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The present invention relates to a height-adjustable drive, in particular for furniture, according to the preamble of claim 1.

5 Such height-adjustable drives are used, for example in furniture, in particular in work or office tables, to adjust the table plate to different heights. The drives may be adjusted either by hand or by electric motor. The gear units used for the height adjustment are complex, require
10 considerable installation space and do not operate at low noise levels.

The invention is based on the object of designing the generic height-adjustable drive in such a way that, with a
15 simple constructional design, it has a compact design and can be operated at low noise levels.

In accordance with the invention, this object is solved for the generic drive by the characterizing features of claim 1.
20

In the case of the drive according to the invention, the height adjustment is performed by displacing the sliding parts in opposite directions relative to each other. The drive connection between the two sliding parts is effected
25 by the tension element. In contrast to conventional height-adjustable drives, the individual elements of the drive are therefore not adjusted in the same direction. The sliding parts with the traction element form a kind of endless drive, by which the sliding parts are adjusted in opposite
30 directions relative to each other. Such a drive is known from W003/003876 A1. During the adjustment in opposite directions, the one sliding part may rest on the floor, for example via a floor support, so that the other sliding part

can be adjusted in height relative to it. In this case, the tension element according to the invention is formed as a tension band, which requires only a small amount of installation space. Similar tension elements are described
5 in DE 102 16 774 A1 and DE 198 41 884 A1. The manufacture and the installation of such a tension element in a cost-effective manner are possible. Furthermore, the drive according to the invention can be made slender by providing the tension bands. In addition, the drive is characterized
10 by a low-noise operation as a result of the design with tension bands according to the invention.

Further features of the invention result from the further claims, the description and the drawings.
15

The invention is explained in more detail by means of embodiments shown in the drawings. In the drawings:

Fig. 1 is a perspective view of a height-adjustable drive
20 according to the invention in a retracted state;

Fig. 2 is a perspective view of the drive according to the invention in a partially extended state;

Fig. 3 is a perspective view of the drive according to the
25 invention in a fully extended state;

Fig. 4 is a perspective view of the individual parts of the drive according to the invention,

30 Fig. 5 is an enlarged view of an end of the drive according to the invention

Fig. 6 is a schematic illustration of an end of a tension band of the drive and the associated end of the drive,

Fig. 7 is an exploded view of a second embodiment of the
5 drive according to the invention,

Fig. 8 shows a second embodiment of a motor of the drive according to the invention,

10 Fig. 9 shows the drive according to the invention accommodated in a lifting column.

The drives described in the following are formed telescopically and are continuously adjustable to different
15 lengths. The drives are advantageously provided for furniture, in particular for tables, which are to be adjusted to different heights. The drives are installed in lifting columns 63 (Fig. 9), which are of telescopic type and with which a table plate 64 or the like can be adjusted
20 continuously in height. This lifting column 63 has at least two telescopic parts 65 to 67, which can be adjusted in height by the telescopic drive. It is easily possible to use the drive itself as a lifting column, thus not accommodating it in a separate lifting column.

25

The drive according to Figs. 1 to 6 has three telescopic parts 1 to 3, which can be displaced continuously in a manner to be described. Of course, the drive may also have more than three telescopic parts.

30

The telescopic part 1, which is lower in installation position, has a support (not shown) with which the drive rests on the floor within the lifting column 63. At its free

end, the upper telescopic part 3 carries a motor 5, preferably an electric motor. It has a motor housing 6 from which a power supply line 7 is led out. The motor 5 has a drive shaft 8 (Figs. 2 and 4) which is non-rotatably
5 connected to the one end of a threaded spindle 9 which is rotatably mounted in the central telescopic part 2, which is preferably a tube in which the threaded spindle may be arranged in a protected manner.

10 At the end facing the motor 5, a guide part 39 (Fig. 4) is seated on the telescopic part 2 and has a spindle nut 10 which sits on the threaded spindle 9 and is fastened in the telescopic part 2. The spindle nut 10 rests on a shoulder 11 which is inserted into the telescopic part 2 and is fastened
15 there in a suitable manner.

A guide part 4 with a shoulder 12 is inserted into the opposite end of the telescopic part 2 and fastened in a suitable manner.

20

The guide part 39 block-shaped and has, on two sides opposite to each other, respective supports 13 and 14 in the shape of circular segments for each tension band 15 and 16. With their ends 17, 18 facing the motor, they are placed
25 over the supporting surfaces 13, 14 and with their free ends they are fastened to a plate-shaped sliding part 19. It is provided on the outer side of the telescopic part 2 and is preferably formed as a U-shaped rail. The sliding part 19 projects through an opening 20 in the guide part 4 (Fig. 3).
30 On its end facing away from the motor 5, the sliding part 19 is provided with a transversely projecting fastening element 21, with which the drive is fastened within the lifting column 63 at the lower end. The fastening element 21 is

formed by two tabs projecting perpendicularly to the longitudinal axis of the sliding part 19. When the drive is retracted, the sliding part 19 extends from the guide part 4 almost to the motor 5.

5

The end 22, 23 of the tension bands 15, 16 facing away from the motor 5 is fastened to a another plate-shaped sliding part 24 close to the end facing away from the motor 5. The sliding part 24 is also preferably formed as a U-shaped rail
10 which is fastened to the underside 25 of the motor housing 6 facing the telescopic part 2 (Figs. 1 and 4). For attachment to the motor housing 6, the sliding part 24 is provided, at its end facing the motor 5, with transversely projecting tabs 26 which are screwed to the underside 25 of the motor
15 housing 6.

The two sliding parts 19, 24 form the telescopic parts 1 and 3 of the drive.

20 The ends 22, 23 of the tension bands 15, 16 are fastened to the inner or outer side of the sliding part 24, at its end facing away from the motor 5, by means of screws 27, rivets and the like. The sliding part 24 is preferably provided on the side of the telescopic part 2 opposite to the sliding
25 part 19. The two sliding parts 19, 24 partially surround the telescopic part 2. When the drive is retracted, the sliding part 24 extends from the motor 5 to the guide part 4 of the telescopic part 2.

30 The guide part 4 carries a freely rotatable deflection roller 28 whose axis of rotation is perpendicular to the longitudinal axis of the telescopic part 2. A further tension band 29 is deflected by 180° by means of the

deflection roller 28 (Fig. 4). The one end 30 of the tension belt 29 is fastened to the end of the sliding part 19 facing the motor 5. The ends 17, 18, 30 of the tension bands 15, 16, 29 are fastened to the inside of the sliding part 19 at the same height by means of screws 31, rivets and the like.

The other end 32 of the tension band 29 is deflected by 180° at the deflection roller 28 and attached to the sliding part 24 at the end region facing away from the motor 5. At its end facing the guide part, the sliding part 24 has a through hole 33 (Figs. 4 and 5), through which the tension band end 32 is led to the outside. The tension band end 32 is fastened to the outer side of the sliding part 24 by means of a screw 34 or the like. In the region between the fastening end and the through hole 33, the sliding part 24 is provided with at least one clamping strap 35 (Fig. 4) which is partially punched out of the sliding part 24 and abuts against the tension band end 32 under pretension. The clamping strap 35 ensures that the tension band 29 is always under tension during the height adjustment of the drive. The strap 35 is bent toward the tension band end 32 so that it abuts against the tension band end 32 in the assembled position of the tension band 29.

A damping element 37 is provided between the spindle nut 10 and the drive element 5, against which the telescopic part 2 abuts when the drive is retracted. The damping element 37 is a damping ring (Fig. 4), through which the threaded spindle 9 extends.

30

On the free end of the threaded spindle 9 located within the telescopic part 2, there is another damping element 38 (Fig. 2) which comes to abut against the shoulder 11 of the

guide part 39 when the drive is fully extended. The two damping elements 37, 38 ensure that the telescopic parts reach the stop position during the retraction and during the extension in a dampened manner. As a result, the drive
5 operates very quietly during the length adjustment. In addition, it is possible that the telescopic parts of the drive reach a hard stop without damage. The motor 5 then switches off in a known manner or remains under voltage until the user switches off the motor. The advantage of this
10 embodiment is that no limit switches are necessary for switching off the motor 5.

Advantageously, the end positions of the drive are adjusted in a known manner via a control and a tachogenerator. For
15 this purpose the motor 5 is operated and the drive is adjusted from the retracted into the extended end position. The blocking position occurring at the end of the extension path is detected and stored by the control unit. In the same way, the blocking position is also detected and stored by
20 the control unit during the retraction of the drive. This calibration procedure is usually necessary only once. During further usage of the drive, this calibration results in the motor 5 switching off shortly before blocking position when the drive is moved in and out.

25

In another embodiment, only the one blocking position is detected in the described manner during the calibration process. The other blocking position is determined automatically by the control if the maximum extension length
30 of the drive is known.

The tension bands 15, 16, 29 are advantageously made of spring steel. However, they may also be made of any other

suitable material guaranteeing tensile strength. Since the tension bands 15, 16, 29 consist of flat material, they require only a small installation space. The height-adjustable drive can therefore be formed slender.

5

The guide part 4 forms a guide for the sliding part 19 during the height adjustment of the drive. The other sliding part 24 is supported by the guide part 39 which contains the spindle nut 10 during the height adjustment of the drive.

10

Fig. 1 shows the drive in the retracted position. The two sliding parts 19, 24 cover the telescopic part 2 over the major part of its circumference (Fig. 1). The sliding part 24 extends almost to the guide part 4. If the motor 5 is

15 switched on and the threaded spindle 9 is rotated in the corresponding direction about its axis, the threaded spindle 9 moves out of the telescopic part 2 with the motor 5. Since the sliding part 24 is connected to the motor 5, it is adjusted to the same extent as the threaded spindle 9

20 relative to the telescopic part 2. By means of the tension bands 15, 16, the telescopic part 2 and the sliding part 24 are caused to move relative to the sliding part 19. In this way, the table plate 64 or the like is raised. The maximally extended position of the drive is shown in Fig. 3. In this

25 position, the damping element 38 (Fig. 2) abuts against the guide part 39. When the telescoping part 3 is displaced, the tension bands 15, 16 are displaced along the supporting surfaces 13 shaped as circular segments relative to the telescopic part 2 at the guide part 39. The tension band 29

30 is displaced relative to the deflection roller 28. Since it is mounted freely rotatably in the guide part 4, the tension band 29 can also be displaced without jerk during the height adjustment of the drive. When the drive is extended, the

tension band 29 is under load or tension, so that the telescopic parts 2, 3 can be displaced properly. The tension bands 15, 16 are relieved from tension during extension.

- 5 The height-adjustable drive is structurally simple in design and can accordingly be produced cost-effectively. The drive is quiet when adjusting the height. The threaded spindle 9 with the spindle nut 10 is configured such that self-locking occurs in each extension position of the drive.

10

Together, the sliding parts 19, 24 and the tension bands 15, 16, 29 form an endless drive, which permits a continuous and exact height adjustment of the drive in a structurally simple yet reliable manner.

15

If the threaded spindle 9 is driven in the opposite direction by the motor 5, the drive is retracted again. During retraction, the tension bands 15, 16 are also relieved of tension in case of sufficient load, while the

- 20 tension band 29 supports the load. If there is an unintentional jamming when the drive is retracted, the tension bands 15, 16 are put under tension, so that the jamming effect is overcome.

- 25 In the exemplary embodiment shown, two tension bands 15 and 16 are provided. Even one of these two tension bands 15, 16 is sufficient for extending and retracting the drive.

Accordingly, the guide part 39 also requires only one support surface shaped like a circular segment for this

- 30 single tension band. Advantageously, the guide part 39 also has the two support surfaces 13, 14 shaped like a circular segment in such a case. The sliding part 24 may also be attached directly or indirectly to the underside of the

table plate 64 via an adapter. This does not change the described function of the drive.

The motor 5 is configured as a spur gear or planetary gear unit. Of course, the motor 5 may also include an angular gear, as shown schematically in Fig. 8. In this case, the drive shaft 8 is at an angle, preferably at right angles, to the longitudinal axis of the motor housing 6.

10 Instead of the freely rotatable deflection roller 28 at the guide part 4, a guide shaped as a circular segment at the guide part 4 is also possible, as is also provided on the opposite guide part 39.

15 Instead of the clamping strap 35, any other suitable tensioning device for the tension band 29 may be provided. Advantageously, the end 32 of the tension belt 29 is configured such that tolerance compensation during assembly is possible. This tolerance compensation is advantageously
20 formed by the tension band edge 32 having a plurality of equally spaced through holes 36 for the fastening elements 34 (Fig. 6). At the sliding part 24, corresponding openings 68 for the fastening element 34 are provided, these openings 68 being at a different distance from one another than the
25 openings 36 in the tension band end 32. In this way, a problem-free tolerance compensation is ensured during assembly of the drive.

Fig. 7 shows a second embodiment of a height-adjustable
30 drive, wherein a single continuous tension band 40 is used instead of the individual tension bands. It is guided over two deflection rollers 41, 42. The sliding parts 19 and 24 are fastened to the two strands of the continuous tension

band 40. At its end facing the motor 5, the sliding part 19 is fastened by screws 43, rivets and the like to the end 44 of the tension belt 40 facing the motor 5 when the drive is retracted. At its end facing the guide part 4, the opposite
5 sliding part 24 is fastened with screws 45, rivets and the like to the end 46 of the other strand of the tension band 40 facing the guide part 4 when the drive is retracted.

A guide element 47, which is fastened to one side of the
10 telescopic part 2, is provided for guiding the tension band 40. It has two transversely projecting bolts 48, 49, on which the guide element 47 is plugged. For this purpose, two plug openings 50, 51 are provided. In addition, the guide element 47 is provided with a respective groove 52, in which
15 the respective strand of the tension band 40 is located, on its upper and lower sides. The grooves 52 ensure that the tension band is guided correctly transversely to its longitudinal direction.

20 The guide element 47 is strip-shaped and has, on its longitudinal side facing away from the telescopic part, a strip 53 which protrudes in the direction of the guide part 4 beyond the guide element 47. The protruding end of the strip 53 is provided with the plug opening 50. The
25 deflection roller 41 is pushed onto the bolt 48 before the guide element 47 is plugged onto the two bolts 48, 49. Thus, the deflection roller 41 is located in the region between the telescopic part 2 and the protruding end of the strip 53. The guide element 47 and the deflection roller 41 are
30 secured by a securing ring 54 fitted onto the free end of the bolt 48. A securing ring 55 is also fastened on the free end of the bolt 49, which protrudes through the plug opening 51 of the guide element 47. The guide element 47, which

supports the circumferential tension band 40, is thus held flawlessly on the telescopic part 2.

In the end of the guide element 47 facing the motor 5, a
5 projection 56 of a fork 57 is inserted, which receives an axis 58 on which the deflecting roller 42 is mounted freely rotatably. It is axially secured between the fork legs of the fork 57.

10 The fork 57 is biased in the direction of the motor 5 by a compression spring 59, which is accommodated in the telescopic part 2 and secured axially by the bolt 49. Under the force of the compression spring 59, the fork 57 with the deflection roller 42 is biased in the direction of the motor
15 5. As a result, the tension belt 40 is always kept under tension.

As in the previous embodiment, the shaft 8 of the motor 5 drives the threaded spindle 9 which projects into the
20 telescopic part 2. In accordance with the previous embodiment, the sliding part 19 is guided in an opening of the guide part 4 during axial displacement. On the end facing away from the motor 5, the sliding part 19 is fastened on a floor support 60. The other sliding part 24 is
25 fastened directly to the underside of the table plate 64 (Fig. 9) by means of a transversely protruding flange 61 on the underside 25 of the motor housing 6 or via an adapter (not shown). In addition, the sliding part 24 is guided by a guide ring 62 during its adjustment. Advantageously, the
30 guide ring 62 is a clamping ring, which is clamped on the end of the telescopic part 2 facing the motor 5. The guide ring 62 is configured such that it can reliably guide the sliding part 24 during its displacement movement.

The two sliding parts 19, 24 are sufficiently wide so that they cover both the telescopic part 2 and the guide element 47 fastened laterally thereto when the drive is retracted.

5 As in the previous exemplary embodiment, the sliding parts 19, 24 are so long that the telescopic part 2 is almost completely covered when the drive is retracted.

When the threaded spindle 9 is rotated by the motor 5, the
10 spiral spindle 9 moves out of the telescopic part 2. Since the sliding part 24 is fastened to the motor housing 6 or is connected to the table plate 64, it is correspondingly moved along. As a result, the sliding part 19 is also displaced in the opposite direction relative to the telescopic part 2 by
15 means of the continuously circulating tension band 40. The movement sequence is the same as in the previous exemplary embodiment.

The deflection rollers 28, 41, 42 used in the described
20 embodiments are advantageously of convex design, thereby reliably ensuring that the tension bands 29, 40 are held centrally on the deflection rollers.

In the described embodiments, the motor 5 is provided close
25 to the table plate 64 or the like of the furniture. This has the advantage that the power supply line 7, the control lines and the like can be easily accommodated in a cable duct under the table plate. In principle, however, the motor 5 may also be provided in the foot region of the lifting
30 column 63. Then the power cable, control cable and the like must be guided upwards to the cable duct of the table plate, however. In this case, the telescopic drive is provided turned by 180° as compared to the illustrated embodiments.

In the two embodiments, the tension bands 15, 16, 29, 40 are connected to the two sliding parts 19, 24 in the described manner. If the drive is accommodated in the lifting column 5 63, at least one end of the tension bands may be fastened to the lifting column. In this case, at least one of the sliding parts may be omitted.

The gear unit of the motor 5 may be self-locking. The drive 10 may further comprise a brake acting in one direction.

Advantageously, the motor 5 includes a speed detection means which includes at least one pulse generator, preferably a Hall generator. The motor 5 may also have a magnetic cogging 15 torque.

It is advantageous if the spindle nut 10 of the guide part 39 has self-lubricating components.

20 The adjustment speed of the two sliding parts 19 and 24 relative to one another is twice as great as the adjustment speed of the telescopic part 2 relative to the motor 5. As a result, the lifting adjustment of the drive may be performed rapidly.

25

Patentkrav

1. Højdejusterbart drev, især til møbler, med mindst to teleskopiske dele, der er bevægelige i forhold til hinanden og kan aktiveres af en motor (5), hvilket drev har mindst to skubbedele (19, 24), der er justerbare i modsatte retninger i forhold til hinanden og som er forbundet af mindst et trækkelement (15, 16, 29, 40), og hvor trækkelementet (15, 16, 29, 40) er dannet som et bånd, **kendetegnet ved at** motoren (5) roterbart driver en gevindspindel (9), på hvilken en spindelmøtrik (10) forbundet til den teleskopiske del (2) er anbragt, hvor gevindspindelen (9) bevæges ud af den teleskopiske del (2).
- 10 **2.** Drevet ifølge krav 1, **kendetegnet ved at** skubbedelene (19, 24) mindst delvist omgiver en teleskopisk del (2) når drevet er tilbagetrukket.
- 15 **3.** Drevet ifølge krav 1 eller 2, **kendetegnet ved at** en skubbedel (19) er fast forbundet til en bundstøtte (60).
- 4.** Drevet ifølge et hvilket som helst af kravene 1 til 3, **kendetegnet ved at** den anden skubbedel (24) er fast forbundet til et hus (6) af motoren (5).
- 20 **5.** Drevet ifølge et hvilket som helst af kravene 1 til 3, **kendetegnet ved at** den anden skubbedel (24) er fast forbundet til delen (64) der skal justeres, fortrinsvis en bordplade.
- 25 **6.** Drevet ifølge et hvilket som helst af kravene 1 til 5, **kendetegnet ved at** den ene teleskopiske del (2) har mindst en føring (4, 39, 62) til mindst en skubbedel (19, 24).
- 30 **7.** Drevet ifølge et hvilket som helst af kravene 1 til 6, **kendetegnet ved at** den ene teleskopiske del (2) har en føring (4, 39, 62) for hver af de to skubbedele (19, 24) .

8. Drevet ifølge et hvilket som helst af kravene 1 til 7,
kendetegnet ved at trækelementerne (15, 16, 29) har en ende (17, 18, 30)
fastgjort til en skubbedel (19) og den anden ende (22, 23, 32) er fastgjort til den
anden skubbedel (24).
- 5
9. Drevet ifølge krav 8,
kendetegnet ved at den ene ende (17, 18) af det ene trækelement (15, 16) er
ført over en buet støtteflade (13, 14) af føringsdelen (39)
- 10
10. Drevet ifølge krav 9,
kendetegnet ved at føringsdelen (39) er fastgjort til en teleskopisk del (2).
11. Drevet ifølge et hvilket som helst af kravene 8 til 10,
kendetegnet ved at den anden ende (32) af det andet trækelement (29) er ført
15 over en omdirigeringsrulle (28).
12. Drevet ifølge krav 11,
kendetegnet ved at omdirigeringsrullen (28) er frit roterbar ved den ene føring
(4) af den ene teleskopiske del (2).
- 20
13. Drevet ifølge et hvilket som helst af kravene 8 til 12,
kendetegnet ved at den anden ende (32) af det andet trækelement (20) er
forspændt af mindst et fastspændingselement (35, 36).
- 25
14. Drevet ifølge krav 13,
kendetegnet ved at fastspændingselementet (35, 36) er en laske delvist
udstanset af det ene skubbedel (24).
15. Drevet ifølge et hvilket som helst af kravene 1 til 14,
30 **kendetegnet ved at** trækelementet (40) er et endeløst omløbende bånd.
16. Drevet ifølge krav 15,
kendetegnet ved at den ene skubbedel (19) er fastgjort til en streng af

trækelementet (40) og den anden skubbedel (24) er fastgjort til den anden streng.

- 17.** Drevet ifølge krav 15 eller 16,
5 **kendetegnet ved at** trækelementet (40) føres over to omdirigeringsruller (41, 42) monteret på den teleskopiske del (2).
- 18.** Drevet ifølge krav 17,
kendetegnet ved at den ene omdirigeringsrulle (42) er forspændt i den
10 langsgående retning af trækelementet (40).
- 19.** Drevet ifølge et hvilket som helst af kravene 15 to 18,
kendetegnet ved at omdirigeringsrullerne (28, 41, 42) har en konveks støtteflade til trækelementet (29, 40).
15
- 20.** Drevet ifølge et hvilket som helst af kravene 1 til 19,
kendetegnet ved at gevindspindelen (9) og spindelmøtrikken (10) er fremstillet selv-låsende.
- 20 **21.** Drevet ifølge et hvilket som helst af kravene 1 til 20,
kendetegnet ved at motoren (5) omfatter en tandkrans- eller planetgearenhed.
- 22.** Drevet ifølge et hvilket som helst af kravene 1 til 21,
kendetegnet ved at motoren (5) omfatter en vinkelgear- eller snækkegearenhed.
25
- 23.** Drevet ifølge krav 21 eller 22,
kendetegnet ved at motorens (5) gearenhed er selv-låsende.
- 24.** Drevet ifølge et hvilket som helst af kravene 1 til 23,
30 **kendetegnet ved at** drevet omfatter en bremse der virker i en retning.
- 25.** Drevet ifølge et hvilket som helst af kravene 1 til 24,
kendetegnet ved at motoren (5) omfatter et
rotationshastighedsdetekteringsorgan.

26. Drevet ifølge krav 25,

kendetegnet ved at rotationshastighedsdetekteringsorganet omfatter en pulsgenerator, fortrinsvis en Hall-generator.

5 **27.** Drevet ifølge et hvilket som helst af kravene 1 til 26,

kendetegnet ved at motoren (5) har et magnetisk forandingsdrejemoment.

28. Drevet ifølge et hvilket som helst af kravene 1 til 27,

kendetegnet ved at spindelmøtrikken (10) har selv-smørende komponenter.

10

29. Drevet ifølge et hvilket som helst af kravene 1 til 28,

kendetegnet ved at den justerbare hastighed af begge skubbedele (19, 24) i forhold til hinanden er to gange så stor som justeringshastigheden af den ene teleskopiske del (2) i forhold til motoren (5).

15

30. Drevet ifølge et hvilket som helst af kravene 1 til 29,

kendetegnet ved at begge skubbedele (19, 24) hver danner en teleskopisk del (1, 3) af drevet.

20

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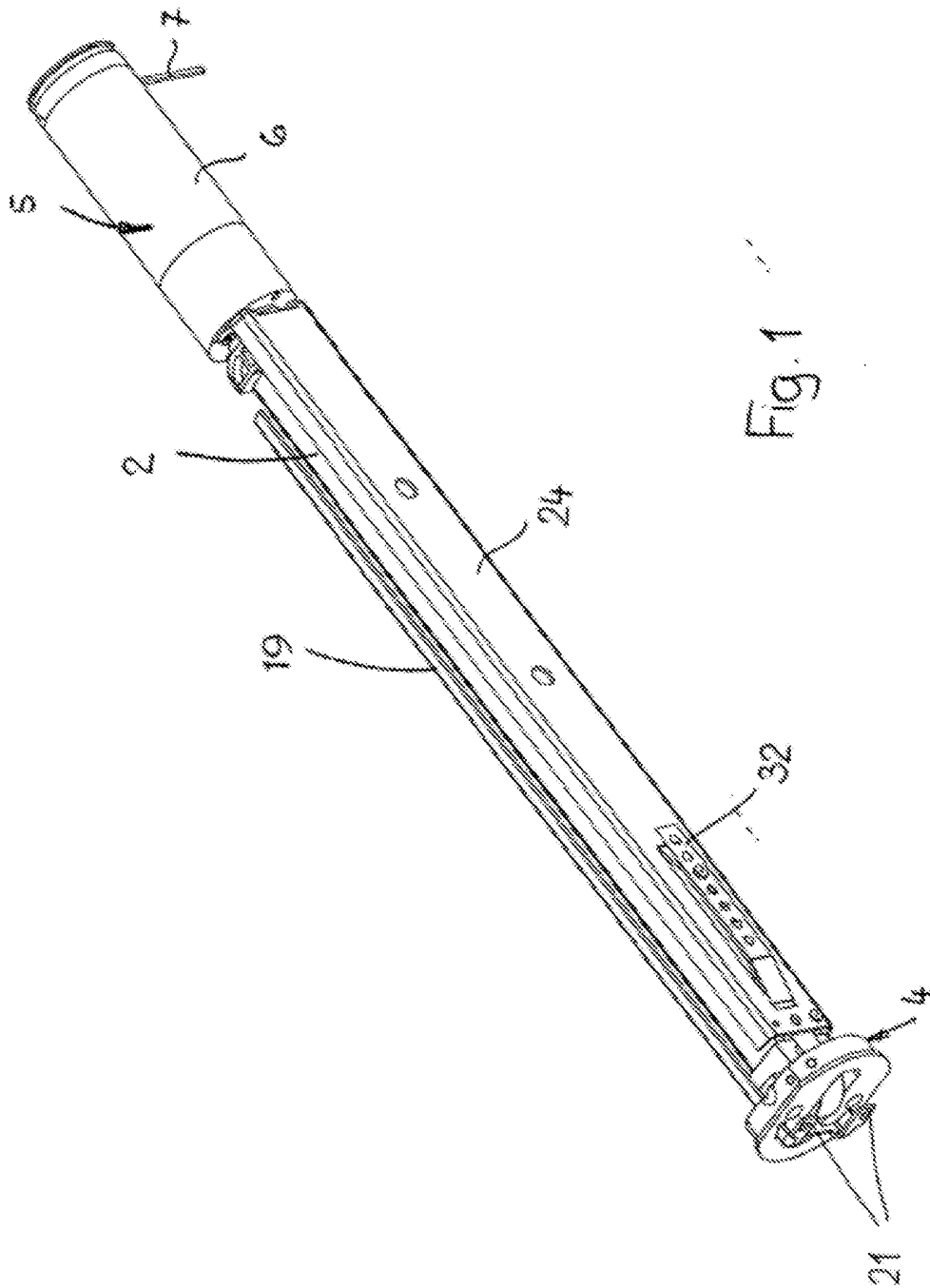
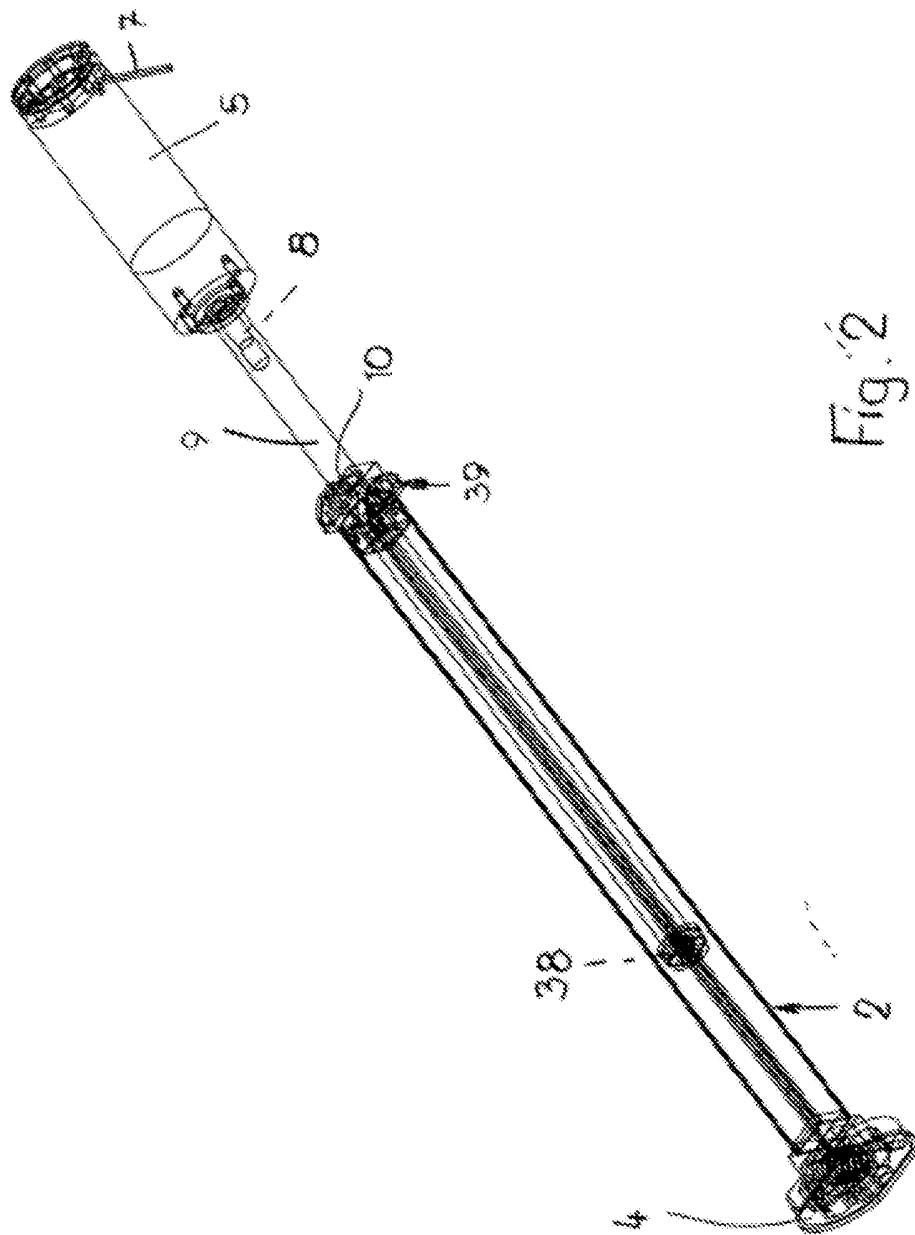
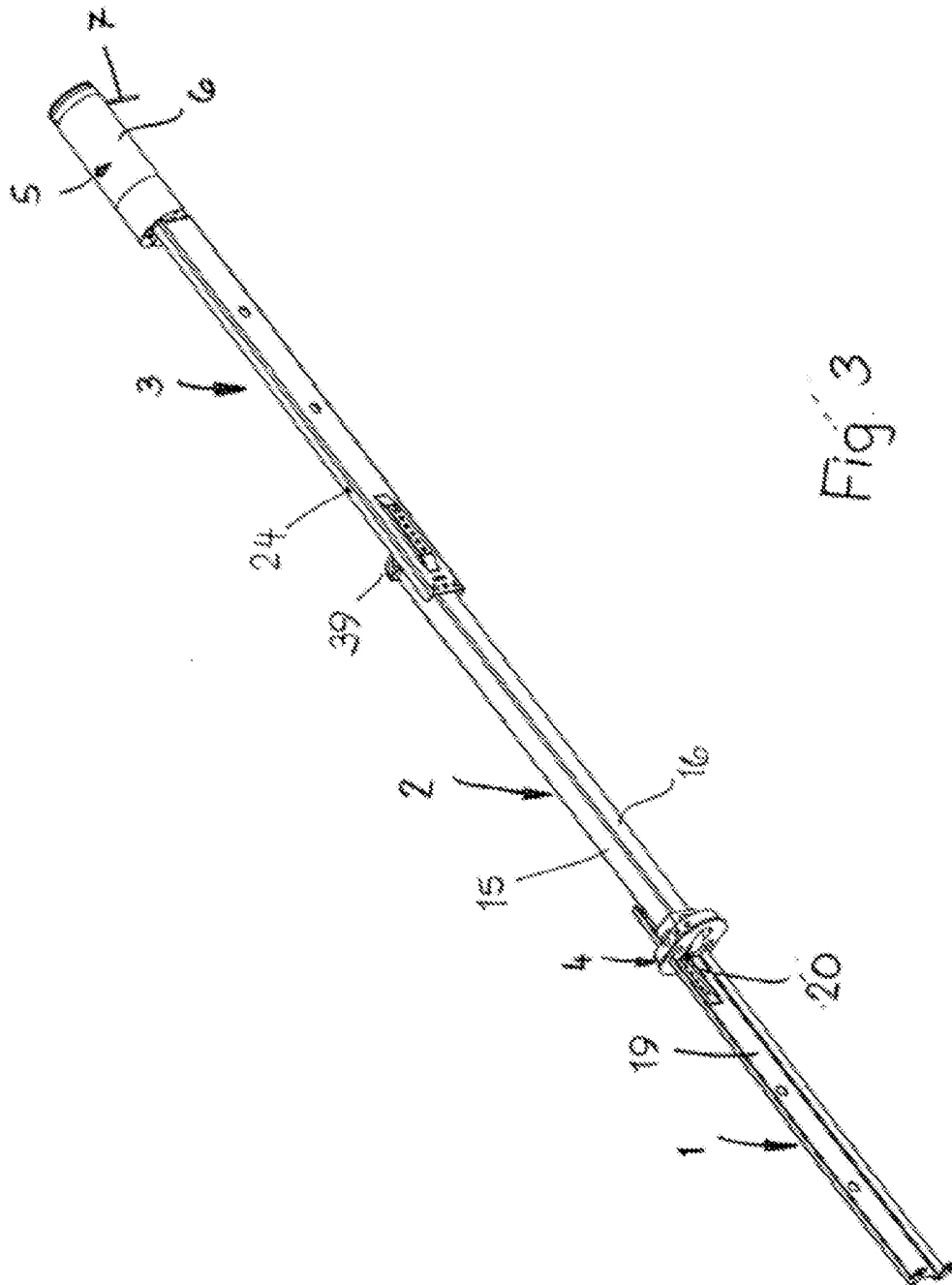


Fig. 1

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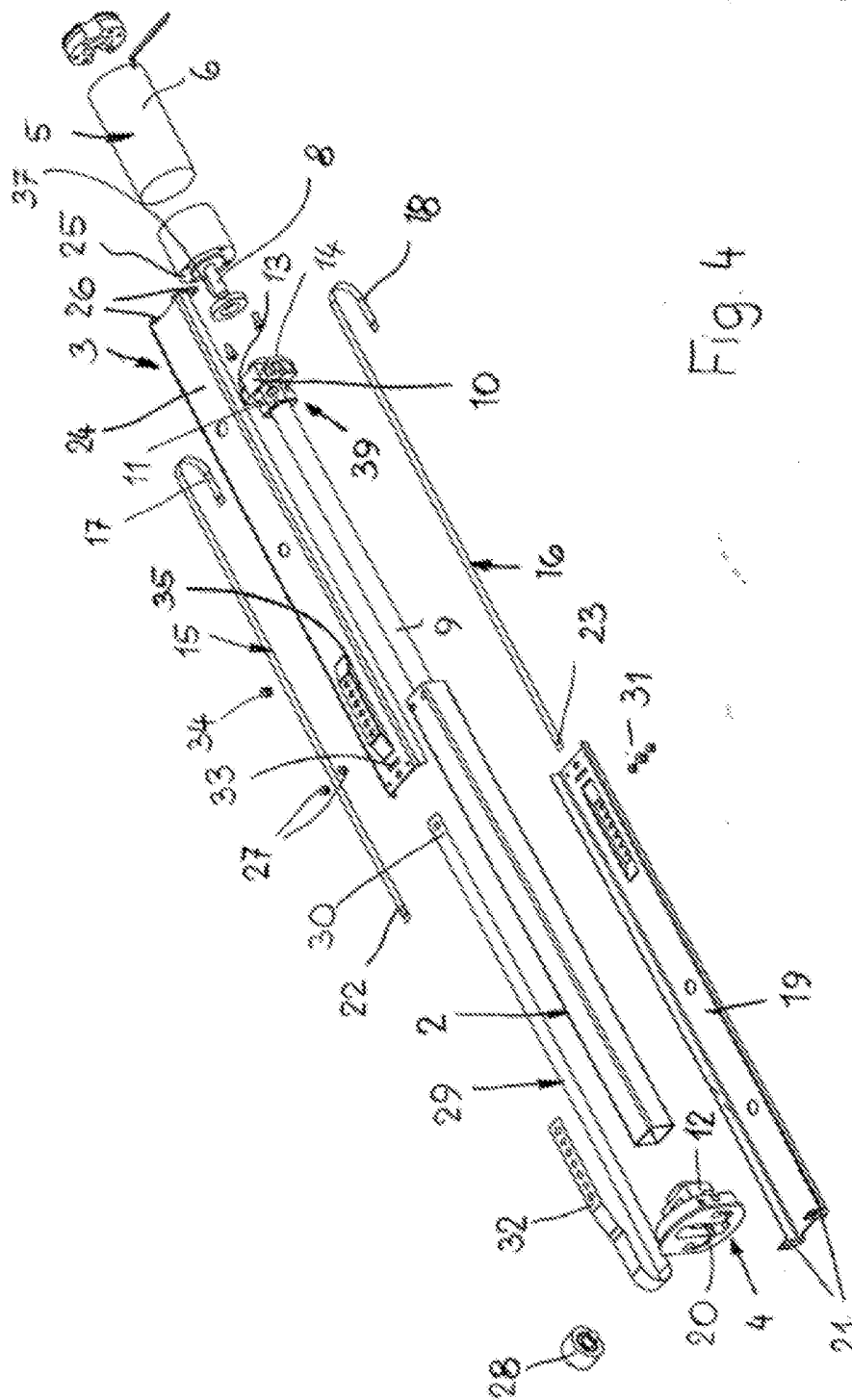


Fig. 4

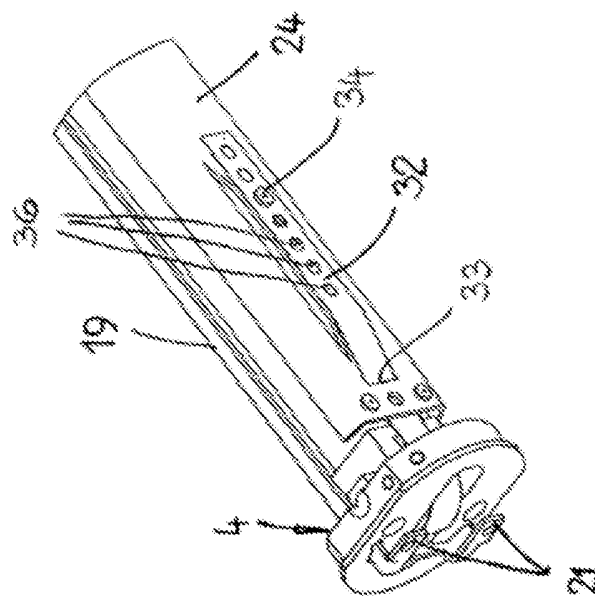


Fig. 5

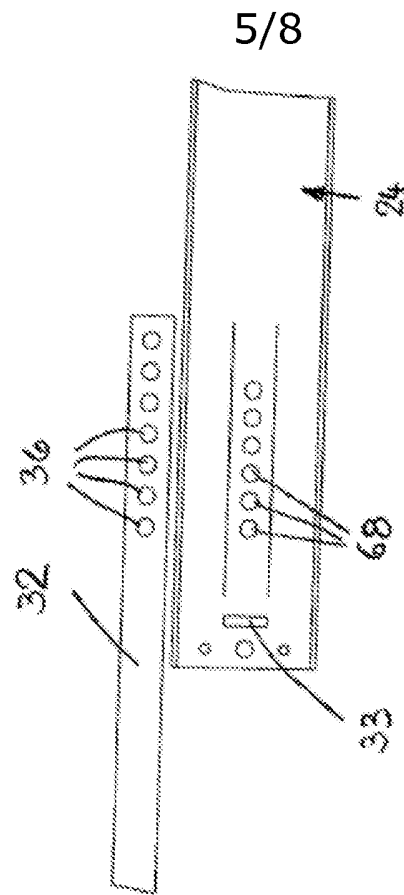


Fig. 6

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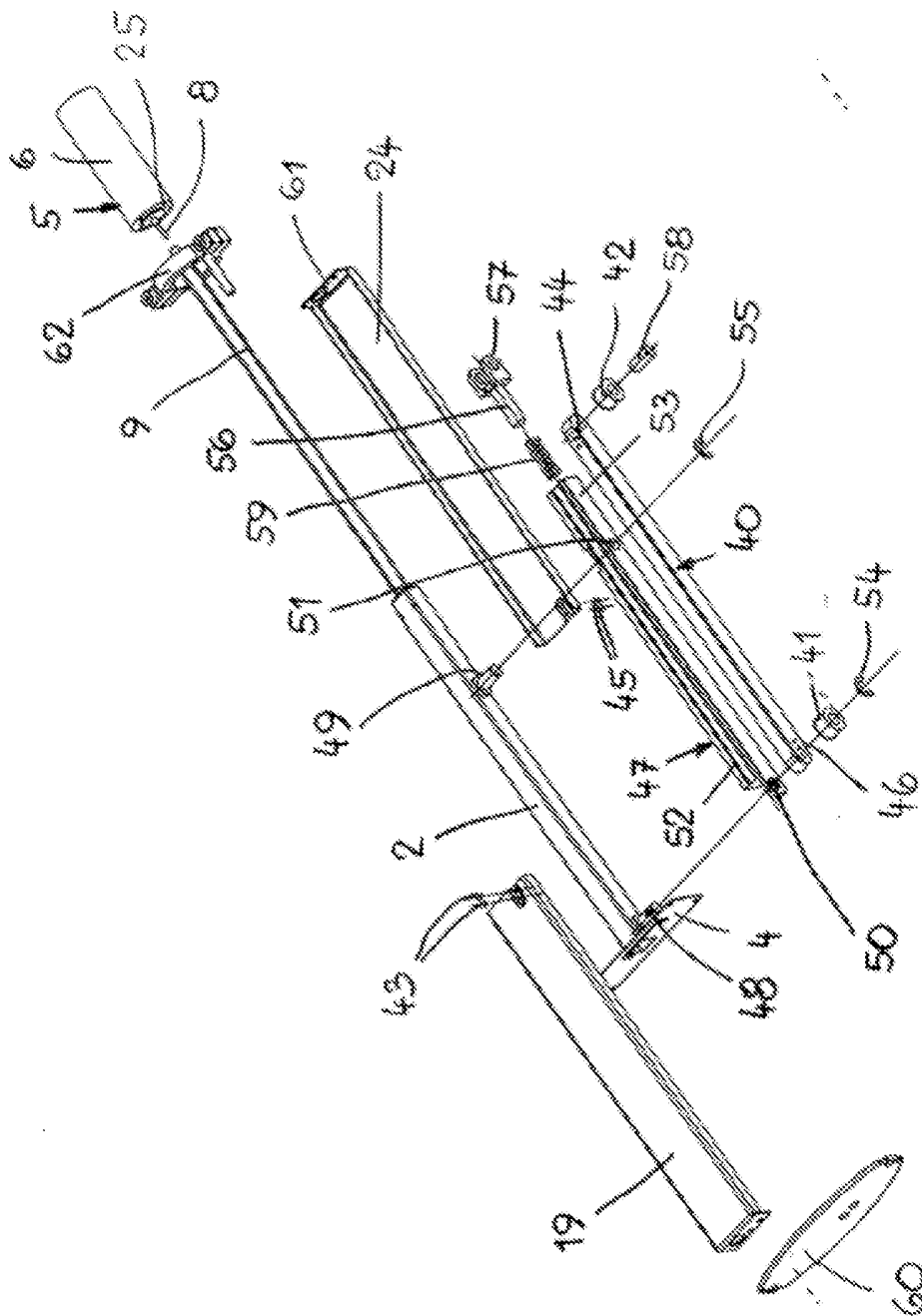


Fig. 7

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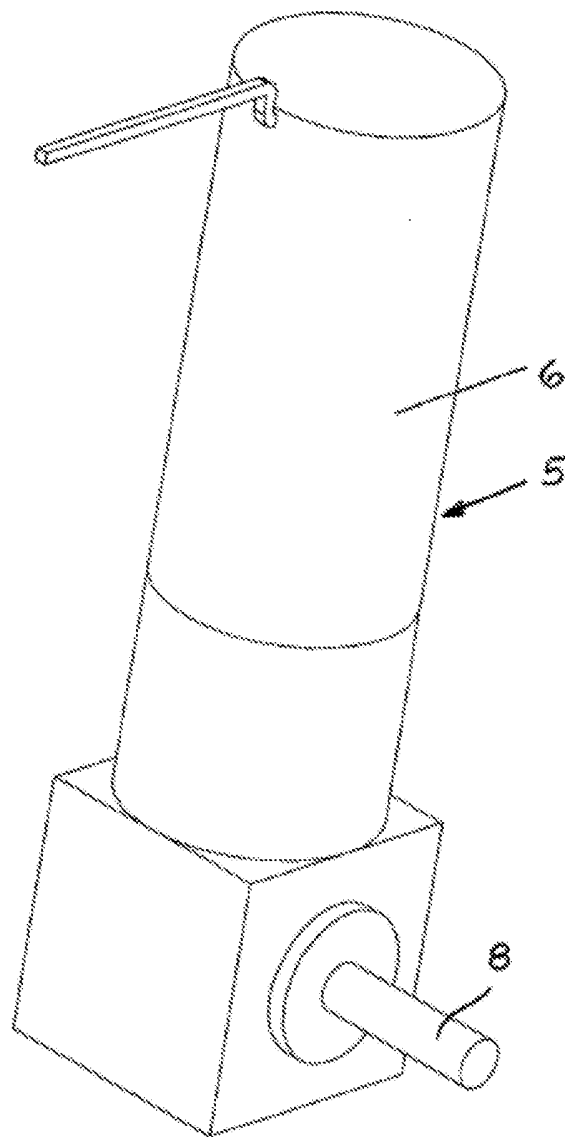


Fig. 8

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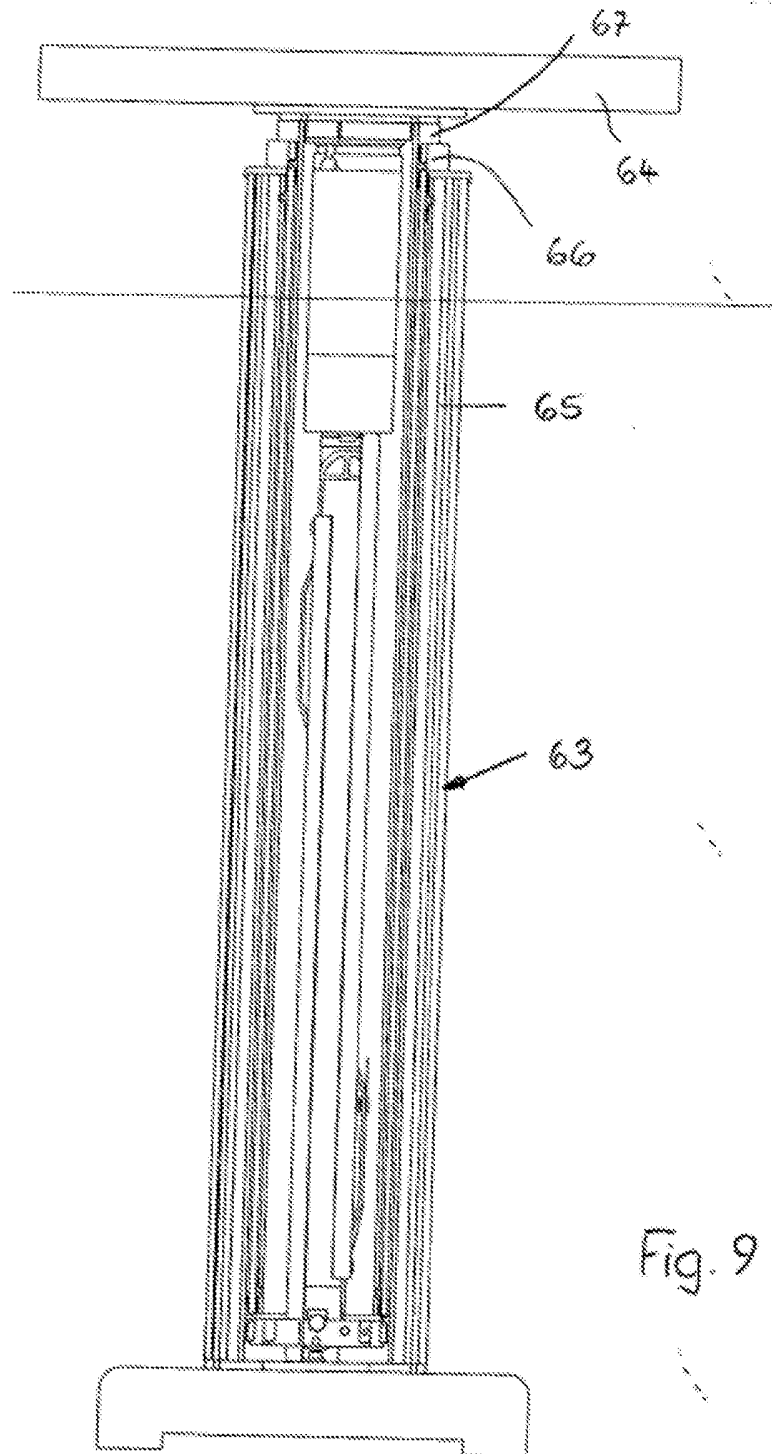


Fig. 9