

(19) **DANMARK**

(10) **DK/EP 2933416 T3**



Patent- og
Varemærkestyrelsen

(12) Oversættelse af
europæisk patentskrift

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- (51) Int.Cl.: **E 05 F 15/63 (2015.01)**
- (45) Oversættelsen bekendtgjort den: **2019-08-19**
- (80) Dato for Den Europæiske Patentmyndigheds
bekendtgørelse om meddelelse af patentet: **2019-06-05**
- (86) Europæisk ansøgning nr.: **15162802.1**
- (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 102015202853**
- (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**
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- (54) Benævnelse: **Dørdrev**
- (56) Fremdragne publikationer:
WO-A1-2008/134442
DE-A1-102007 030 088
DE-U1- 20 320 657
US-A1- 2008 236 048

DOOR DRIVE

The present invention relates to a door drive, in particular a swing door drive, having a housing, which comprises a first mounting surface on a first housing outer side and a second mounting surface on an opposite second housing outer side, an electronic printed circuit board, which is arranged adjacent to the first housing outer side and substantially parallel thereto, an output shaft which is mounted rotatably in the housing and can be coupled to a door leaf or a fixed frame, wherein the output shaft is arranged with an offset to the centre of the housing along a longitudinal axis of the housing, a motor for driving the output shaft, in particular via a rack, and a spring unit which is tensioned during an opening movement of the door leaf and relaxes during a closing movement of the door leaf.

Door drives of a similar kind are described in DE 10 2007 030088 A1 and WO 2008/134442 A1.

Such door drives are used to close using spring force the leaf of a door opened by a motor. This is particularly important for smoke-proof and fire doors, which must be quickly and reliably closed in the event of an alarm, in particular after responding to a smoke detector and in the event of a power failure. By opening the door leaf, the spring unit is simultaneously tensioned. Using the spring unit, the door drive can thus close the door leaf even in the event of a power failure, which is essential for fire doors.

For swing door drives comprising a rack, the spring action on the output shaft can only develop in one direction of rotation. The output shaft typically sits off-centre in the longitudinal direction of the door drive, i.e. with an offset along a longitudinal axis of the housing to the centre of the housing, in the range of about 20% of the door drive length. Until now, two different door drives have therefore been required for these models for different types of mounting on a door.

An electronic printed circuit board is usually arranged within the housing of the door drive to control the door drive. Owing to the required size of the electronic printed circuit board, it is advantageous to arrange the electronic printed circuit board parallel to the mounting surfaces since the dimensions of the installation space of the substantially cuboid door drive are largest in this direction. However, this creates the problem that the electronic printed circuit board stands in the way of the mounting of the door drive on a door leaf or fixed frame since fixing screws must pass through the housing and stable bearing surfaces are needed on the housing to transmit the arising forces. It has therefore been customary to date to arrange a plurality of mutually spaced electronic printed circuit boards in the housing to provide space between them for the passage of fixing screws for

mounting the housing on a door leaf or fixed frame. This, however, has the disadvantage that the plurality of electronic printed circuit boards must be connected to each other by ribbon cables, which is complicated and expensive.

5 The aim of the invention is to provide a door drive, in particular a swing door drive of the type mentioned above, which has a small installation space despite the electronic printed circuit board, can be mounted in different ways on the door leaf and the fixed frame and requires no complex connection of a plurality of electronic printed circuit boards by means of ribbon cables.

10 The aim is achieved according to the invention by a door drive having the features of claim 1. Preferred embodiments of the door drive according to the invention arise from the dependent claims, the present description and the drawings.

The problem that installation space must be provided in order to create sufficiently stable mounting surfaces and to be able to guide the other fastening means perpendicular to the mounting surfaces through the housing can be achieved by providing cutouts in the
15 electronic printed circuit board. The installation space in the housing of the door drive can be best exploited thereby without sacrificing one of the following six types of installation:

1. Head mounting strip side slide rail
2. Head mounting opposite strip side slide rail
3. Door mounting strip side slide rail
- 20 4. Door mounting opposite strip side slide rail
5. Head mounting opposite strip side rod
6. Door mounting strip side rod

Head mounting is understood to be a mounting of the door drive on the upper horizontal member of the fixed frame, and door mounting is understood to be the mounting of the
25 door drive on the door leaf. Mounting on the strip side is understood to be mounting of the door drive on the side of the fixed frame or the door leaf on which the strips are provided. Accordingly, mounting of the door drive on the opposite strip side is understood to be mounting of the door drive on the side opposite the strip side. Finally, the output shaft can be connected for conjoint rotation with a sliding arm or lever guided in a linear
30 moveable manner in a slide rail or with a rod.

According to the invention, continuous mounting openings are provided in the housing, and the associated cutouts are arranged in the electronic printed circuit board in alignment with the mounting openings. This provides a simple way of mounting the housing in different ways on the door leaf and the fixed frame without being inhibited by
35 the electronic printed circuit board.

It is advantageous if the housing is provided with bearing surfaces for fastening means which can be introduced into the mounting openings for fastening the door drive to the fixed frame or to the door leaf. Each bearing surface can, for example, be annular and suitable for a screw to bear at the head side against it for fixing the housing with the screw to the fixed frame or door leaf.

The first mounting surface of the housing and/or the second mounting surface of the housing can consist of at least two separate partial surfaces which lie in particular in one plane. This has the advantage that the housing can be produced more cost-effectively because the mounting surface to be precisely produced is smaller than for a large mounting surface.

A plurality of housing portions can project through respective cutouts of the electronic printed circuit board and together form one of the mounting surfaces of the housing. This has the advantage that the cutouts in the electronic printed circuit board can be kept small.

The cutouts can be provided, on the one hand, in the edge region of the electronic printed circuit board and, on the other hand, in the central region of the electronic printed circuit board. The cutouts can accordingly be lateral cutouts. It is also possible for the cutouts to be in the form of an opening in the electronic printed circuit board. Particular structural freedom arises when the electronic printed circuit board has cutouts in the form of the said lateral cutouts and openings.

To provide good accessibility and thus connectivity for electronic components on the door drive, the door drive can have a second electronic printed circuit board which is arranged substantially parallel to an end side of the housing and substantially perpendicular to the first electronic printed circuit board having the cutouts. Thus, no matter against which of the two mounting surfaces the door drive bears on the door leaf or fixed frame, it can be ensured that the electronic printed circuit board lying parallel to the end side is easily accessible.

Preferably, the first electronic printed circuit board and the second electronic printed circuit board positioned substantially perpendicular thereto are connected via an angle plug. Such an angle plug simplifies the connection between the mutually perpendicular electronic printed circuit boards.

The second electronic printed circuit board can have at least one plug socket for connection to a sensor system. In this case, the plug socket on the outside of the electronic printed circuit board, i.e. the side facing away from the centre of the housing, can be oriented such that a plug can be plugged into the plug socket in a simple manner.

For example, the sensor system can comprise a radar sensor and/or an infrared sensor. The connection with a radar sensor and/or an infrared sensor has the advantage that, with the help of sensors, it can be detected whether an object is in the opening region of the door and whether the door should be opened or not.

- 5 Owing to the solution according to the invention, only a single door drive or swing door drive is required for all the aforementioned embodiments.

The invention is explained in more detail below on the basis of an exemplary embodiment with reference to the drawings. These schematic drawings are described in the following:

- Fig. 1 shows a perspective view of an embodiment of a door drive according to the invention.
- 10 Fig. 2A shows a perspective view of a door having the door drive according to figure 1 in the mounted state according to the "head mounting strip side slide rail" mounting type.
- Fig. 2B shows a detailed perspective view of the door drive of figure 2A.
- 15 Fig. 3A shows a perspective view of a door having the door drive according to figure 1 in the mounted state according to the "head mounting opposite strip side slide rail" mounting type.
- Fig. 3B shows a detailed perspective view of the door drive of figure 3A.
- Fig. 4A shows a cross-sectional view of the door drive according to figure 1, the door drive being mounted on a mounting surface on the electronics side.
- 20 Fig. 4B shows a cross-sectional view of the door drive according to figure 1, the door drive being mounted on a mounting surface on the transmission side.
- Fig. 5A shows a perspective view of two mutually perpendicular electronic printed circuit boards.
- 25 Fig. 5B shows a detail view from figure 5A.
- Fig. 6A shows a plan view of the door drive according to figure 1 in the mounted state according to the "head mounting strip side slide rail" mounting type.
- Fig. 6B shows a plan view of the door drive according to figure 1 in the mounted state according to the "head mounting opposite strip side slide rail" mounting type.
- 30

- The door drive 10 shown in figure 1 comprises a housing 12 having a first mounting surface 14 on a first housing outer side and a second mounting surface 16 (figure 3B) on a second housing outer side. In this case, the first mounting surface 14 and the second mounting surface 16 are positioned on opposite sides of the housing 12. As seen in figure
- 35 1, the door drive 10 comprises an electronic printed circuit board 18 which extends

substantially parallel to the first housing outer side and has approximately the internal dimensions of the housing 12. More specifically, the length and width of the electronic printed circuit board 18 correspond approximately to the length and width of the first housing outer side, minus the installation space, which is occupied by a transformer 32 and a further short electronic printed circuit board 34 at the end sides. A plurality of cutouts 36 are formed in the electronic printed circuit board 18. Either a housing portion with at least one part 13 of the first mounting surface 14, a fastening means 38 in the form of a screw or a housing portion with at least one part 13 of the first mounting surface 14, in which there are mounting openings 42 for a fastening means 38', protrudes in each case through said cutouts 36. The housing portions projecting through the cutouts 36 each have a partial surface 13 of the first mounting surface 14. From figure 1 it can be seen that the cutouts 36 are formed in corner regions of the electronic printed circuit board 18, on sides of the electronic printed circuit board 18 and in the central region of the electronic printed circuit board 18. The electronic printed circuit board 18 itself is generally not suitable as a mounting surface since any mechanical stress on the electronic printed circuit board 18 should be avoided.

In addition to the described electronic printed circuit board 18, the door drive comprises a motor, in particular an electric motor, for driving an output shaft 20. The output shaft 20 is rotatably mounted in the housing 12 and can be or is coupled to a door leaf 22 (figure 2A and 3A) or a fixed frame 24 (figures 2A and 3A). The axis of rotation D of the output shaft 20 is off-centre, i.e. is arranged with an offset with respect to the centre of the housing 12 along a longitudinal axis L of the housing 12. The housing 12 in each case has a housing opening 26 on the first housing side and the second housing side. These two housing openings 26 allow the output shaft 20 to be selectively coupled at each of its end regions to a lever 28.

In addition, the door drive 10 comprises a displaceable transmission element (not shown), in particular a rack, with which a driving force is transmitted from the motor to the output shaft 20. In the event of a power failure, a spring unit 30 (figure 6B) is provided, which is tensioned when the door leaf 22 is open in order to drive the output shaft 20 via the displaceable transmission element and thus to close the door leaf 22.

Figure 2B shows the first mounting surface 14 on the electronics side and the housing 12 attached with the second mounting surface 16 on the transmission side to the fixed frame 24. In contrast, figure 3B shows the second mounting surface 16 on the transmission side and the housing 12 attached with the first mounting surface 14 on the electronics side to the fixed frame 24.

Figure 4A shows the door drive 10 on the electronics side, i.e. screwed to the fixed frame 24 as in figure 3B, while figure 4B shows the door drive 10 on the transmission side, i.e. screwed to the fixed frame 24 as in figure 2B. For this purpose, mounting openings 42 are provided in the housing 12 which consists of two separate housing parts. Each of the mounting openings 42 has two opposite, annular bearing surfaces 44. The screws 38 can thus be plugged once from the left (figure 4A) and once from the right (figure 4B) through the housing 12 in order to attach the housing 12 and thus the door drive 10 in different ways to the fixed frame 24 on either the electronics side or on the transmission side. The mounting openings 42 are arranged in alignment with the previously described cutouts 36 of the electronic printed circuit board 18.

Figures 5A and 5B show the electronic printed circuit board 18, which is electrically connected using one or more (not shown) angle plugs to the short electronic printed circuit board 34. While the electronic printed circuit board 18, as shown in figure 1, is installed substantially parallel to the first housing outer side, the short electronic printed circuit board 34 is substantially parallel to one of the end sides of the housing 12. A plurality of plug sockets 46 are configured on the outer side of the short electronic printed circuit board 34, into which plugs 48 are inserted. These plugs 48 are connected via connecting lines 50 to sensors (not shown). It can be determined via the sensors, for example radar sensors and/or infrared sensors, whether the door should be opened, for example because a person is standing in front of the closed door, or whether the door can be closed, for example because there is no object in the pivoting range of the door leaf 22.

Figures 6A and 6B illustrate again why it is necessary to be able to attach the door drive 10 of the design according to the invention optionally to the first mounting surface 14 or to the second mounting surface 16 in order to be able to realise all six mounting types (see preamble) using the same model. Figure 6A shows a strip-side mounting of the door drive 10, i.e. the door drive 10 is attached to the fixed frame 24 on the side into which the door leaf 22 can be opened. By contrast, figure 6B shows the mounting of the door drive 10 on the opposite strip side, i.e. on the side towards which the door leaf 22 cannot be opened. In both cases, the door drive must be installed such that the spring unit 30 can move the door leaf 22 from an open position to a closed position. For this purpose, the direction of rotation of the output shaft 20 must remain the same, regardless of whether the door drive 10 is attached to the strip side or opposite the strip side. Direction of rotation is understood to mean the direction of rotation of the output shaft 20 when the door leaf 22 is closed. Therefore, it is necessary to provide two different mounting surfaces 14, 16 and to design the electronic printed circuit board 18 such that mounting on the strip side

(figure 6A) and opposite the strip side (figure 6B) possible without changing the orientation of the door drive 10.

- 10 Door drive
- 12 Housing
- 5 13 Partial mounting surface
- 14 First mounting surface
- 16 Second mounting surface
- 18 Electronic printed circuit board
- 20 Output shaft
- 10 22 Door leaf
- 24 Fixed frame
- 26 Housing opening
- 28 Lever
- 30 Spring unit
- 15 32 Transformer
- 34 Electronic printed circuit board
- 36 Cutout
- 38 Fastening means
- 42 Mounting opening
- 20 44 Bearing surface
- 46 Plug socket
- 48 Plug
- 50 Connecting lines
- D Axis of rotation
- 25 L Longitudinal axis

Dørdrev

Patentkrav

1. Dørdrev (10), særligt svingdørsdrev, med
et hus (12), der omfatter en første monteringsflade (14) på en første husydside og
5 en anden monteringsflade (16) på en modsat liggende anden husydside,
et elektronikprintkort (18), der er placeret ved siden af den første husydside og i det
væsentlige parallelt med denne,
en drivaksel (20), der er lejret drejeligt i huset (12) og kan kobles til en dørløj (22)
eller en dørkarm (24), hvor drivakslen (20) er placeret langs en længdeakse (L) af
10 huset (12) forskudt i forhold til midten af huset (12),
en motor til at drive drivakslen (20), særligt via en tandstang, og en fjederenhed (30),
der spændes under en respektiv åbningsbevægelse af dørløjen (22) og slækkes
under en respektiv lukkebevægelse af dørløjen (22),
kendetegnet ved,
15 at dørdrevet (10) efter eget valg kan monteres på den første eller den anden
monteringsflade (14, 16) på en dørløj (22) eller en dørkarm (24),
hvor der i elektronikprintkortet (18) er udformet udsparinger (36), gennem hvilke der i
hvert enkelt tilfælde rager et fastgørelsesmiddel (38), der kan føres gennem huset
vinkelret på monteringsfladerne (14, 16), særligt en skrue, og/eller et husafsnit med i
20 det mindste en del (13) af en monteringsflade (14, 16), hvor der i huset (12) er
tilvejebragt gennemgående monteringsåbninger (42), der hver især er tilgængelige
fra de to monteringsflader (14, 16), der vender modsat i forhold til hinanden, til
fastgørelsesmidlerne (38), der er placeret således, at de flugter med de tilsvarende
udsparinger (36) i elektronikprintkortet (18).
- 25 2. Dørdrev (10) ifølge krav 1,
kendetegnet ved,
at huset (12) er forsynet med anlægsflader (44) til fastgørelsesmidlerne (38), der til
fastgørelse af dørdrevet (10) på dørkarmen (24) henholdsvis på dørløjen (22) kan
føres ind i monteringsåbningerne (42).
- 30 3. Dørdrev (10) ifølge mindst et af de foregående krav,
kendetegnet ved,
at den første monteringsflade (14) på huset (12) og/eller den anden monteringsflade

(16) på huset (12) består af mindst to separate delflader (13), der særligt ligger i samme plan.

4. Dørdrev (10) ifølge krav 3,
kendetegnet ved,

5 at flere husafsnit rager gennem respektive udsparinger (36) på elektronikprintkortet (18) og sammen danner en af monteringsfladerne (14, 16) på huset (12).

5. Dørdrev (10) ifølge mindst et af de foregående krav,
kendetegnet ved,

10 at udsparingerne (36) på den ene side er tilvejebragt i elektronikprintkortets (18) randområde og på den anden side i det midterste område af elektronikprintkortet (18).

6. Dørdrev (10) ifølge mindst et af de foregående krav,
kendetegnet ved,

at et andet elektronikprintkort (34) i det væsentlige er placeret parallelt med en forside på huset (12) og i det væsentlige vinkelret på det første elektronikprintkort (18).

- 15 7. Dørdrev (10) ifølge krav 6,
kendetegnet ved,

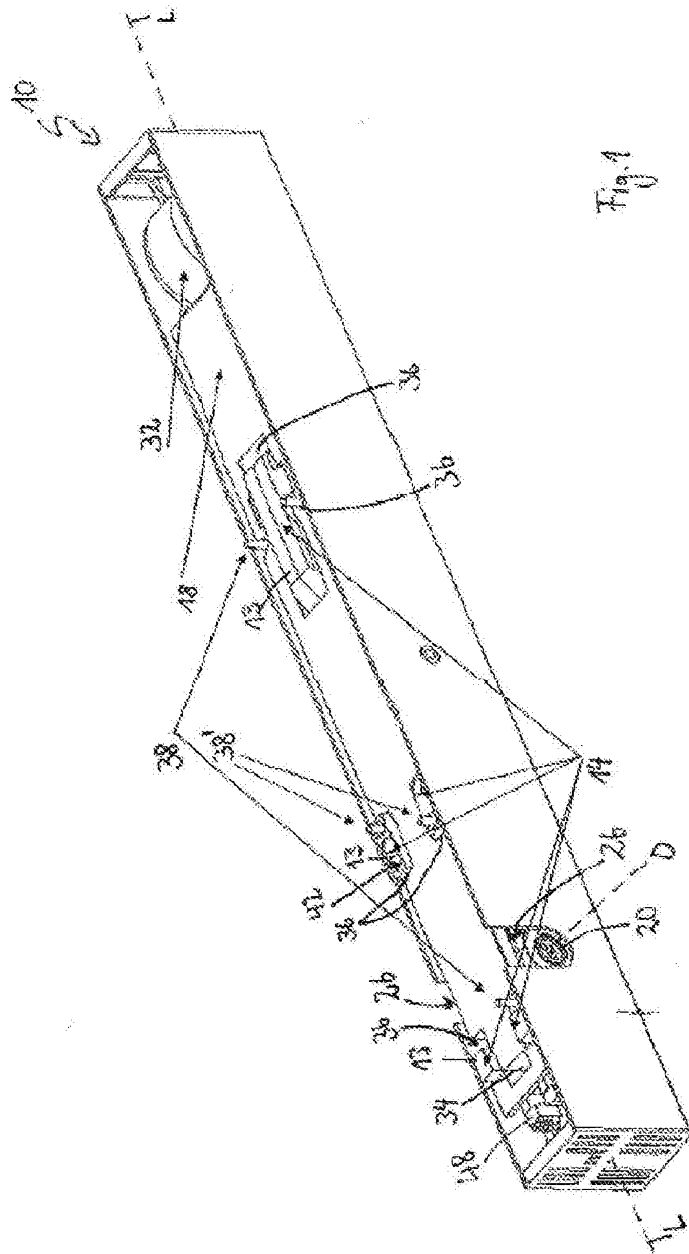
at det første elektronikprintkort (18) og det andet elektronikprintkort (34) er forbundet elektrisk via et vinkelstik.

8. Dørdrev (10) ifølge krav 6 eller 7,
20 kendetegnet ved,

af det andet elektronikprintkort (34) er forsynet med mindst én stikholder (46) til forbindelse med en sensoranordning.

9. Dørdrev (10) ifølge krav 8,
kendetegnet ved,

25 at sensoranordningen omfatter en radarsensor og/eller en infrarød sensor.



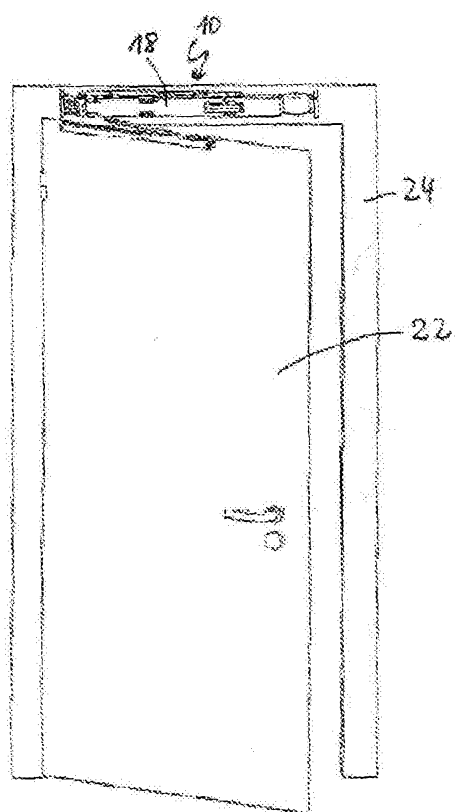


Fig. 2A

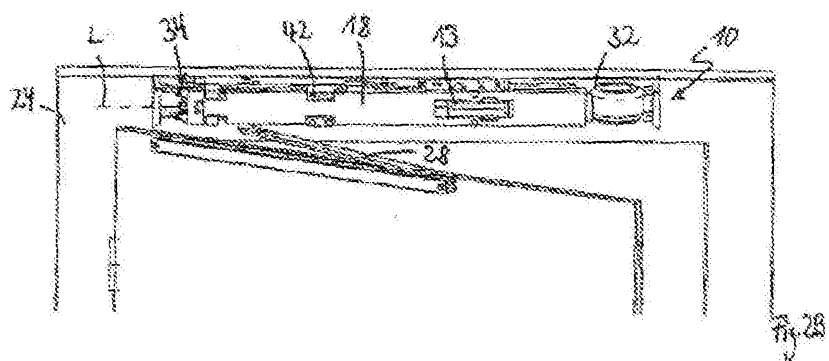


Fig. 2B

