with a ridge on top. Generally on the interior of many known screen tubes irregularities are present, such as seams or

edges. The ridge provides a more universal fit and in general a better grip.
(11) Preferably the adapter means comprise three engaging elements.
(12) In a practical preferred embodiment the engaging elements are radially protruding ribs.

Description

DESCRIPTION OF THE DRAWING
(1) The invention will now be described in more detail with reference to the figures, in which
(2) FIG. **1** shows a schematic view of a first preferred embodiment of an assembly according to the invention;
(3) FIG. **2**A shows a schematic view of an adaptable drive plug as part of the assembly of FIG. **1**;
(4) FIG. **2**B shows the adaptable drive plug of FIG. **2**A with exploded parts;
(5) FIG. **2**C schematically shows a longitudinal section through the adaptable drive plug of FIG. **2**A;
(6) FIG. **2**D schematically shows a longitudinal section through the adaptable drive plug in a different position;
(7) FIG. **2**E shows a cross section through the adaptable drive plug of FIG. **2**A;
(8) FIG. **2**F shows a cross section through a first variant of the adaptable drive plug as part of the assembly according to the invention;
(9) FIG. **2**G shows a cross section through a second variant of the adaptable drive plug as part of the assembly according to the invention;
(10) FIG. **3**A shows a schematic view of an adaptable end plug as part of the assembly of FIG. **1**;
(11) FIG. **3**B shows the adaptable end plug of FIG. **3**A with exploded parts;
(12) FIG. **3**C schematically shows a longitudinal section through the adaptable end plug of FIG. **3**A;
(13) FIG. **3**D schematically shows a longitudinal section through the adaptable end plug in a different position;
(14) FIG. **3**E shows a cross section through the adaptable end plug of FIG. **3**A;
(15) FIG. **4**A shows a schematic view of a first preferred embodiment of an adaptable crown plug as part of the assembly of FIG. **1**;
(16) FIG. **4**B shows the adaptable crown plug of FIG. **4**A with exploded parts;
(17) FIG. **5**A shows a schematic view of a second preferred embodiment of an adaptable crown plug as part of the assembly according to the invention; and
(18) FIG. **5**B shows the adaptable crown plug of FIG. **5**A with exploded parts.
(19) The same components are designated in the different figures with the same reference numerals.
DETAILED DESCRIPTION
(20) FIG. **1** schematically shows an exploded view of a preferred embodiment of an assembly **1** according to the invention to motorize any type of screen having a tube. As an example, a roller blind system **100** is shown having a roller blind tube **101** to which a flexible sheet member or roller curtain is to be attached in a conventional manner.
(21) The assembly **1** comprises a tubular motor **2** and a set of plugs **10**, **20**, **30** for engaging the inner surface of the tube **101**.
(22) The set of plugs comprises a drive plug **10** for driving the tube, which is arranged to be connected to a drive shaft **3** at a first outer end of the tubular motor **2**. The set of plugs comprises a crown plug or crown **30** that is arranged to be connected to a second outer end **4** of the tubular motor **2**. In the embodiment shown the crown plug **30** could first be placed over the drive shaft **3** at the first outer end of the tubular motor **2** and could then be moved towards the second outer end **4**. The tubular motor **2** provided with the drive plug **10** and preferably also provided with the crown

30 is to be inserted at one end of the tube **101**, for example at the right end of the tube **101** in FIG. **1**.
(23) The set of plugs comprises an end plug **20** arranged to be inserted into the tube **101** at an opposite end of the tube **101**, for example at the left end of the tube **101** in FIG. **1**.
(24) According to the invention the drive plug **10**, the end plug **20** and the crown **30** are all provided with adapter means for adapting the outer diameter of the plug to the inner diameter of the tube **101**.
(25) Suitable devices for mounting the roller blind tube **101** on a surface, such as a wall, window frame or a ceiling, having releasably attachable mounting brackets and bracket connectors or shaft holders are known in the relevant field. Particularly suitable is a known device of the same applicant that is described in the abovementioned European patent application EP2933428, incorporated herein by reference.
(26) Said known device comprises two bracket connectors **102** that are arranged to be attached at the outer ends of the roller blind tube **101**. The bracket connectors **102** are arranged for releasable attachment to mounting brackets **103** for mounting the roller blind system on a surface. Optionally end caps **104** are mounted over the mounting brackets **103** in the mounted state of the roller blind system **101**. One of the bracket connectors **102** is visible and provided with a bearing pin **105** for insertion in the end plug **20**.
(27) FIGS. **2**A, **2**B, **2**C and **2**D show a preferred embodiment of the adaptable drive plug **10** in more detail. FIG. **2**A shows a schematic view of the adaptable drive plug **10** in the extreme position in which the dimensions of the outer diameter of the drive plug **10** are at a maximum. FIG. **2**B shows an exploded view of the adaptable drive plug **10**. FIG. **2**C schematically shows a cross section in longitudinal direction through the adaptable drive plug **10** in the extreme position shown in FIG. **2**A. FIG. **2**D schematically shows a cross section in longitudinal direction through the adaptable drive plug **10** in the minimal position in which the dimensions of the outer diameter of the drive plug **10** are at a minimum.
(28) According to the invention the adaptable drive plug **10** comprises first adapter means that define the outer dimensions of the adaptable drive plug **10**. In the preferred embodiment shown the first adapter means comprise a number of engaging elements, preferably ribs **13**, that are movable over the outer circumference of the adaptable drive plug **10** between the minimal position and the extreme position.
(29) The adaptable drive plug **10** comprises a base part **11** and a cover part **12** that is slidable over the base part **11** in longitudinal direction thereof. The cover part **12** and the base part **11** enclose the ribs **13**. The adaptable drive plug **10** further comprises a spring **14** that is enclosed by the cover part **12** and the base part **11**. The cover part **12** is arranged to push the ribs **13** over the base part **11** under the action of the spring **14** out of a minimal position towards an extreme position. In the preferred embodiment shown the cover part **12** comprises a number of longitudinal openings **16**A to accommodate the ribs **13**. Each longitudinal opening **16**A has a short edge **16** that is arranged to abut against a short side of one of the ribs **13**.
(30) In the preferred embodiment shown the base part **11** is provided with a number of guiding elements, preferably wings **15**, corresponding to the number of ribs **13**. The ribs **13** have first, generally oblique guiding surfaces **13**A and the wings **15** have second, generally oblique guiding surfaces **15**A. The first and second guiding surfaces **13**A, **15**A are mating surfaces that facilitate sliding of the ribs **13** in a stepless manner between the minimal position (shown in FIG. **2**D) and the extreme position (shown in FIG. **2**C).
(31) Preferably the ribs **13** are provided with ridges **13**B to form the contact area with the inner surface of the tube **101**.
(32) In the preferred embodiment shown the number of ribs **13** and wings **15** is three. Preferably the ribs **13** lie substantially on an imaginary circle.
(33) In the preferred embodiment the ribs **13** are distributed unevenly over the circumference and

the angles between adjacent ribs increase in clockwise direction. This can be seen in FIG. **2**E showing a cross section through the adaptable drive plug **10** in the extreme position. Herein the angle α.sub.1 is substantially 110 degrees, the angle α.sub.2 is substantially 120 degrees and the angle α.sub.3 is substantially 130 degrees. An asymmetrical distribution of the ribs allows for finding a fit by rotating the adaptable plug in a tube having an irregular interior surface.

(34) FIG. **2**F shows a cross section through a first variant of the adaptable drive plug as part of the assembly according to the invention. Herein the angles α.sub.1 and α.sub.3 are substantially equal at substantially 135 degrees, whereas the angle α.sub.2 is substantially 90 degrees. The larger angles provide a larger fitting area.

(35) FIG. **2**G shows a cross section through a second variant of the adaptable drive plug as part of the assembly according to the invention. In the second variant the ribs **13** are distributed substantially evenly over the circumference. The angles α.sub.1, α.sub.2 and α.sub.3 are substantially equal at substantially 120 degrees. A symmetrical distribution of the ribs works well with tubes having a smooth interior surface.

(36) The base part **11** has a nose piece **18** for accommodating the spring **14**. A locking ring **17** locks the spring **14** in place.

(37) Preferably the spring **14** is arranged to pretension the cover part **22** in a direction towards the base part **21**. Preferably the adaptable drive plug **10** is provided with operating means for the spring that comprise retaining means that are arranged to retain the spring **14** in inwardly pressed position thereby allowing the adaptable drive plug **10** to assume the minimal position. In the minimal position the adaptable drive plug **10** can be easily inserted in the tube **101**. In FIG. **2**B a removable locking pin **19** is shown as an example of suitable retaining means. Once the retaining means release the spring **14**, these will force the ribs **13** radially outwards until the ribs **13** engage with the inner surface of the tube **101**. The adaptable drive plug **10** is then in a position to transfer the torque from the tubular motor **2** onto the tube **101**.

(38) FIGS. **3**A, **3**B, **3**C and **3**D show a preferred embodiment of the adaptable end plug **20** in more detail. FIG. **3**A shows a schematic view of the adaptable end plug **20** in an intermediate position. FIG. **3**B shows an exploded view of the adaptable end plug **20**. FIG. **3**C schematically shows a cross section in longitudinal direction through the adaptable end plug in the extreme position. FIG. **3**D schematically shows a cross section in longitudinal direction through the adaptable drive plug **10** in the position of FIG. **3**A.

(39) According to the invention the adaptable end plug **20** comprises second adapter means that define the outer dimensions of the adaptable end plug **20**. In the preferred embodiment shown the second adapter means comprise a number of engaging elements, preferably ribs **23**, that are movable over the outer circumference of the adaptable end plug **20** between the minimal position and the extreme position.

(40) The adaptable end plug **20** comprises a base part **21** and a cover part **22** that is slidable over the base part **21** in longitudinal direction thereof. The cover part **22** and the base part **21** enclose the ribs **23**. The adaptable end plug **20** further comprises a spring **24** that is enclosed by the cover part **22** and the base part **21**. The cover part **22** is arranged to push the ribs **23** over the base part **21** by operating the bolt **29** against the action of the spring **24** out of a minimal position towards an extreme position (shown in FIG. **3**C). In the preferred embodiment shown the cover part **22** comprises a number of longitudinal openings **26**A to accommodate the ribs **23**. Each longitudinal opening **26**A has a short edge **26** that is arranged to abut against a short side of one of the ribs **23**.

(41) In the preferred embodiment shown the base part **21** is provided with a number of guiding elements, preferably wings **25**, corresponding to the number of ribs **23**. The ribs **23** have first, generally oblique guiding surfaces **23**A and the wings **25** have second, generally oblique guiding surfaces **25**A. The first and second guiding surfaces **23**A, **25**A are mating surfaces that facilitate sliding of the ribs **23** in a stepless manner between the minimal position and the extreme position.

(42) Preferably the ribs **23** are provided with ridges **23**B to form the contact area with the inner

surface of the tube **101**. Preferably the number of ribs **23** and wings **25** is three.
(43) FIG. **3**E shows a cross section through the adaptable end plug **20** in the position of FIG. **3**A. In the preferred embodiment shown the ribs **23** are distributed substantially symmetrically over the circumference of the end plug. The angles α.sub.1, α.sub.2 and α.sub.3 are substantially equal at substantially 120 degrees and lie substantially on an imaginary circle. As an alternative an asymmetrical distribution of the ribs **23** is possible, for example one of the distributions shown in FIGS. **2**E and **2**F for the ribs of the drive plug.
(44) The base part **21** has an inner space **28** for accommodating the spring **24**. The inner space **28** is accessible by operating means, for example a bolt **29** that cooperates with a nut **27** to press or release the spring **24** and thereby change the position of the cover part **22** and the ribs **23**.
(45) Preferably the adaptable end plug **20** is first brought in the minimal position in which it can be easily inserted in the tube **101**. Preferably the spring **24** is arranged to pretension the cover part **22** in a direction away from the base part **21**. The operating means can be used to press the spring **24** inwards thereby forcing the ribs **23** radially outwards until the ribs **23** engage with the inner surface of the tube **101**. The adaptable end plug **20** is then in a position to hold the tube **101**.
(46) FIG. **4**A shows a schematic view of a first preferred embodiment of an adaptable crown plug **30** as part of the assembly of FIG. **1**. FIG. **4**B shows the adaptable crown plug **30** with exploded parts.
(47) According to the invention the adaptable crown plug **30** comprises third adapter means that define the outer dimensions of the adaptable crown plug **30**. The third adapter means comprise a number of engaging elements, preferably ribs **33**, that can be moved between a minimal position in which the dimensions of the outer diameter of the crown plug **30** are at a minimum and an extreme position in which the dimensions of the outer diameter of the crown plug **30** are at a maximum. The engaging elements are provided on one or more inserts for releasable connection to the outer circumference of the plug.
(48) In the first preferred embodiment the insert is a ring **34** provided with engaging elements formed by a number of radially outwardly protruding ribs **33**. The crown plug **30** comprises a tube part **31** and a flange part **39**. The ring **34** comprises connection means for releasable connection of the ring **34** in different positions on the tube part **31** the crown plug **30**. The connection means preferably comprise mating grooves **32** and tongues **35** that extend in circumferential direction over the outer surface of the tube part **31** of the crown plug **30** and over the opposing inner surface of the ring **34**. The ring **34** is open and the outer ends **36** of the ring **34** pre-clamp towards each other.
(49) Preferably a set of rings, for example rings **34-1**, **34-2**, **34-3**, is provided having ribs **33-1**, **33-2**, **33-3** of different heights. The rings allow for a simultaneous connection of all engaging elements to the plug and consequently for a fast adaptation of the outer diameter of the plug to the inner diameter of the tube.
(50) Preferably rows of grooves **32**, each having a different depth, are provided on the tube part **31**. As such a stepwise adaptation of the outer dimensions of the crown plug **30** to the inner dimensions of the tube can be accomplished. The connection means preferably further comprise first and second ring segments **37** and **38** having different inner diameters. The first ring segments **37** fit between the rows of grooves **32**, whereas the second ring segments **38** fit over the rows of grooves **32**.
(51) FIG. **5**A shows a schematic view of a second preferred embodiment of an adaptable crown plug **40** as part of the assembly according to the invention. FIG. **5**B shows the adaptable crown plug **40** with exploded parts.
(52) In the second preferred embodiment the inserts are sets of pins **44**, wherein each pin is provided with a radially outwardly protruding rib **43**. Preferably different sets of pins are provided having ribs of different heights. The crown plug **40** comprises a tube part **41** and a flange part **49**. The tube part **41** and the pins **44** comprise connection means for releasable connection of the pins **44** in different positions on the tube part **41**. The connection means preferably comprise mating

grooves **42** and tongues **45** that extend in radial direction from the tube part **41** of the crown plug **40** and over the opposing sides of the pins **44**.
(53) Preferably the grooves **42** are arranged in rows, wherein adjacent grooves in a row have different depths. As such a stepwise adaptation of the outer dimensions of the crown plug **40** to the inner dimensions of the tube can be accomplished.
(54) The invention follows from the inventive thought to provide a universal assembly for motorizing a large number of roller blind systems of different manufacturers. The use of adapter means, with either integrated or releasably connectable engaging elements, which can assume varying radial positions on the plug to adapt the outer diameter of the plug to the inner diameter of the tube, makes the universal assembly very suitable for the aftermarket.
(55) The invention is of course not limited to the described and shown preferred embodiments but extends to any embodiment falling within the scope of protection as defined in the claims and as seen in the light of the foregoing description and accompanying drawings.

Claims

1. An assembly of a motor for a tube of a screen, the assembly comprising a set of plugs for engaging an inner surface of the tube, wherein the set of plugs comprises a drive plug for driving the tube, the drive plug is arranged to be connected to a drive shaft of the motor, wherein the set of plugs comprises a crown plug, the crown plug is arranged to be connected to an outer end of the motor for forming a first bearing at a first outer end of the tube, wherein the set of plugs comprises an end plug arranged to be inserted into the tube at a second outer end of the tube for forming a second bearing, wherein each of the plugs has an outer diameter having dimensions and each of the plugs is provided with adapter means that define the dimensions of the outer diameter for adapting the outer diameter of the plug to the inner diameter of the tube, wherein the adapter means comprise one or more engaging elements for engaging the inner surface of the tube that are movable between a minimal position in which the dimensions of the outer diameter of the plug are at a minimum and an extreme position in which the dimensions of the outer diameter of the plug are at a maximum.
2. The assembly according to claim 1, wherein the screen is a roller blind.
3. The assembly according to claim 1, wherein the engaging elements are slidable over the plug and the adapter means further comprise pushing means to push the engaging elements radially outward towards the extreme position.
4. The assembly according to claim 3, wherein one or more of the plugs comprise a base part and a cover part that is slidable over the base part, wherein the cover part and the base part enclose the engaging elements and the cover part forms part of the pushing means.
5. The assembly according to claim 3, wherein the pushing means further comprise pretensioning means, such as a spring.
6. The assembly according to claim 5, wherein the adapter means further comprise operating means for the pretensioning means.
7. Assembly according to claim 6, wherein the pretensioning means are arranged to pretension the engaging elements in the extreme position and the operating means comprise retaining means that are arranged to retain the pretensioning means in a pressed position and the operating means are arranged to release the pretensioning means.
8. The assembly according to claim 6, wherein the operating means are arranged to move the engaging elements towards the extreme position against the force of the pretensioning means.
9. The assembly according to claim 1, wherein the engaging elements of at least one of the plugs are provided on one or more inserts and the adapter means comprise connection means for releasable connection of the inserts to the outer diameter of the plug in two or more different positions.

10. The assembly according to claim 9, wherein the inserts are open rings.
11. The assembly according to claim 9, wherein the inserts are pins.
12. The assembly according to claim 1, wherein the adapter means comprise three engaging elements.
13. The assembly according to claim 1, wherein the engaging elements are provided with a ridge on top.
14. The assembly according to claim 1, wherein the engaging elements are radially protruding ribs.