

(19) **DANMARK**

(10) **DK/EP 2933415 T3**



Patent- og
Varemærkestyrelsen

(12) Oversættelse af
europæisk patentskrift

-
- (51) Int.Cl.: **E 05 F 15/63 (2015.01)** **E 05 F 3/10 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2017-01-23**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2016-10-19**
- (86) Europæisk ansøgning nr.: **15162799.9**
- (86) Europæisk indleveringsdag: **2015-04-08**
- (87) Den europæiske ansøgnings publiceringsdag: **2015-10-21**
- (30) Prioritet: **2014-04-15 DE 102014207217** **2015-02-17 DE 102015202852**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
- (73) Patenthaver: **GEZE GmbH, Reinhold-Vöster-Straße 21-29, 71229 Leonberg, Tyskland**
- (72) Opfinder: **Vögele, Roland, GEZE GmbH, TI, Alpenrosenstr. 30, 71364 Winnenden, Tyskland**
- (74) Fuldmægtig i Danmark: **Dennemeyer & Associates S.A, P.O. Box 700425 , Landaubogen 1-3, DE-81373 Munich, Tyskland**
- (54) Benævnelse: **DØRDREV**
- (56) Fremdragne publikationer:
EP-A1- 0 733 763
WO-A1-01/98615
US-A- 4 333 270
US-A- 4 590 639
US-A1- 2007 256 362

DOOR DRIVE

The present invention relates to a door drive, in particular a swivel door drive, comprising a housing, an output shaft which may be coupled to a door leaf or a frame shaft, a motor for driving the output shaft and a spring unit which is loaded during a respective opening movement of the door leaf and relaxed during a respective closing movement of the door leaf. Such a door drive is known, for example, from WO 01/98615 A1.

Such door drives are used to close the leaves of a motor-opened door through spring force. This is particularly important for smoke and fire protection doors, which must be closed quickly and reliably in the event of an alarm, in particular after activation of a smoke detector or in the event of a power failure. When the door leaf is opened, the spring unit is simultaneously loaded. The door drive may thus close the door leaf with the aid of the spring unit, even in the event of a power failure, which is imperative for fire protection doors.

Swivel door drives of the type mentioned above and customary until now are relatively space-demanding and voluminous and relatively costly to produce.

The object of the invention is to provide a door drive, in particular a swivel door drive of the type mentioned in the introduction, which has a more compact design and may be produced more cost-effectively.

The object is achieved according to the invention by a door drive with the features of claim 1. Preferred embodiments of the door drive according to the invention result from the sub-claims, the present description as well as the drawing.

The door drive according to the invention, in particular a swivel door drive, comprises a housing, an output shaft which may be coupled to a door leaf or a frame shaft, a motor for driving the output shaft and a spring unit which is loaded during a respective opening movement of the door leaf and relaxed during a respective closing movement of the door leaf. In this way, the output shaft may be driven by the motor via a rack, which may be actuated via a spur-gear/bevel gear mechanism, which comprises a motor-side helically toothed spur wheel gear portion, a rack-side straight-toothed spur wheel gear portion, and a bevel gear portion provided with a Gleason toothing in between.

This design results in a more compact and simpler design of the door drive, which also significantly reduces the production costs. The preferably provided Gleason toothing

of the bevel gear portion is characterized in that the edges of the tooth spaces form a spiral.

The motor-side helically toothed spur wheel gear portion on the motor side preferably comprises a Helically toothed motor pinion connected to a motor shaft and a helically toothed spur wheel meshing therewith.

According to a preferred practical embodiment of the door drive according to the invention, the helically toothed spur wheel of the motor-side helically toothed spur wheel gear portion consists of a carbon-fiber-reinforced polyamide-containing material, thus achieving a corresponding noise reduction.

The bevel gear portion advantageously comprises a bevel pinion meshing with a bevel wheel, which is connected to the helically toothed spur wheel of the motor-side helically toothed spur wheel gear portion.

In this way, the helically toothed spur wheel of the motor-side helically toothed spur wheel gear portion and the bevel pinion of the bevel wheel portion are preferably arranged on a common shaft which is supported by a ball bearing arranged axially between the helically toothed spur wheel and the bevel pinion.

In this case, the common shaft may be provided, for example, in the form of a bevel pinion pin, while the helically toothed spur wheel may be fixed on the bevel pinion pin by means of a center grooved pin. The ball bearing arranged between the helically toothed spur wheel and the bevel pinion may thus absorb axial and radial forces, wherein the bevel pinion may be positioned very precisely relative to the bevel wheel.

The shaft, which is provided with the helically toothed spur wheel of the motor-side helically toothed spur wheel gear portion and with the bevel pinion of the bevel wheel portion, may also be supported by a ball bearing arranged on the side of the helically toothed spur wheel remote from the bevel pinion.

The bevel gear of the bevel gear portion and the straight-toothed spur wheel of the straight-toothed spur wheel gear portion are preferably designed as a one-piece sintered part, which reduces the production costs for the door drive and achieves a construction as compact as possible.

The bevel wheel and the bevel gear portion in question may thus be produced as a one-piece sintered part with two toothings and, for example, a seven-tooth spur wheel.

The rack-side straight-toothed spur wheel gear portion may, in particular, comprise a straight-toothed pinion which meshes with the rack and comprises a straight-toothed spur wheel connected to this straight-toothed pinion, which meshes with a straight-toothed pinion connected to the bevel wheel of the bevel gear portion.

5 In particular, it is also advantageous if the straight-toothed pinion and the straight-toothed spur wheel of the toothed-side straight-toothed spur gear portion are designed as a one-piece sintered part, thus further reducing the production costs for the door drive and keeping the door drive relatively compact.

10 The spring unit preferably comprises a pressure spring pushed onto the rack, which is particularly advantageous again with respect to the construction of the door drive as compact as possible.

15 According to a further preferred practical embodiment of the door drive according to the invention, the spring unit is arranged between an axially-adjustable sleeve pushed onto the rack and a thrust bearing supported on a bearing disc or the like. In this case, the sleeve may be axially adjustable, in particular, via a worm gear mechanism.

By means of the pinion of the third stage of the Spur-gear/bevel gear mechanism, the toothed rack with modulating toothing may be drawn into the gear mechanism on the one side, while being pushed out of the gear by the spring unit on the other side. The rack may extend through the sleeve, the spring unit and the thrust bearing with the bearing disc.
20 The spring force and thus the closing force may be adjusted via the sleeve in the currentless mode.

The rack preferably comprises a toothed portion which meshes with the straight toothed pinion of the rack-side straight-toothed spur wheel gear portion, as well as a toothed portion arranged in particular on the same side in the region of its opposite end and meshing with a toothing of the output shaft. The toothed portions of the rack may thus
25 be provided on the same side of the rack, i.e. in the same direction.

In order to ensure reliable tooth engagement, the rack in the region of the toothed portions which mesh with the straight-toothed pinion of the rack-side straight-toothed spur wheel gear portion and the toothing of the output shaft, the rack is in each case preferably
30 provided with at least one rolling-bearing-mounted roller, cylinder pin or the like, which is arranged on the side of the rack remote from the respective toothed portion.

The toothed rack preferably comprises a wavy toothed portion which meshes with an out-of-round toothing portion of the output shaft.

The resulting closing and opening torque may be influenced in a desired manner with such a configuration of the interacting toothings of the output shaft and of the rack. In this way, a respective desired course of the closing and opening torque may be predetermined, in particular by a corresponding choice of the form of the toothed portion of the rack and a corresponding choice of the shape of the out-of-round toothing portion of the output shaft.

Preferably, the door drive has at least one pinion having a number of teeth between three and eight. As a result, small stable gear wheels may be produced with a very small number of teeth.

The door drive may be arranged on a door leaf or a frame shaft. The output shaft of the door drive may be connected to the frame shaft or the door leaf via a lever or a linkage.

The output shaft may, for example, comprise a bore with splines and, for example, thirty-one teeth for the transmission of torque to the lever or the linkage.

For example, a gear housing, a gear cover, as well as a train profile and a bearing disc may be provided, wherein the biased spring unit, the rack and the output shaft may be inserted into the bearing assembly comprising the train profile and the bearing disc. The train profile may be closed on one side via the sleeve, while it may be closed with a cover on the other side. The spring unit may be clamped in between. The rack may protrude from the sleeve. The, for example, screwed bearing disc together with the train profile may form the bearing points for the output shaft.

The motor may be attached to a bearing disc, which is screwed to the gear housing and gear cover.

The helically toothed motor pinion may, for example, be pressed onto the motor shaft.

In order to obtain the smallest possible stable gear wheels, the pinions may each have a very small number of teeth, for example between three and eight teeth. Thus, depending on the desired gearing, the motor pinion may have, for example, four to seven teeth and the bevel pinion, for example, five teeth, wherein the straight toothed front pinion in conjunction with the bevel pinion may have, for example, seven teeth, and the straight

toothed pinion meshing with the rack may have seven teeth. For profile covering of toothings of more than 1, this is almost the smallest possible number of teeth. A profile covering greater than 1 ensures smooth running of the gear stages, i.e. the second tooth is already engaged before the first tooth is disengaged. The small number of pinion teeth leads to small gear ratios and to stable teeth with large gear ratios per gear stage. On the other hand, this provides the prerequisite for sintering the gears without the risk of tooth breakage, since the sintered material has lower strength than the steel commonly used. In the case of sintered gears, the production costs may be reduced by a factor of 5 to 10 compared to steel gear wheels that have to be machined.

The door drive may also be provided with a transformer in order to reduce the voltage, for example, from 230 V to 24 V, as well as control electronics. In addition, the door drive may be provided with covers on the end side and comprise a cover hood.

The motor drives the rack via the motor pinion and the spur-gear/bevel gear mechanism and, via the latter, the output shaft, via which a lever or linkage is correspondingly acted upon in order to open the door leaf. When the door leaf is closed, the previously loaded spring unit drives the gearing and the motor, wherein the output shaft is rotated and adjusted with the lever or linkage in the other direction. In this way, the motor may pass into the generator mode and control the closing speed and the end stroke of the door leaf via the control electronics.

The closing of the door leaf also functions without current, which is imperative for fire protection swivel door drives.

The out-of-round toothing of the output shaft and the wavy tooth portion of the rack meshing with the latter may, in particular, be so designed that the torque transmitted by the spring unit to the output shaft decreases with the increasing opening angle of the door leaf.

In this way, the out-of-round toothing of the output shaft and the wavy toothed portion of the toothed rack, which meshes with the latter, is preferably so designed that the torque transmitted by the spring unit to the output shaft decreases with the increasing angle of opening of the door leaf from an opening angle of the door leaf in the region of 4°. By changing the pitch circle from large to small, a larger torque is generated at small door opening angles than at larger opening angles. The requirements with respect to a large door closing torque at door opening angles in the range of 0° to 4° and a rapidly

decreasing door closing torque at larger door opening angles with a smaller motor, are thus achieved.

The door drive according to the invention has a lower viewing height than previous drives. When the door is operated without power, less force is needed at an opening angle above 4° than previously. Production costs are minimized with sintered gears. The use of smaller and correspondingly more cost-effective motors and transformers is now possible. In addition, the lower overall weight of the door drive is also a result of a smaller motor and more compact components.

The invention is explained in more detail below with the aid of an exemplary embodiment with reference to the drawings, wherein:

- Fig. 1 shows a schematic representation of an exemplary embodiment of a door drive according to the invention, provided, for example, as a door closer,
- Fig. 2 shows a schematic sectional view of the door drive according to Fig. 1,
- Fig. 3 shows an enlarged schematic sectional top view of the part of the door drive according to Fig. 1, including the spur-gear/bevel gear mechanism, the rack and the output shaft,
- Fig. 4 shows an enlarged schematic sectional side view of the part of the door drive according to Fig. 1, spur-gear/bevel gear mechanism, the rack and the output shaft,
- Fig. 5 shows a schematic plan view of the spur-gear/bevel gear mechanism, the rack and the output shaft of the door drive according to Fig. 1,
- Fig. 6 shows a schematic side view of the spur-gear/bevel gear mechanism, the rack and the output shaft of the door drive according to Fig. 1.
- Fig. 7 shows a schematic perspective view of the spur-gear/bevel gear mechanism, the rack and the output shaft of the door drive according to Fig. 1.

Fig. 1 to 7 show schematically an exemplary embodiment of a door drive according to the invention or, in the illustration according to Fig. 1, for example, a door closer for a swivel door.

The door drive 10 comprises a housing 12, an output shaft 18 which is pivotably mounted in the housing 12 and may be coupled to a door leaf 14 or a frame shaft 16, a motor 20, in particular an electric motor to drive the output shaft 18, and a spring unit 22,

which is loaded during a respective opening movement of the door leaf 14 and is relaxed during a respective closing movement of the door leaf 14 in order to provide a closing torque.

In this way, the door drive 10 in the illustration according to Fig. 1 is provided, for example, as an overhead door closer for a swivel door. In the present case, the housing 12 is mounted with the output shaft 18 on the door leaf 14, while the output shaft 18 is connected to a lever 24 which is provided with a sliding block or the like which is guided in a slide rail 26 which is fixed to the frame shaft 16.

As may be seen from Fig. 2 to 7, the output shaft 18 may be driven by the motor 20 via a rack 28, which may be actuated by means of a spur-gear/bevel gear mechanism 30; comprises a motor-side helically toothed spur wheel gear portion 32, a rack-side straight-toothed spur wheel gear portion 34, a straight-toothed spur wheel gear portion 37, and a bevel gear portion 36 arranged therebetween, in particular with Gleason gearing.

The motor-side helically toothed spur wheel gear portion 32 comprises a helically toothed motor pinion 40, which is connected to a motor shaft 38, and a helically toothed spur wheel 42 meshing with the latter.

The helically toothed spur wheel 42 of the motor-side helically toothed spur wheel gear portion 32 may be composed of a carbon fiber-reinforced polyamide-containing material.

The bevel gear portion 36 comprises a bevel pinion 46 meshing with a bevel wheel 44, which is connected to the helically toothed spur wheel 42 of the helical-toothed spur gear portion 32 on the motor side.

The oblique-toothed spur gear 42 of the motor-side helically toothed spur wheel gear portion 32 and the bevel pinion 46 of the bevel gear portion 36 are arranged on a common shaft 48 which is supported by a ball bearing 50 arranged axially between the helically toothed spur wheel 42 and the bevel pinion 46 (see, in particular, Fig. 3 and 4). As may be seen in particular in Fig. 3 and 4, the shaft 48 provided with the helically toothed spur wheel 42 of the motor-side helically toothed spur wheel gear portion 32 and the bevel pinion 46 of the bevel-gear portion 36 provided with a shaft 48, is also supported by a ball bearing 52 arranged on the side of the helically toothed spur wheel 42 remote from the bevel pinion 46.

The bevel gear 44 of the bevel gear portion 36 and the straight-toothed pinion 58 of the straight-toothed spur wheel gear portion 37 may, in particular, be designed as a one-part sintered part.

The rack-side straight-toothed spur wheel gear portion 34 comprises a straight-toothed pinion 54 meshing with the rack 28 and a straight-toothed spur wheel 56, which is connected with this straight-toothed pinion 54 and meshes with a straight-toothed pinion 58 connected to the bevel wheel 44 of the bevel-gear portion 36.

In this way, the straight-toothed pinion 54 and the straight-toothed spur wheel 56 of the rack-side straight-toothed spur wheel gear portion 34 may also be designed as a one-piece sintered part.

As may be seen in particular with reference to Fig. 3 and 4, the spring unit 22 may comprise a compression spring pushed onto the rack 28. In the present case, the spring unit 22 is arranged between an axially-adjustable sleeve 60 pushed onto the rack 28 and an axial bearing 62 arranged on a bearing disc 64 or the like. The sleeve 60 is, for example, axially adjustable via a worm gear 66 (see in particular Fig. 3).

The rack 28 comprises a toothed portion 68 which meshes with the straight-toothed pinion 54 of the rack-side straight-toothed spur wheel gear portion 34 and, in the region of its opposite end, a wavy toothed portion 70 which is arranged on the same side and meshes with an out-of-round toothing portion 72 of the output shaft 18.

In this way, the rack may, in particular, comprise a wavy toothed portion 70 which meshes with an out-of-round toothing portion 72 of the output shaft 18.

The shaft 48, which is provided with the helically toothed spur wheel 42 and the bevel pinion 46, may be provided, for example, in the form of a bevel pinion pin, on which the helically toothed spur wheel 42 is fixed by means of a center grooved pin, wherein the ball bearing 50 arranged between the helically toothed spur wheel and the bevel pinion 46 may absorb axial and radial forces, and the bevel pinion 46 is positioned exactly relative to the bevel gear 44.

The rack 28 may, in the region of the rack-side straight-toothed spur wheel gear portion 34 meshing with the straight-toothed pinion 54 of the toothed-side straight-toothed spur gear portion 34 and with the out-of-round toothing portion 72 of the output shaft 18, be respectively supported on the rolling-bearing-mounted roller, cylinder pin 74 (see Fig. 5 and

7) or the like, which is arranged in particular on the side of the rack 28 remote from the respective toothed portion 68, 70.

The pinion 54 of the rack-side straight-toothed spur wheel gear portion 34 thus drives the rack 28 with module toothing via the motor into the spur-gear/bevel gear mechanism 30, which is pushed out of the spur-gear/bevel gear mechanism 30 by the spring unit 22 on the other side. The rack 28 penetrates the sleeve 60, the spring unit 22 and the axial bearing 62 with the bearing disk 64. The spring force and thus the closing force may be adjusted via the sleeve 60 in the currentless mode. A reliable tooth engagement is ensured by the rolling-bearing-mounted roller, cylinder pin 74. The sleeve 60 may be moved axially via the worm gear mechanism 66, for example a worm with an Allen screw. The output shaft 18 may be provided with a bore which, for example, has splined toothing, e.g. thirty-one teeth for transmitting torque to the lever 24 driving the door leaf 14.

The door drive 10 may be provided with a gear housing 76, a gear cover 77 (see in particular Fig. 3 and 4), a train profile as well as a bearing disc. The biased spring unit 22, the rack 28 and the output shaft 18 may be arranged in the train profile and the bearing disc bearing module. The train profile is closed by the adjustable sleeve 60 on one side and by the cover 78 on the other side. The spring unit 22 is clamped in between. The rack 28 extends outwards through the sleeve 60. The screwed bearing disc, together with the train profile, forms the bearing points for the output shaft 18.

During assembly, the gear wheels and the train profile and bearing disc bearing assembly are inserted into the gear box. The gear cover 77 closes the gearing and at the same time holds the train profile and bearing disc assembly in position.

The motor 20 may be attached to a bearing disc 80 (see in particular Fig. 2 and 3), which may be screwed onto the gear housing 76.

The helically toothed motor pinion 40 may be pressed onto the motor shaft 38.

In order to obtain stable gears as small as possible, the pinions may have a very small number of teeth. Thus the motor pinion 40 may, for example, have four to seven teeth, and the bevel pinion with a Gleason gearing may, for example, have five teeth, while the straight-toothed pinion 54 of the rack-side straight-toothed spur wheel gear portion 34 may have, for example, seven teeth. For profile coverage of the toothings of more than 1, this is almost the smallest possible number of teeth. A profile covering greater than 1

ensures stepless running of the gear stages, i.e. the second tooth is already engaged before the first tooth is disengaged.

The door drive 10 may also comprise a transformer and control electronics.

5 The motor 20 drives the rack 28 via the spur-gear/bevel gear mechanism 30 and the output shaft 18 via the latter in order to open the door leaf 14 via the lever 24. When the door leaf 14 is closed, the now loaded spring unit 22 drives the spur-gear/bevel gear mechanism 30 and the motor 20, in order to rotate the output shaft 18 with the lever 24 in the opposite direction. The motor now operates in the generator mode and controls the closing speed and the final stroke of the door leaf 14 via the control electronics.

10 The closing of the door leaf 14 also operates without current, which is imperative for fire protection swivel door drives.

A greater torque is generated at smaller opening angles than larger opening angles of the door leaf 14, since the pitch circle becomes smaller with the wavy toothed portion 70 of the rack 28 and the out-of-round toothing portion 72 of the output shaft 18. As
15 a result, the high closing torque required for the opening angle of the door leaf in the range between 0 ° and 4 ° and the rapidly decreasing door closing torque required for larger opening angles, may also be achieved with relatively smaller motors.

List of reference numerals

10	Door drive	34	Rack-side straight-toothed spur
12	Housing		wheel gear portion
14	Door leaf	36	Bevel gear portion
16	Frame shaft	37	Straight-toothed spur wheel gear
18	Output shaft		portion
20	Motor	38	Motor shaft
22	Spring unit	40	Helically toothed motor
24	Lever		pinion
26	Slide rail	42	Helically toothed spur wheel
28	Rack	44	Bevel wheel
30	Spur-gear/bevel gear mechanism	46	Bevel pinion
32	Motor-side helically toothed spur	48	Shaft
	wheel gear portion	50	Ball bearing
		52	Ball bearing

54	Straight-toothed pinion	72	Out-of-round toothing portion of the output shaft
56	Straight-toothed spur wheel		
58	Straight-toothed pinion	74	Rolling-bearing-mounted roller, cylinder pin
60	Sleeve		
62	Axial bearing	76	Gear housing
64	Bearing disc	77	Gear cover
66	Worm gear mechanism	78	Further gear cover
68	Toothed portion	80	Bearing disc
70	Wavy toothed portion		

DØRDREV**PATENTKRAV**

- 5 1. Dørdrev (10), især et svingdørsdrev, med et hus (12), med en drivaksel (18),
der kan kobles til en dørløj (14) eller en yderramme (16), med en motor (20) til
drev af drivakslen (18) og med en fjederenhed (22), som spændes under en
respektiv åbningsbevægelse af dørløjen (14) og afspændes under en
respektiv lukkebevægelse af dørløjen (14), hvor drivakslen (18) har en
10 fortanding (72) og kan trækkes af motoren (20) via en tandstang (28),
kendetegnet ved, at tandstangen (28) kan påvirkes via en cylindrisk-konisk-
tandhjulsudveksling (30), som omfatter en på motorsiden anbragt
skråfortandet cylindrisk tandhjulsudvekslingsdel (32), en på tandstangssiden
anbragt ligefortandet cylindrisk tandhjulsudvekslingsdel (34) og en derimellem
15 anbragt konisk tandhjulsudvekslingsdel (36), navnlig med en Gleason-
fortanding.
2. Dørdrev ifølge krav 1, kendetegnet ved, at den på motorsiden anbragte
skråfortandede cylindriske tandhjulsudvekslingsdel (32) omfatter et
skråfortandet motortanddrev (40), der er forbundet med en motoraksel (38), og
20 et skråfortandet cylindrisk tandhjul (42), der går i indgreb med nævnte
tanddrev.
3. Dørdrev ifølge krav 2, kendetegnet ved, at det skråfortandede cylindriske
tandhjul (42) på den på motorsiden anbragte skråfortandede cylindriske
tandhjulsudvekslingsdel (32) består af et materiale, der indeholder kulfiber-
25 forstærket polyamid.
4. Dørdrev ifølge et af de foregående krav, kendetegnet ved, at den koniske
tandhjulsudvekslingsdel (36) omfatter et konisk tanddrev (46), der går i
indgreb med et konisk tandhjul (44), og som er forbundet med det
skråfortandede cylindriske tandhjul (42) af den på motorsiden anbragte
30 skråfortandede cylindriske tandhjulsudvekslingsdel (32).

5. Dørdrev ifølge krav 4, kendetegnet ved, at det skråfortandede cylindriske tandhjul (42) af den på motorsiden anbragte skråfortandede cylindriske tandhjuludvekslingsdel (32) og det koniske tanddrev (46) af den cylindriske tandhjulsudvekslingsdel (36) er anbragt på en fælles aksel (48), som er understøttet af et kugleleje (50), der er anbragt aksialt mellem det skråfortandede cylindriske tandhjul (42) og det koniske tanddrev (46).
6. Dørdrev ifølge krav 5, kendetegnet ved, at akslen (48), der er tilvejebragt med det skråfortandede cylindriske tandhjul (42) af den på motorsiden anbragte skråfortandede cylindriske tandhjulsudvekslingsdel (32) og med det koniske tanddrev (46) af den cylindriske tandhjulsudvekslingsdel (36), endvidere er understøttet af et kugleleje (52), som er anbragt på siden af det skråfortandede cylindriske tandhjul (42), der vender bort fra det koniske tanddrev (46).
7. Dørdrev ifølge et af de foregående krav, kendetegnet ved, at det koniske tandhjul (44) af den koniske tandhjulsudvekslingsdel (36) og det ligefortandede koniske tandhjul (58) af den ligefortandede cylindriske tandhjulsudvekslingsdel (37) er udført som sintret del i ét stykke.
8. Dørdrev ifølge et af de foregående krav, kendetegnet ved, at den på tandstangssiden anbragte ligefortandede cylindriske tandhjulsudvekslingsdel (34) omfatter et ligefortandet tanddrev (54), der griber ind i tandstangen (28), og et ligefortandet cylindrisk tandhjul (56), der er forbundet med dette ligefortandede tanddrev (54), og som griber ind i et ligefortandet tanddrev (58), der er forbundet med det cylindriske tandhjul (44) af den cylindriske tandhjulsudvekslingsdel (36).
9. Dørdrev ifølge krav 8, kendetegnet ved, at det ligefortandede tanddrev (54) og det ligefortandede cylindriske tandhjul (56) af den på tandstandssiden anbragte ligefortandede cylindriske tandhjulsudvekslingsdel (34) er konfigureret som en sintret del i ét stykke.
10. Dørdrev ifølge et af de foregående krav, kendetegnet ved, at fjederenheden (22) omfatter en trykfjeder, der er skubbet ind på tandstangen (28).

11. Dørdrev ifølge krav 10, kendetegnet ved, at fjederenheden (22) er anbragt imellem en aksialt forskydelig muffe (60), som er skubbet ind på tandstangen (28), og et aksialt leje (62), der understøttes på en anlægsskive (64) eller lignende.
- 5 12. Dørdrev ifølge krav 11, kendetegnet ved, at muffen (60) kan justeres aksialt via et snekkedrev (66).
13. Dørdrev ifølge et af de foregående krav, kendetegnet ved, at tandstangen (28) omfatter en fortandet del (68), som går i indgreb med det ligefortandede tanddrev (54) af den på tandstangssiden anbragte ligefortandede cylindriske tandhjulsudvekslingsdel (34), og, i området med dens modsatte ende, en
- 10 fortandet del (70), som er anbragt fortrinsvis på samme side, og som går i indgreb med en fortanding (72) på drivakslen (18).
14. Dørdrev ifølge krav 13, kendetegnet ved, at tandstangen (28) er understøttet, i området med dens fortandede dele (68, 70) der går i indgreb med det
- 15 ligefortandede tanddrev (54) af den på tandstangssiden anbragte cylindriske tandhjulsudvekslingsdel (34) og med fortandingen (72) på drivakslen (18), i hvert tilfælde via mindst én, fortrinsvis rullelejemonteret, rulle, cylinderstift (74) eller lignende, der er anbragt på den side af tandstangen (28), som vender bort fra den respektive fortandede del (68, 70).
- 20 15. Dørdrev ifølge et af de foregående krav, kendetegnet ved, at tandstangen (28) omfatter en bølgeformet fortandingsdel (70), der går i indgreb med en ikke-rund fortanding (72) på drivakslen (18).
16. Dørdrev ifølge et af de foregående krav, kendetegnet ved, at mindst ét tanddrev har et tandantal på mellem tre og otte tænder.

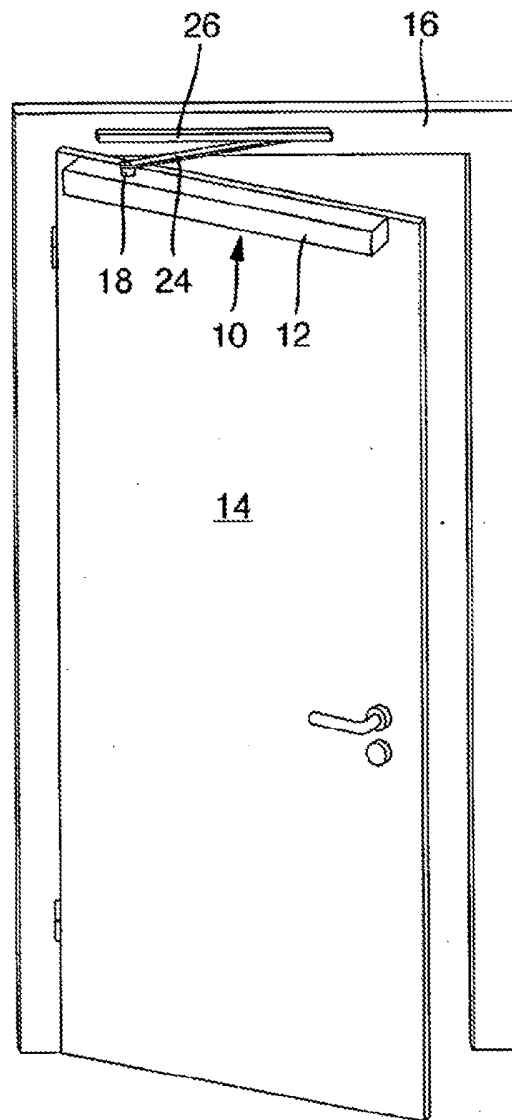


Fig. 1

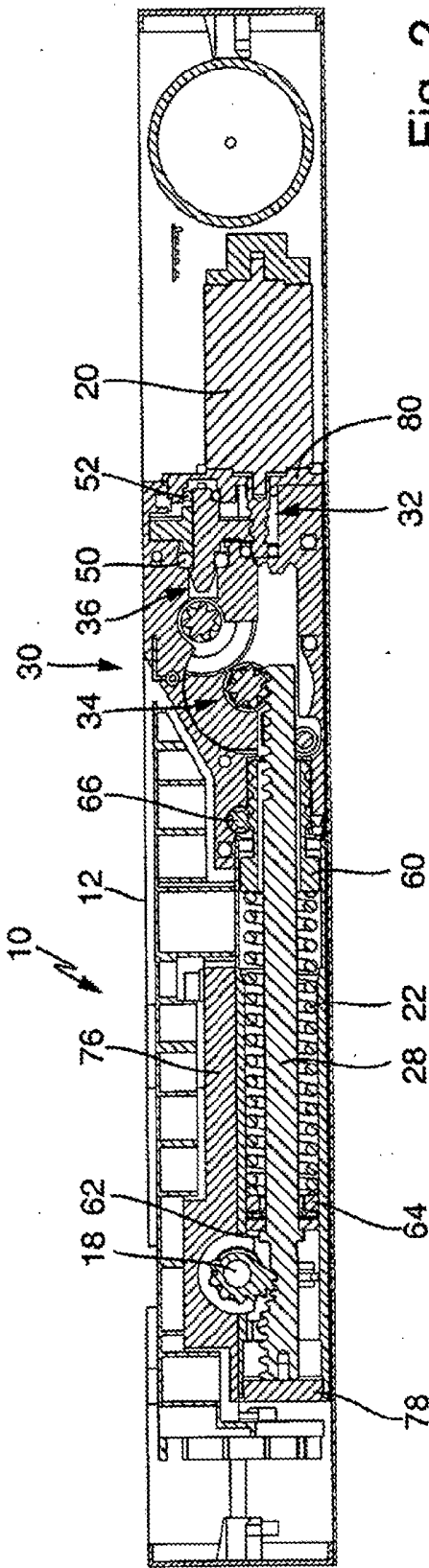


Fig. 2

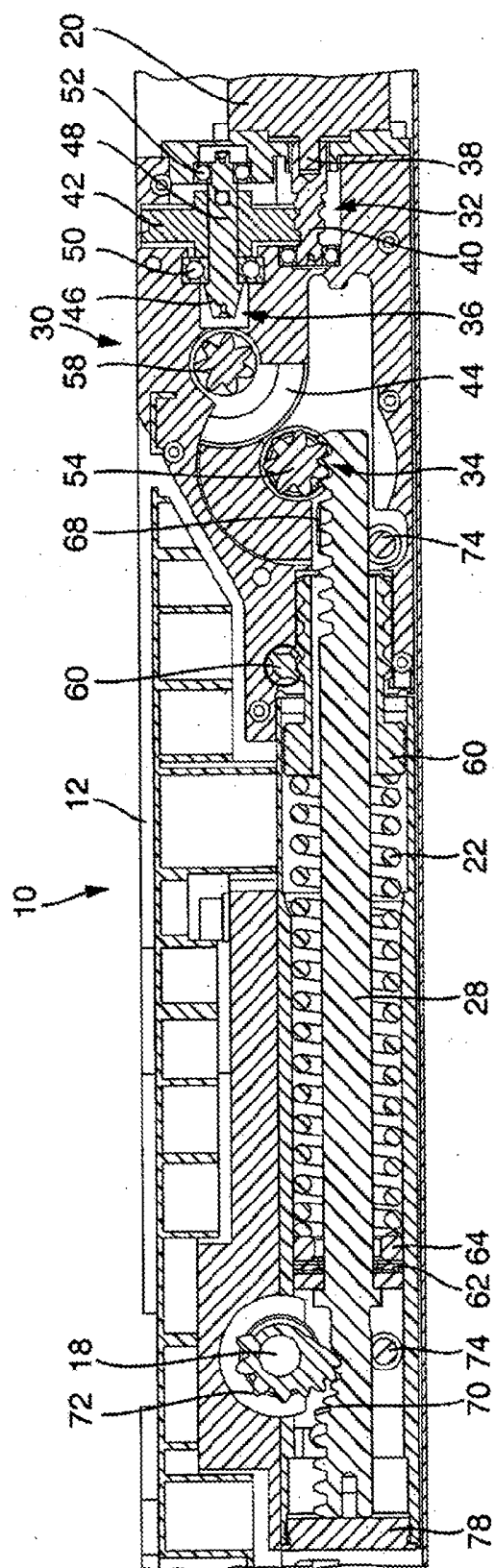


Fig. 3

