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(54) **Limit switch device actuated by rotary elements**

(57) A limit switch device for a tubular motor or a like winding device is provided for stopping power to the motor at two positions. Coaxial left and right handed screw threaded portions (17,18) are formed internally on a rotatable sleeve (16), the sleeve portions engaging respective left and right handed travelling screws. Axially aligned guide rods (54) connected between two cheeks and received in apertures in the travelling screws restrain

the travelling screws to reciprocate linearly, in opposite direction with rotation of the sleeve. A pair of limit switches (40,41) are disposed proximate one another, and for fine adjustment of the limit positions are provided by threaded abutments (24,25) engaged in each of the travelling screws. A winding tube for receiving the roller, or the like may be made rotationally fast with an internally geared ring driven through an internal reduction gear set to rotate the sleeve.

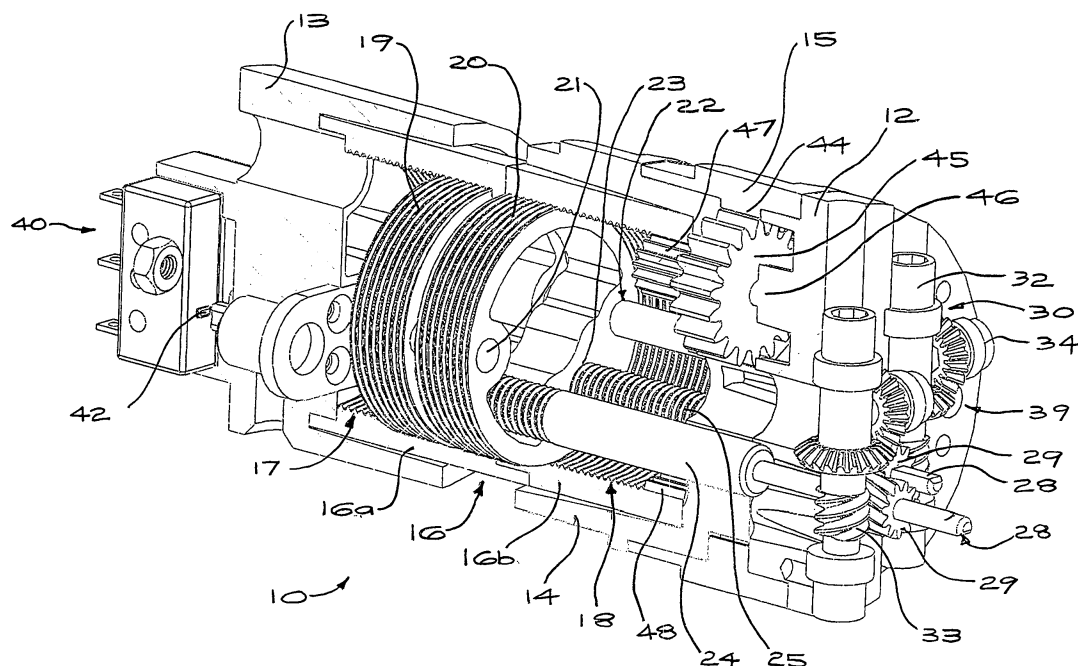


Figure 2

Description

Technical field

[0001] The present invention relates generally to an electrical switching device, and, more particularly, to such a switching device which is actuated by rotary elements.

Background of the Invention

[0002] There are many applications in which it is desirable to actuate switching means through rotary elements driven by an electric motor. One example is in blinds raised and lowered by a reversible motor, where a limit switch device controls power to the motor, stopping the motor when the blinds are fully raised and lowered respectively. One type of limit switch device employs left and right-hand threaded shafts each receiving a travelling nut and connected to a roller receiving the blind such that rotation of the roller produces relative rotation between the travelling nuts and screws. When the blinds are raised and lowered the nuts thus reciprocate linearly, in opposite directions, and operate respective switches, advantageously positioned together at an end of the device. In many of these prior art devices the left and right-hand threaded shafts lie parallel to one another, within the roller, however with this arrangement it is difficult to achieve a compact device which can be readily assembled. It is an object of the present invention to overcome or substantially mitigate these disadvantages or more generally to provide an improved limit switch device.

Disclosure of the Invention

[0003] According to one aspect of the present invention there is provided a limit switch device comprising:

a rotatable sleeve;

left and right handed screw threaded portions formed internally on the sleeve, the screw threaded portions having a common central longitudinal axis;

first and second travelling screws having external screw threads, each external screw thread being complementary to, and engaged in, a respective one of the left and right handed screw threaded portions;

guide means extending longitudinally through the travelling screws and preventing rotation of the travelling screws relative to the sleeve, wherein the guide means restrain the traveling screws to move linearly between opposing limit positions upon rotation of the sleeve;

a pair of co-located electrical switches (40, 41), and

a first and second abutment, each abutment being mounted to a respective one of the first and second travelling screws for contacting a respective ones of the switches.

[0004] Preferably the device further includes:

a cheek to which the guide means is fixed;

an internally toothed ring gear coaxial with the sleeve and mounted for rotation relative to the sleeve and to the cheek, and

a reduction gear set mounted to the cheek for transmitting torque between the ring gear and the sleeve.

[0005] Preferably the reduction gear set includes a second gear supported on an axle mounted to the cheek and meshed internally with the ring gear, a third gear rotationally fast with the second gear and meshed internally of a fourth gear rotationally fast with the sleeve.

[0006] Preferably first and second travelling screws each have a longitudinally extending threaded aperture therein and the first and second abutments have complementary threaded portions engaged therein for adjusting the abutments longitudinally.

[0007] Preferably the guide means comprises a pair of parallel rods fixed at one longitudinal end to the cheek and received in diametrically opposite apertures in each of the first and second travelling screws.

[0008] Preferably each abutment is adjustable longitudinally relative to the travelling screw to which it is mounted. Preferably each abutment comprises a screw threaded shaft portion in a threaded aperture in a respective one of the travelling screws such that the position of the abutment is adjusted by rotation of the threaded shaft. Preferably the device further includes a pair of adjuster members each mounted to rotate about a transverse axis, each adjuster member having means for engaging a tool and transmission means for transmitting torque between adjuster and its respective abutment. Preferably the transmission means includes a worm coaxial with the adjuster member and meshed with a worm wheel mounted to the abutment shaft.

[0009] In another aspect the invention provides a limit switch device comprising:

a rotating sleeve defining a longitudinal axis;

a pair of cheeks supporting opposing ends of the sleeve for rotation thereof about the longitudinal axis;

an internally toothed ring gear mounted to one of the cheeks for rotation about the longitudinal axis relative to the sleeve;

a reduction gearset meshed with the ring gear for transmitting torque between the ring gear and

sleeve;

left and right handed screw threaded portions formed internally on the sleeve, the screw threaded portions having a common central longitudinal axis;

first and second travelling screws having external screw threads, each external screw thread being complementary to, and engaged in, a respective one of the left and right handed screw threaded portions;

at least one guide extending through the travelling screws and supported at opposing ends by the cheeks, the guide cooperating with the travelling screws to prevent rotation thereof relative to the sleeve wherein the at least one guide restrains the traveling screws to move linearly in opposite directions upon rotation of the sleeve;

a pair of electrical switches mounted to one of the cheeks, and

a first and second abutment, each abutment being mounted to a respective one of the first and second travelling screws for contacting a respective ones of the switches, wherein each abutment is adjustable longitudinally relative to the travelling screw to which it is mounted.

[0010] In still another aspect the invention provides a winding device comprising:

an elongate winding tube for receiving a roller blind or the like;

an electric motor connected by transmission means for rotating the winding tube;

an internally toothed ring gear rotationally fast with the winding tube;

a sleeve coaxial with the ring gear and mounted for rotation relative to the ring gear;

a reduction gearset transmitting torque between the ring gear and sleeve;

left and right handed screw threaded portions formed internally on the sleeve, the screw threaded portions having a common central longitudinal axis;

first and second travelling screws having external screw threads, each external screw thread being complementary to, and engaged in, a respective one of the left and right handed screw threaded portions;

guide means extending longitudinally through the travelling screws and cooperating with the travelling

screws to prevent rotation thereof relative to the sleeve wherein the guide means restrain the traveling screws to move linearly between opposing limit positions upon rotation of the sleeve;

a pair of substantially adjacent electrical switches disposed proximate one of the limit positions, and

a first and second abutment each abutment mounted to a respective one of the first and second travelling screws for contacting a respective ones of the switches, wherein each abutment is adjustable longitudinally relative to the travelling screw to which it is mounted.

[0011] This invention provides a limit switch device which is effective and efficient in operational use, and which is compact in both the longitudinal and radial dimensions. The device may be economically constructed and has an overall simple design which minimizes manufacturing gear costs.

Brief Description of the Drawings

[0012] Preferred forms of the present invention will now be described by way of example with reference to the accompanying drawings, wherein:

Figure 1 is a schematic longitudinal section of a winding device incorporating a limit switch device according to an embodiment of the invention;

Figure 2 is a partially sectioned pictorial view of the limit switch shown in Fig. 1, and

Figure 3 is a pictorial view of the limit switch of Fig. 2 in which a number of the component have been omitted for clarity.

Description of the Preferred Embodiments

[0013] Referring gear to the drawings, Fig. 1 shows a tubular motor winding device comprising a winding tube 11 on which is wound a roller blind, or the like (not shown). This winding tube 11 has a central longitudinal axis 71 and one end of the winding tube 11 engages the limit switch device 10. Fixed to a longitudinal end of the limit switch device 10 is a support assembly 70 which may be mounted, for example, in a window opening.

[0014] Supporting the moving components of the limit switch device 10 are a first cheek 12 and a second cheek 13 fixed together by a pair of parallel guide rods 54. When installed the cheeks 12, 13 are fixed via intermediate members to the frame of a window, or the like. A journal block 14 is fixed to the first cheek 12 and cooperates with the cheek 12 to locate and support a ring gear 15 for rotation about the axis 71. The ring gear 15 is journaled on coaxial cylindrical faces on the journal block 14 and

cheek 12 and located axially between shoulders on the journal block 14 and cheek 12.

[0015] A generally cylindrical sleeve 16 is supported to rotate about the axis 71 with its opposing ends received in coaxial recesses in the second cheek 13 and the journal block 14. On the inside of the sleeve 16 are screw threaded portions of opposite hand, a left handed portion 17 innermost and a right handed portion 18 outermost. The screw threaded portions 17, 18 are aligned coaxially and are of the same nominal diameter and pitch. As illustrated, the screw threaded portions 17, 18 may be formed on separate portions 16a, 16b permanently joined as by an interference fit or welding to form the sleeve 16.

[0016] First and second travelling screws 19, 20 have external left and right handed threads and are received in the left and right handed screw threaded portions 17, 18 respectively. A pair of parallel axially extending apertures 21, 22 are provided in each of the travelling screws 19, 20, in diametrically opposing positions. A threaded hole 23, aligned axially, is also formed in each of the travelling screws 19, 20.

[0017] The guide rods 54 extend axially and are received in the apertures 21, 22 in both traveling screws 19, 20 in a sliding fit thereby preventing rotation of the traveling screws which are thereby guided linearly.

[0018] First and second abutments or abutment shafts 24, 25 are elongated to extend axially and each is externally threaded and received in one of the threaded holes 23 in each of the travelling screws 19, 20. The abutment shafts 24, 25 protrude from the traveling screws 19, 20 and their inner ends terminate in inner faces 26, 27. The longitudinally opposing outer ends of the abutment shafts 24, 25 extend through the cheek where each is supported in a worm wheel mounted to the cheek, securing gear the worm wheel axially relative to the abutment shaft 24, 25. The outer end of each abutment shaft 24, 25 has a longitudinally extending flat 28 and is received in a through-extending aperture in the helicoids gear or worm wheel 29 which is of complementary shape to the abutment shaft 24, 25, with a corresponding flat such that torque can be transmitted between the worm wheel 29 and abutment shaft 24, 25, while the abutment shaft 24, 25 can also slide longitudinally within the worm wheel.

[0019] Two adjuster members 30, 31 are mounted to the cheek 12 such that each may rotate about transversely aligned first parallel axes 35, 36. Each adjuster member 30, 31 has a first socket 32 for receiving a tool, and an integral worm gear 33 meshed with the worm wheel 29. The sockets 32 are recessed within the cheek 12. By rotation of an adjuster member, the respective abutment shaft 24, 25 is thereby turned so as to adjust the positions of the inner faces 26, 27 longitudinally relative to the travelling screw 19, 20 in which it is threadably engaged. To provide for further flexibility in accessing the device to perform this manual adjustment of the longitudinal stop positions, second sockets 34 are mounted for rotation about parallel transverse axes 37, 38 substantially orthogonal to the first axes 35, 36. A bevel gear pair 39

connects each second socket 34 and adjuster member 30, 31 for transmitting torque therebetween.

[0020] A pair of electrical limit switches 40, 41 are co-located at one longitudinal end of the limit switch device 10. The switches are mounted to the second cheek 13 adjacent one another. Each switch 40, 41 has an actuator 42 by which the switch is actuated, the actuators 42 being aligned axially with the end faces 26, 27 of the abutment shafts 24, 25. The switches 40, 41 are connected to a controller (not shown) for controlling power supply to the reversible motor for moving the blind. For instance, if switches 40 and 41 are actuated when the blind is fully raised and lowered respectively, then the controller prevents the motor being driven in a first direction to raise the blind when switch 40 is actuated, and correspondingly prevents the motor being driven in a second direction, opposite the first direction, to lower the blind when switch 41 is actuated.

[0021] Straight cut teeth 44 are formed internally on the ring gear 15. A reduction gear set includes a second spur gear 45 supported on an axle 46 integral with the first cheek 12 and meshed internally with the teeth 44 of first ring gear. A third spur gear 47 rotationally fast with the second gear 45 is sized to provide a second reduction stage. A third reduction stage is provided by the third gear 47 being meshed internally with a fourth ring gear 48, the teeth of which are formed internally in the sleeve 16.

[0022] The winding tube 11 is rotationally fast with the ring gear 15 and thus operation of the motor to rotate the winding tube 11 drive the travelling screws 19, 20 to reciprocate linearly, in opposite directions. The reduction gear set provides a large reduction in a small space, thereby allowing the axial dimension of the device to be reduced, while the coaxial arrangement of the traveling screws allows a reduction in the radial dimension of the device.

[0023] Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope thereof.

Claims

1. A limit switch device (10) comprising:

a rotatable sleeve (16);
left and right handed screw threaded portions (17,18) formed internally on the sleeve, the screw threaded portions having a common central longitudinal axis (71);
first and second travelling screws (19, 20) having external screw threads, each external screw thread being complementary to, and engaged in, a respective one of the left and right handed screw threaded portions;
guide means (54) extending longitudinally

- through the travelling screws and preventing rotation of the travelling screws relative to the sleeve, wherein the guide means restrain the traveling screws to move linearly between opposing limit positions upon rotation of the sleeve; a pair of co-located electrical switches (40, 41), and
a first and second abutment (24, 25), each abutment being mounted to a respective one of the first and second travelling screws for contacting a respective ones of the switches.
2. The device of claim 1 further including:
- at least one cheek (12, 13) to which the guide means is fixed;
an internally toothed ring gear (15) coaxial with the sleeve and mounted for rotation relative to the sleeve and to the cheek, and
a reduction gear set (45, 47, 48) mounted to the cheek for transmitting torque between the ring gear and the sleeve.
3. The device of claim 2 wherein the reduction gear set includes a second gear (45) supported on an axle mounted to the cheek and meshed internally with the ring gear, a third gear (47) rotationally fast with the second gear and meshed internally of a fourth gear (48) rotationally fast with the sleeve.
4. The device of any one of claims 1 to 3 wherein first and second travelling screws each have a longitudinally extending threaded aperture therein and the first and second abutments have complementary threaded portions engaged therein for adjusting the abutments longitudinally.
5. The device of any one of claims 2 to 4 wherein the guide means comprises a pair of parallel rods (54), and the cheek is fixed at one longitudinal end of the rods, the rods being received in diametrically opposite apertures (21,22) in each of the first and second travelling screws.
6. The device of any one of claims 1 to 3 wherein each abutment is adjustable longitudinally relative to the travelling screw to which it is mounted.
7. The device of any one of claims 1 to 6 wherein each abutment comprises a screw threaded shaft portion received in a threaded aperture in a respective one of the travelling screws such that the position of the abutment is adjusted by rotation of the threaded shaft, a pair of adjuster members are each mounted to rotate about a transverse axis, each adjuster member having means for engaging a tool and transmission means for transmitting torque between adjuster and its respective abutment.
8. The device of claim 7 wherein the transmission means includes a worm (33) coaxial with the adjuster member and meshed with a worm wheel (29) mounted to the abutment shaft.
9. The device of any one of claims 1 to 8 wherein first and second cheeks support opposing ends of the sleeve for rotation thereof about the longitudinal axis, longitudinally opposing ends of the guide means are fixed to the first and second cheeks respectively, both pairs of adjuster members are mounted to the first cheek and the pair of switches are mounted to the second cheek.
10. A winding device including a limit switch device (10) as claimed in any one of claims 1 to 9 and further including
an elongate winding tube (11) rotationally fast with the rotatable sleeve (16), the winding tube being adapted for receiving a roller blind or the like, and a reversible electric motor connected by transmission means for rotating the winding tube.

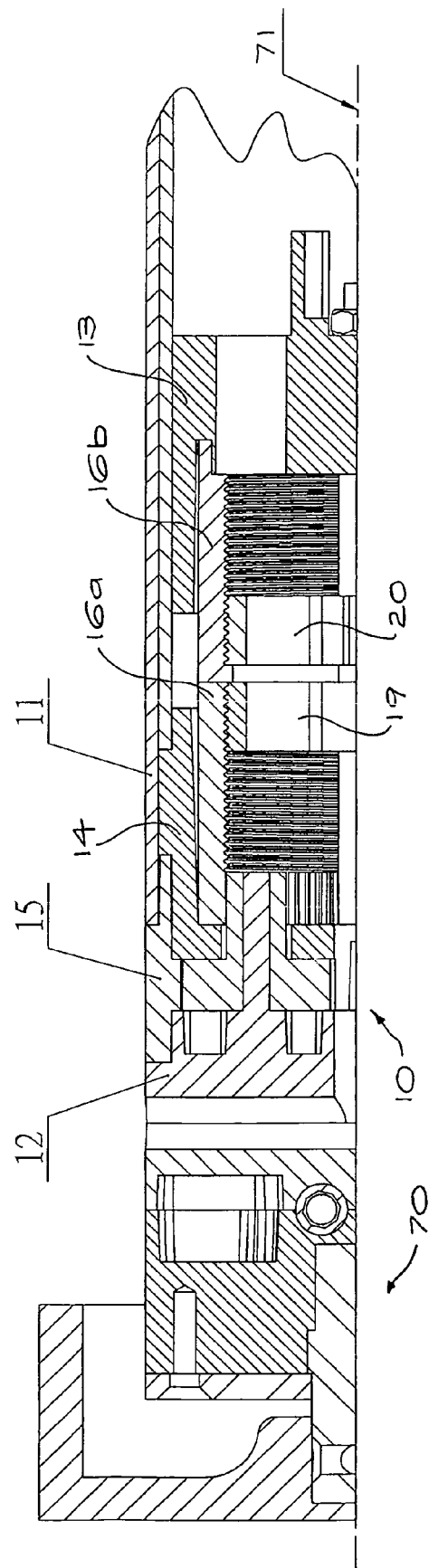


Figure 1

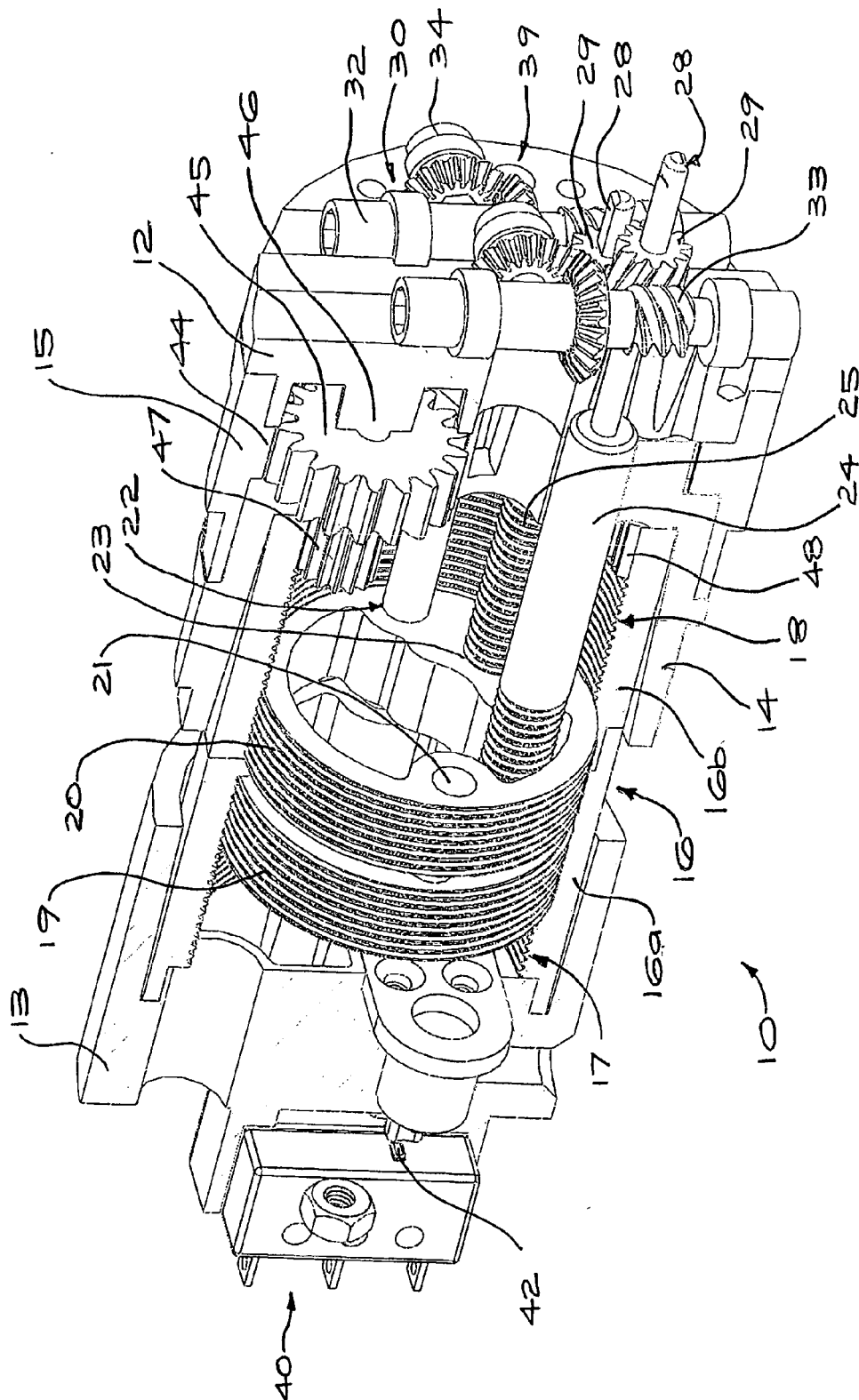


Figure 2

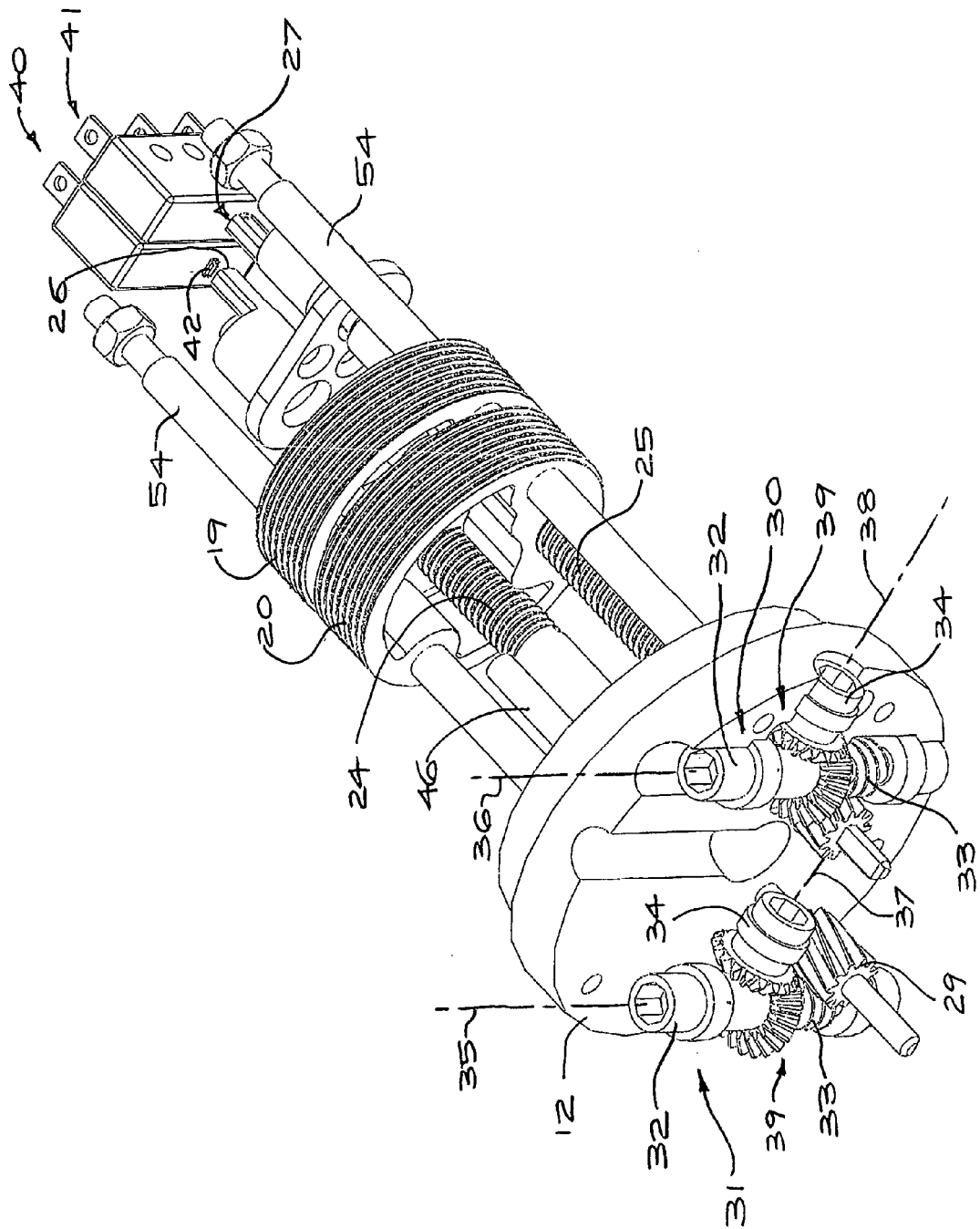


Figure 3



EUROPEAN SEARCH REPORT

Application Number
EP 08 25 2426

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			H01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 27 November 2008	Examiner Simonini, Stefano
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

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EPO FORM 1503 03 82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 08 25 2426

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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27-11-2008

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