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(54) Tubular gearmotor for actuating roller blinds

Rohrförmiger Getriebemotor zur Betätigung von Rollläden

Moteur à engrenages tubulaire pour actionner des volets roulants

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(73) Proprietor: **NICE S.P.A.**
31046 Oderzo (Treviso) (IT)

(72) Inventors:
- **La Fortezza, Francesco**
  31046 Oderzo (Treviso) (IT)
- **Perisan, Stefano**
  31046 Oderzo (Treviso) (IT)

(74) Representative: **Citron, Massimiliano et al**
Via Primo Maggio, 6
31020 San Fior (TV) (IT)

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EP 2 397 647 B1

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The invention refers to a tubular gear motor used to actuate and automate movable barriers or closing systems in general such as gates, doors, garage doors or for moving rolling shutters in general such as curtains, rolling gates, blinds or similar elements.

[0002] The described solution refers in particular to a gear motor of the type used in moving rolling shutters in general, but the same concepts can be used in any other mechanical reduction gear.

STATE OF THE ART

[0003] A gear motor AZ of this type (see fig. 1a) in general is made up of a tube T that contains: an electric motor M, a mechanical reduction gear R contained in a casing or crown C, and part of a head H in which control circuits, as well as mechanical and/or electronic end stop devices are housed. The head H can be partially slotted inside the end of the tube T and with it fixed to a wall or box W, with or without the help of the relative support. Projecting at the other end of the tube T there is an output shaft or pinion P directly connected inside the reduction gear R, to move a rolling shutter.

[0004] The reduction gear R is designed to make large reduction ratios. Given the small size of the tube T, the reduction gear R is selected to be of the epicyclic type and made up of many stages (generally 3) in cascade. At the output shaft P a pulley K is fitted to transmit rotary motion to a winding tube V on which the rolling shutter is wound. Roughly at the head H there is an adaptation pulley G that receives rotary motion from the winding tube V and transmits it to the electronic or mechanical device for measuring the end stops. Generically, the gear motor AZ is almost totally slotted/inserted inside the winding tube V; only part of the head H remains outside to be fixed to the wall or box W. The winding tube V and the gear motor AZ are both fixed and mounted canti-levered to the wall or box W at one of its ends. At the other end they interact and support one another, see pulley G and K.

[0005] Particularly considering the field of application, i.e. building industry, it can be understood that the installations can have rough tolerances. Possible clearances between the mechanical members and/or assembly errors mean significant alignment errors between the rotation axis of the winding tube V and that of the pulley K, which in turn misaligns the output shaft P and thus the mechanical members of the reduction gear R. In fig. 1b for example it is possible to appreciate another cause of misalignment - the weight of the rolling shutter, indicated with the arrow MC. Since the gears are designed to work coaxially, any misaligned position produces high levels of noise and can lead to early breaking or wear.

[0006] US 6 979 962 describes a tubular motor for a window-covering panel that adopts multiple elastic insulation joints to avoid transmitting vibrations to the outside. The electric motor and the mechanical reduction gear are not in direct contact with the containment tube but are insulated, and the transmission of motion takes place through an elastic joint. Substantially, it is taught to insert a gear motor inside an outer tube but the construction is very complex and particularly expensive. And there is the problem that the use of one or more elastic joints in applications that are often exposed to the sun and to high temperatures can be problematic.

[0007] EP 0 783 155 describes a motor for a panel. Like in the previous case, elastic couplings are also used here to damp or cancel out vibrations and noise, made through connecting elastic discs between rotating parts. The elastic discs allow a bending around and along the rotation axis but they are torsionally rigid.

[0008] WO03/008818 describes a particular elastic element for transmitting rotary motion in these applications. The elastic element is flexible with respect to a longitudinal axis and extendible along it, but torsionally rigid.

[0009] All of these solutions have their drawbacks.

[0010] Those presented in US 6 979 962 and EP 0 783 155 are without doubt very complex, and therefore expensive. In particular, the elastic element in EP 0 783 155 is very bulky, and difficult to use in modem actuation systems that increasingly tend to reduce their size so as to take up less space. The elastic element in US 6 979 962, on the other hand, is difficult to assemble, requires many discs to be really effective and is very bulky.

[0011] The elastic element of WO03/008818 has above all problems of durability, because a small crack in the structure can lead to it breaking apart.

[0012] In summary, the prior art currently only indicates solutions unable to be taken up by the market because the relative production costs are excessive and cannot be justified.

PURPOSES OF THE INVENTION

[0013] The main object of the invention is to improve the state of the art, with a low-noise gear motor.

[0014] Other objects of the invention are to make a gear motor of the aforementioned type that

- transmits less vibrations to the application to which it is installed, and/or
- has an output shaft that also tolerates assembly misalignments; and/or
- can be produced at reasonable cost.

[0015] Such objects are obtained by a gear motor as defined in Claim 1.

[0016] The spherical shape-coupling that is exploited to connect the output shaft and the reduction gear allows the axis of the shaft to oscillate if necessary around the

reference axis of the gear motor and of the inner rotating members. In this way the shaft decouples sufficiently, whilst still receiving driving torque, so as not to transfer vibrations to such rotating members, or cause misalignment or an anomalous operation condition thereof. As a result of this there is always optimal operation that is not sensitive to the stresses on the shaft.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] Further characteristics and advantages of the invention will become clearer from the example description of a gear motor, together with the attached drawing, in which:

figures 1a, 1b show a schematic side view of a known actuation system;

figure 2 shows an exploded view of part of a stage according to the invention;

figure 3 shows an exploded view of the stage of fig. 2 from another angle;

figure 4 shows a vertical section view of a reduction gear stage;

figures 5 and 6 show an enlarged view of the section of fig. 2 in two different operative positions.

EMBODIMENTS OF THE INVENTION

[0018] Figure 4 shows a tubular motor or gear motor NC formed by a containment tube or tubular casing 10, with longitudinal axis X. An end of the tube 10 is closed by a cover or cap 12 from which a rigid output shaft 30 comes out, having rotation axis Y, intended to set the winding tube of the rolling shutter in motion thanks to the interposition of an adapter pulley (not shown).

[0019] Through a planet gear carrier disc 50 the output shaft 30 is connected to the last stage of a mechanical reduction gear (of the known type), which is connected to the previous stage by means of the relative output pinion 16.

[0020] The pinion 16 receives the motion from the previous stage or from the electric motor, and engages on three planetary gear wheels 60 mounted so as to be able to rotate, through pins 48, on the planet gear carrier disc 50 and each arranged at 120° (like the vertices of an equilateral triangle). The planet gears 60 at the centre engage and interact with the pinion 16, whereas peripherally they engage with the toothing 14 of a fixed sleeve 18 arranged in the tube 10. The planet gear carrier disc 50 is shaped like a disc having three inlets 54 in the perimeter, which extend from the outer edge inwards, arranged symmetrically at 120°. Visually, the planet gear carrier disc 50 could be described as a flower with three symmetrical petals or an element with a trefoil plan.

[0021] Three sectors or petals 52 arranged at 120° and symmetrically with respect to the centre remain defined by the inlets 54. Each sector or branch 52 is provided with holes 56 (only some are indicated). At the centre of the planet gear carrier disc 50, on a face, there is a semispherical or lenticular recess or concavity 58.

[0022] The output shaft 30 at the end that projects from the cap 12 has a known configuration, i.e. a grooved profile to couple with the pulley that moves the rolling shutter. Roughly in the middle area it is furrowed by a circumferential groove 38, used to block the shaft 30, which defines a part 30E arranged outside and a part 301 arranged inside the tube 10. The part 301 hidden inside the tube 10 interacts with the mechanical reduction gear and at its end has a ring 32 in relief, perimetrically separated from the central area by a throat 35, from which three teeth 34 extend parallel to the axis Y, arranged at 120° around the axis Y. At the centre of the ring 32, between the teeth 34 and at the axis Y, there is a small semispherical ridge or stud 36, complementary to the concavity 58.

[0023] The cap 12, on the inside, has a plurality of cantilevered flexible tabs 90, in direct contact with the output shaft 30, which are oriented parallel to the axis X and have a stop tooth 92 at the outer end on the side facing towards the axis X. The tooth 92 has dimensions complementary to the groove 38.

[0024] During assembly, the output shaft 30 is inserted into the tube 10 and is in turn closed by the cover 12, so that the teeth 92 snap into the groove 38. It is thus ensured that there is free rotation of the output shaft 30 around its axis Y but at the same time it is retained, constrained by the teeth 92, so that it does not move along the axis X.

[0025] The outer surface of the ring 32 rests and slides on an (optional) complementary concave seat 80 present on the inner surface of the end of the cap 12 and of a locating ring 84, whereas the teeth 34 are slotted into the seats 54 of the planet gear carrier disc 50. The mutual dimensions are such that the stud 36 inserts into the concavity 58 (see also fig. 5 and 6).

[0026] All of the contact surfaces, like that of the ring 32, of the seat 80, the side surfaces of the teeth 34 are advantageously semi-spherical to facilitate and favour the conical movement of the output shaft 30.

[0027] In operation, the pinion 16 is set in rotation by the electric motor or by the previous stage of the reduction gear, and makes the planets 60 rotate. Through the pins 48 the torque is imparted to the planet gear carrier disc 50, and from here, through the teeth 34, to the shaft 30. Along the axis X the output shaft 30 is blocked. On one side it is held by the teeth 92 and on the other side by the opposition of (and the contact with) the planet gear carrier disc 50, whereas it is allowed to make possible precession motion around the axis X. The sliding of the ring 32 in the concave seat 80, of the stud 36 in the concavity 58, of the teeth 34 in the respective seats 54 and the flexing of the tabs 90, allows the output shaft 30 to

tilt its axis Y with respect to the axis X.

[0028] This allows a rotation movement in which the trajectory of the axis Y can describe a cone the vertex of which is roughly positioned at the contact surfaces of the stud 36 and concavity 58. In the example shown the sliding surfaces and the relative curvatures are sized to allow an oscillation of about ±2° of the axis Y with respect to the axis X. The angle between the axes has its vertex roughly on the bottom of the concavity 58, see also angle H in fig. 5 and 6, where the neighbourhood of the stud 36 and of the concavity 58 is illustrated in an enlargement to highlight the two opposite positions of the shaft 30 for a maximum oscillation. As can be seen, the shaft 30 can "rock/oscillate" on the planet gear carrier disc 50, thanks to the rolling of the stud 36 in the concavity 58, to the clearance between a tooth 34 and its seat 54, to the curved contact surfaces of the tooth 34 and its seat 54 and to the shaping of the surfaces 80 and 32.

[0029] Basically, the configuration of the shaft 30, of the cap 12 and of the planet gear carrier disc 50 form a spherical joint with a small stroke. It should be observed that a solution that makes the shaft 30 oscillate through for example pure mechanical clearances creates many problems. The output shaft 30 not aligned with the axis X would transmit stresses to the gears of the reduction gear, and it would create unforeseen friction and wearing of the contact surfaces as well as increasing the amount of noise produced (see fig. 1b).

[0030] On the other hand, the invention envisages to configure all the parts involved like a spherical joint (for example by curving some surfaces of the output shaft 30 and of the components to which it is constrained).

[0031] Experimentally it has been found that if the shaft 30 can tilt by an angle H equal to about 4-5° with respect to the axis X, the noise and the vibrations are greatly reduced without at all compromising the structural strength of the actuation system.

[0032] The position of the teeth 34 and of the seats 54 can also be inverted.

Claims

1. Gear motor (AZ) for rolling shutters comprising

- a tubular casing (10) having a longitudinal axis (X),
- motor means contained in the casing,
- an output shaft (30), rotatable around a rotation axis (Y), which comes out from the tubular casing and is adapted for moving a rolling shutter,
- an epicyclic reduction gear (R) to reduce the revolutions generated by the motor means and transfer them to the output shaft,

characterised by comprising spherical shape-coupling means (32, 80 34, 54, 36, 58) to connect the output shaft and the reduction gear, so that the axis of said shaft can tilt with respect to the longitudinal axis of the casing.

2. Gear motor according to claim 1, wherein said means comprise a convex or concave surface (32) of the output shaft in contact with a complementary convex or concave surface (80) of an element (12, 84) inside the casing, so that said two surfaces can slide or roll on one another.

3. Gear motor according to claim 1 or 2, comprising a planet gear carrier disc (50), equipped with planetary gear wheels (60) constituting a stage of the reduction gear, adapted for transferring rotary motion to the output shaft through mutually jointed parts (34, 54), said parts having shaped and/or conjugated curves to allow the output shaft to rotate on the planet gear carrier disc and tilt with respect to the longitudinal axis of the casing.

4. Gear motor according to claim 3, wherein the output shaft has a plurality of axial pins (34) and the planet gear carrier disc has a plurality of seats (54) corresponding to the pins, or vice-versa, so as to receive them therein, in order to transfer rotary motion to the output shaft through the deriving joint.

5. Gear motor according to claim 4, wherein said seats and/or said pins have mutual contact arched surfaces to promote a relative rolling motion when the output shaft tilts with respect to the longitudinal axis of the casing.

6. Gear motor according to claim 4 or 5, wherein the plurality of seats in the planet gear carrier disc are configured as introflexions (54) of its perimeter.

7. Gear motor according to claim 6, wherein the introflexions define, in the planet gear carrier disc, a plurality of sectors (52) provided with holes (56) in which pins (48) can be inserted that are adapted for rotatably supporting the planetary gear wheels.

8. Gear motor according to claim 7, wherein the planet gear carrier disc (50) comprises three symmetrical sectors arranged at 120 degrees and symmetrically with respect to its centre.

9. Gear motor according to one of claims 3 to 8, wherein the planet gear carrier disc has a support surface (58) for the output shaft at the rotation axis, said support surface comprising a convexity or concavity that is complementary to a concavity or convexity (38) of the output shaft, the latter being able to slide or roll on the corresponding one of the planet gear carrier disc to promote the tilting of the output shaft with respect to the longitudinal axis of the casing.

10. Gear motor according to claim 9, wherein said convexity or concavity of the support surface is semispherical.

11. Gear motor according to any one of the previous claims, comprising elastic means (90) to elastically keep the rotation axis of the output shaft coinciding with the longitudinal axis of the casing.

12. Gear motor according to claim 11, wherein the elastic means comprise flexible tabs (90) integral with and fixed inside the casing configured to push the rotation axis of the output shaft towards the longitudinal axis of the casing.

13. Gear motor according to any one of the preceding claims, wherein said shape-coupling means are configured to allow a tilt by an angle equal to about 4-5 degrees with respect to said axis (X).

Patentansprüche

1. Getriebemotor (AZ) für Rollläden aufweisend

- eine Rohrhülle (10) mit einer Längsachse (X),
- Antriebsmittel in der Hülle,
- eine Abtriebswelle (30), die sich um eine Drehachse (Y) dreht, die aus dem Rohr herausragt und einen Rollladen auf- und abwickeln kann,
- ein Planetengetriebe (R), um die von den Antriebsmitteln erzeugten Umdrehungen zu verringern und diese an die Abtriebswelle zu übertragen,

dadurch gekennzeichnet, dass er kugelförmige Kupplungselemente (32, 80 34, 54, 36, 58) aufweist, um die Abtriebswelle und das Getriebe so zu verbinden, so dass die Welle der besagten Achse sich bezogen auf die Längsachse der Hülle neigen kann.

2. Getriebemotor nach Anspruch 1, wobei besagte Mittel eine konvexe oder konkave Oberfläche (32) der Abtriebswelle aufweisen, die in Berührung mit einer entsprechenden konkaven oder konvexen Oberfläche (80) eines Elements (12, 84) innerhalb der Hülle steht, damit beide besagten Oberflächen aufeinander gleiten oder wälzen können.

3. Getriebemotor nach Anspruch 1 oder 2, aufweisend einen Planetenträger (50), mit Planetenzahnrädern (60), die eine Stufe des Getriebes darstellen, der dazu dient, die Drehbewegung über gegenseitig einrückende Teile (34, 54) an die Abtriebswelle zu übertragen. Besagte Teile haben geformte und/oder zusammenarbeitende Kurven, damit die Abtriebswelle sich auf dem Planetenträger drehen und sich bezogen auf die Längsachse der Hülle schräg neigen kann.

4. Getriebemotor nach Anspruch 3, wobei die Abtriebswelle eine Vielzahl von axial angeordneten Zapfen (34) aufweist und der Planetenträger eine Vielzahl von den Zapfen entsprechenden Sitzen (54) aufweist oder umgekehrt, um diese in sich aufzunehmen und so die Drehbewegung über den daraus resultierenden Eingriff an die Abtriebswelle weiterzuleiten.

5. Getriebemotor nach Anspruch 4, wobei die besagten Sitze und/oder die besagten Zapfen in Berührung stehende, gebogene Flächen haben, um eine entsprechende Wälzbewegung zu begünstigen, wenn die Abtriebswelle sich bezogen auf die Längsachse der Hülle neigt.

6. Getriebemotor nach Anspruch 4 oder 5, wobei die Vielzahl der Sitze auf dem Planetenträger als Ausnehmungen (54) deren Umfangs ausgeführt sind.

7. Getriebemotor nach Anspruch 6, wobei die Ausnehmungen auf dem Planetenträger eine Vielzahl von Sektoren (52) mit Löchern (56) bilden, in denen die Zapfen (48) einrücken können, welche die Planetenzahnräder bei der Drehung unterstützen.

8. Getriebemotor nach Anspruch 7, wobei der Planetenträger (50) drei symmetrische Sektoren umfasst, die um 120 Grad und jeweils symmetrisch zu dessen Mitte angeordnet sind.

9. Getriebemotor nach einem der Ansprüche 3 bis 8, wobei der Planetenträger eine Auflagefläche (58) für die Abtriebswelle auf der Höhe der Drehachse aufweist. Diese Auflagefläche umfasst eine Wölbung oder Konkavität, die einer Wölbung oder Konkavität (38) der Abtriebswelle entspricht. Diese Welle kann auf dem entsprechenden Teil des Planetenträgers gleiten oder wälzen, um die Neigung der Abtriebswelle bezogen auf die Längsachse der Hülle zu begünstigen.

10. Getriebemotor nach Anspruch 9, wobei die besagte Wölbung oder Konkavität der Auflagefläche halbrund ist.

11. Getriebemotor nach einem der vorhergehenden Ansprüche mit elastischen Mitteln (90), um die Drehachse der Abtriebswelle mit der Längsachse der Hülle federnd zusammenfallend zu halten.

12. Getriebemotor nach Anspruch 11, wobei die elastischen Mittel flexible Rippen (90) umfassen, die mit der Innenseite der Hülle verbunden und an dieser befestigt und so konfiguriert sind, dass sie die Drehachse der Abtriebswelle zur Längsachse der Hülle

drücken.

13. Getriebemotor nach einem der vorhergehenden Ansprüche, wobei besagte kugelförmige Kupplungselemente so ausgebildet sind, dass sie die Neigung in einem Winkel von ca. 4-5 Grad bezogen auf besagte Achse (X) gestatten.

Revendications

1. Motoréducteur (AZ) pour volets roulants comprenant

- une enveloppe tubulaire (10) ayant un axe longitudinal (X),
- des dispositifs moteurs logés dans l'enveloppe,
- un arbre de sortie (30) pivotant autour d'un axe de rotation (Y), qui sort de l'enveloppe tubulaire et est prévu pour actionner un volet roulant.
- un réducteur épicycloïdal (R) pour réduire les tours provoqués par les dispositifs moteurs et les transférer à l'arbre de sortie,

caractérisé en ce qu'il comprend des pièces d'accouplement de forme sphérique (32, 80 34, 54, 36, 58) pour raccorder l'arbre de sortie et le réducteur, de façon que l'axe dudit arbre puisse s'incliner par rapport à l'axe longitudinal de l'enveloppe.

2. Motoréducteur selon la revendication 1, dans lequel lesdites pièces comportent une surface convexe ou concave (32) de l'arbre de sortie au contact d'une surface concave ou convexe (80) complémentaire d'un élément (12, 84) interne de l'enveloppe, permettant à ces deux surfaces de frotter ou de rouler l'une sur l'autre.

3. Motoréducteur selon la revendication 1 ou 2 comprenant
un disque porte-satellites (50) muni de roues dentées satellites (60), formant un étage du réducteur, prévu pour transférer un mouvement rotatoire à l'arbre de sortie par les pièces (34, 54) à encastrement réciproque ; lesdites pièces ont des courbes moulées et/ou conjuguées pour permettre à l'arbre de sortie de tourner sur les porte-satellites et de s'incliner par rapport à l'axe longitudinal de l'enveloppe.

4. Motoréducteur selon la revendication 3, dans lequel l'arbre de sortie comporte une pluralité de tiges axiales (34) et le disque porte-satellites, une pluralité de sièges (54) correspondant aux tiges, ou vice versa, de façon à les loger et à transférer un mouvement rotatoire à l'arbre de sortie par l'encastrement qui en résulte.

5. Motoréducteur selon la revendication 4, dans lequel lesdits sièges et/ou lesdites tiges ont des surfaces de contact réciproque incurvées pour favoriser un mouvement relatif de roulement, au moment où l'arbre de sortie s'incline par rapport à l'axe longitudinal de l'enveloppe.

6. Motoréducteur selon la revendication 4 ou 5 dans lequel la pluralité de sièges du disque porte-satellites se présente sous forme de replis (54) de son périmètre.

7. Motoréducteur selon la revendication 6 dans lequel les replis déterminent une pluralité de secteurs (52) dans le disque. Ces secteurs sont percés de trous (56) où peuvent être enfilées des tiges (48) prévues pour supporter par roulement les roues dentées satellites.

8. Motoréducteur selon la revendication 7 dans lequel le disque porte-satellites (50) comprend trois secteurs symétriques placés à 120 degrés, symétriquement par rapport à son centre.

9. Motoréducteur selon l'une des revendications de 3 à 8 dans lequel le disque porte-satellites comporte une surface d'appui (58) pour l'arbre de sortie à hauteur de l'axe de rotation. Ladite surface d'appui comprend une convexité ou une concavité, qui est complémentaire d'une concavité ou d'une convexité (38) de l'arbre de sortie, cette dernière pouvant frotter ou rouler sur la concavité ou la convexité correspondante du disque porte-satellites afin de favoriser l'inclinaison de l'arbre de sortie par rapport à l'axe longitudinal de l'enveloppe.

10. Motoréducteur selon la revendication 9 dans lequel ladite convexité ou concavité de la surface d'appui est demi-sphérique.

11. Motoréducteur selon n'importe laquelle des revendications précédentes comprenant des pièces élastiques (90) pour maintenir en souplesse l'axe de rotation de l'arbre de sortie coïncidant avec l'axe longitudinal de l'enveloppe.

12. Motoréducteur selon la revendication 11 dans lequel les pièces élastiques comprennent des ailettes flexibles (90) solidaires et fixes à l'intérieur de l'enveloppe, façonnées afin de pousser l'axe de rotation de l'arbre de sortie vers l'axe longitudinal de l'enveloppe.

13. Motoréducteur selon n'importe laquelle des revendications précédentes, dans lequel lesdites pièces d'accouplement de forme sphérique sont façonnées pour permettre une inclinaison à un angle d'environ 4-5 degrés par rapport au dit axe (X).

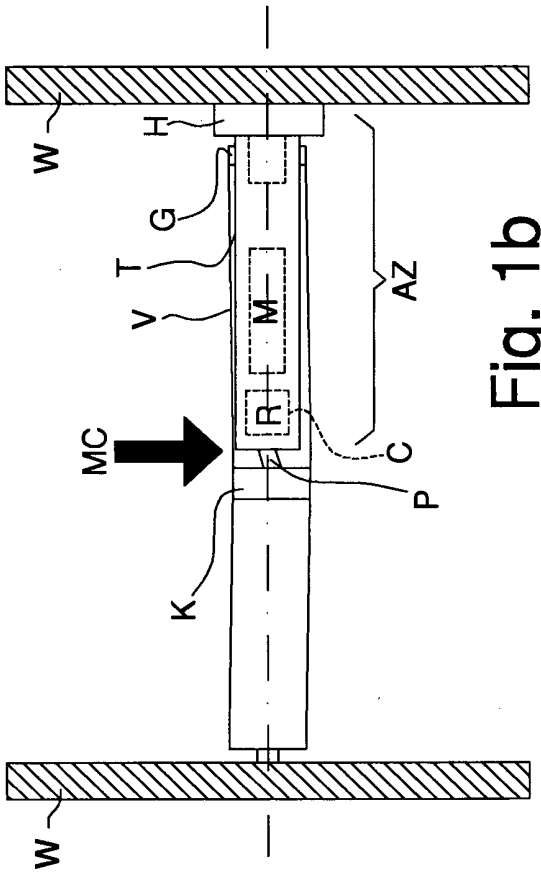


Fig. 1b

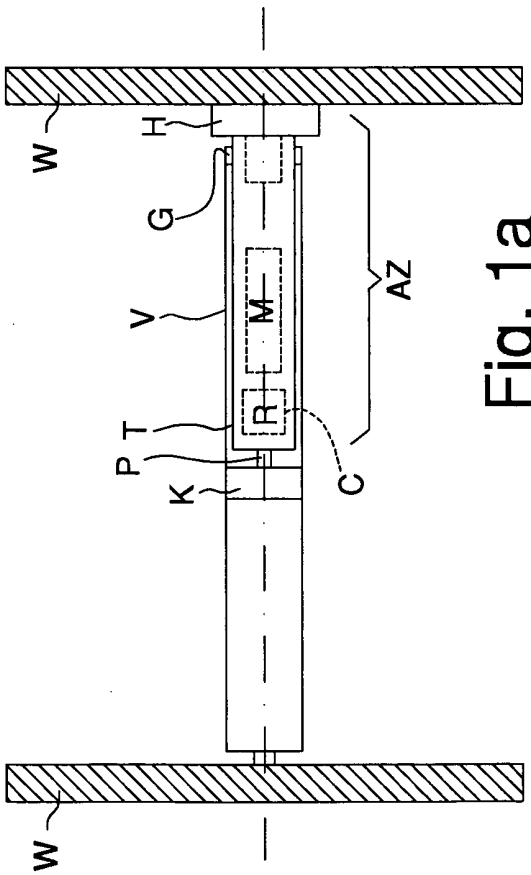


Fig. 1a

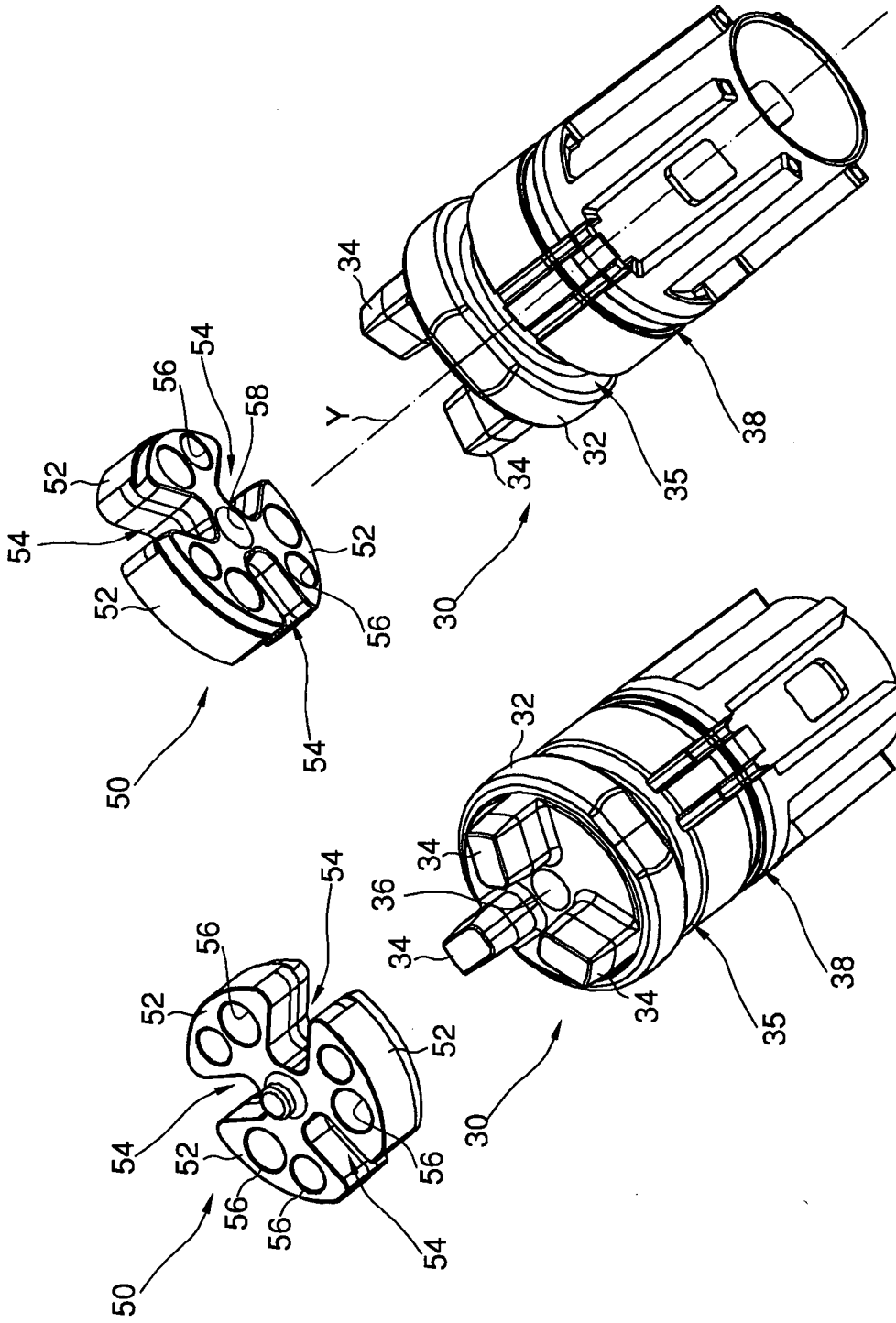

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Fig. 3

Fig. 2

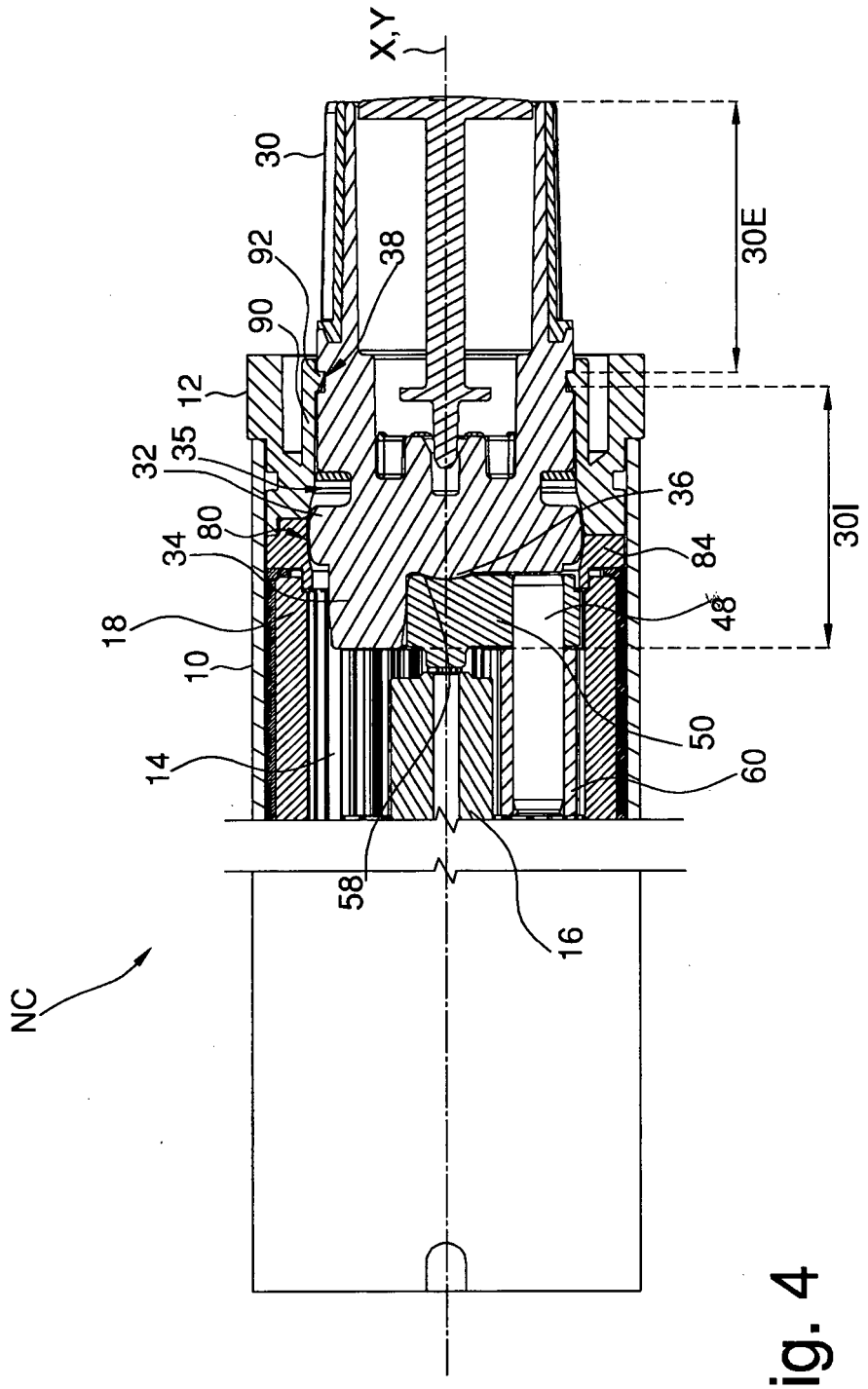


Fig. 4

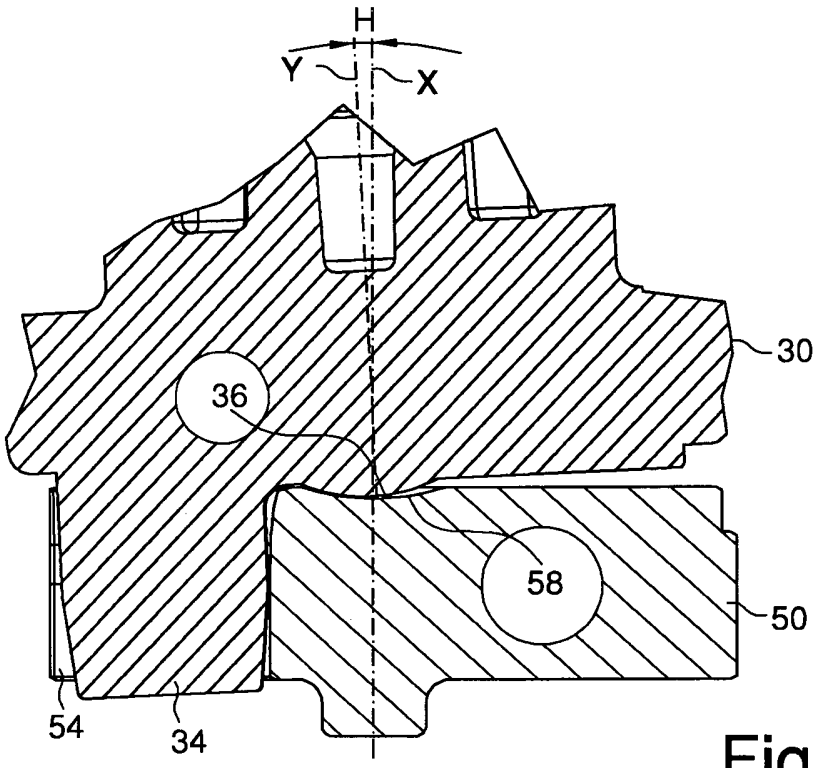


Fig. 5

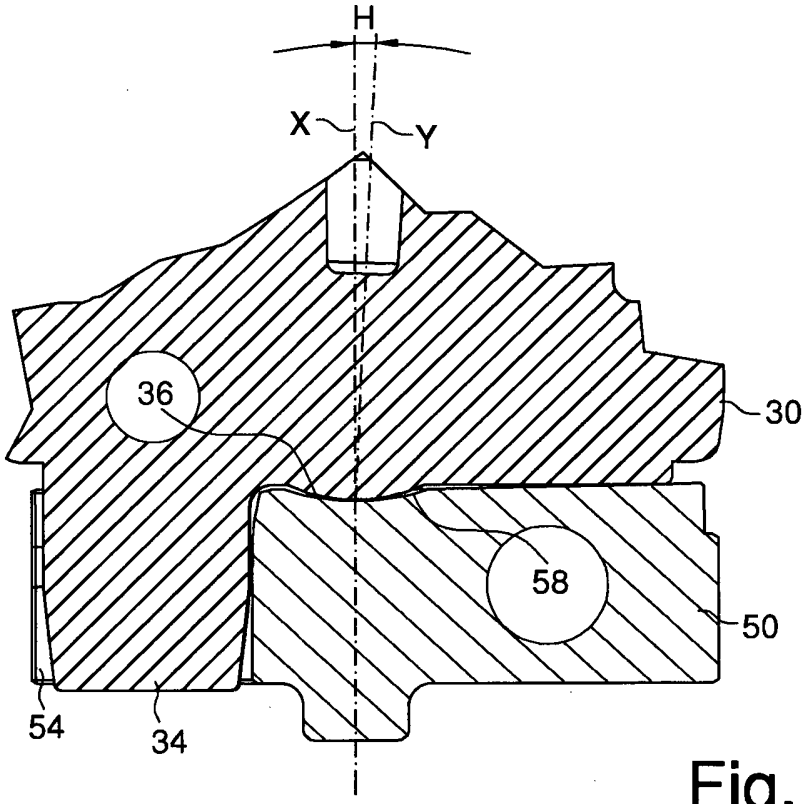


Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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