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(54) **A door drive for a swing door of a passenger transport vehicle**

(57) The object of the invention is door drive for a swing door of a passenger transportation vehicle, comprising a rotary post (10), which is arranged on the vehicle, with at least one pivot arm (12) for arrangement at a door leaf (13), wherein the rotary post (10) is connected with a drive device (20), wherein a rotary member (24), more specifically a pinion, which is fixable by a locking device (40), extends from the drive device (20), wherein a force transmission device (30) is provided between the drive device (20) and the rotary post (10) for driving the rotary post (10), wherein the force transmission device (30) comprises an elastomeric member (32), which is connected on the one hand with the drive device (20) and on the other hand with the rotary post (10).

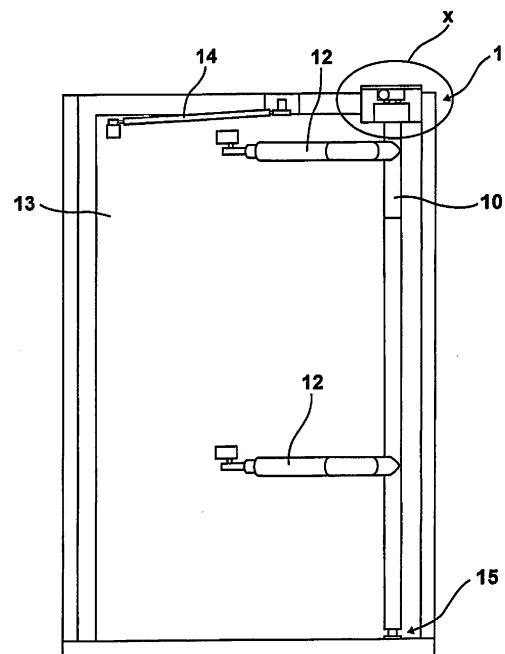


Fig. 1

Description

[0001] The invention relates to a door drive for a swing door of a passenger transport vehicle, comprising a rotary post, which is disposed on the vehicle, with at least one pivot arm that engages with a door leaf, wherein the rotary post is connected to a drive device, wherein a rotary member, more specifically a pinion that is fixable by way of a locking device extends from the drive device, wherein a torque transmission device is provided between the drive device and the rotary post for driving the rotary post. Some swing doors known from the prior art are distinguished by the fact that they have amongst others one rotary post, a spindle drive which converts a stroke motion and a rotary motion being provided in the rotary post. In this regard, a head plate is provided, wherein the head plate receives a drive cylinder, the head plate being arranged at the top in the door portal, so that to that extent the height of the door passage itself is restricted. In this connection, another door drive is known which is also based on a spindle drive, wherein in this door drive, in order to fix the door leaf in the closed position, the door drive at the end of the closing movement executes a vertical movement which ensures that the door leaf runs into wedge-shaped locking elements arranged inside at the door portal. Such spindle drives are pneumatically actuable by way of piston-cylinder drives, wherein, however, an electric door drive is also known in this connection, such an electric door drive being arranged in the region of the boarding step of the vehicle. The arrangement of such a motor in the region of the boarding step usually restricts the entry width of the door portal, which is particularly disadvantageous when, for example, a ramp for wheelchair users has to be arranged in the region of such a door entry.

[0002] A drive device for a door of a vehicle of public transport services with a rotary post drive is known from DE 20 2007 015 770 U1, wherein both the drive motor and the transmission are accommodated in the rotary post. In addition, a brake is accommodated in the rotary post, the brake being moved into the blocking setting under the action of a spring. Release of the brake can be carried out electromagnetically or mechanically, this not being described in more detail.

[0003] A door drive of the type mentioned in the introduction is known from DE 10 2009 053 991 B3, the drive device comprising an electric motor that is coupled to a planetary transmission stage, the rotary post being set in rotation by the motor housing. In this connection, it is provided in detail that, during normal operation of the swing door, the rotary member, for example a pinion, is fixed by a locking device, i.e. prevented from rotating. In such a case, the motor housing and consequently the rotary post connected to it rotate. If the rotary member is not fixed, the rotary post is free and consequently, in case of an emergency, the door leaf can be manually transferred from the closed setting to the open setting. The rotary post has two pivot arms disposed above one an-

other for receiving the door leaf, wherein, due to the rotation of the rotary post, the door leaf is now transferable into the open setting or closed setting in the door portal.

[0004] It often happens that individuals will lean against the door during vehicle operation or also grab hold of the rotary post. In this respect, the rotary post is subjected to a radial force component. Likewise, the chassis, for example of a bus, may be subjected to forces that lead to a torsion of the chassis. This is the case for example when such a bus rolls through a pothole on a stretch of rough road. In such a case, the rotary post is subjected to forces applied in an axial direction. In addition, it may happen that passengers will try to block the door leaf during the opening process. In such a case, there is a risk that the drive device of the rotary post will be damaged. The same can happen, if passengers try to push the door leaf open or try to close it with force.

[0005] The problem underlying the invention is accordingly to provide a door drive of the type mentioned in the introduction that is able to absorb forces in an axial direction as well as in a radial direction, without the door drive being damaged, and that is able to cope with the application of forces on the door leaf, which intend to move it against the motion caused by the drive avoiding any damage to the drive.

[0006] In order to solve the problem the invention proposes that the force transmission device comprises an elastomeric member that is connected with the drive device on the one hand and with the rotary post on the other hand. Such an elastomeric member as a component of the drive transmission device can serve on the one hand as a slipping clutch, and in this regard ensure that the door drive is not damaged when the door is blocked during a swinging motion of the door leaf. By using an elastomeric member as a part of a torque transmission device, the door drive is also able to absorb shocks in the axial direction of the rotary post as well as forces applied in the radial direction of the rotary post, without causing damage to the drive device or the door leaf.

[0007] Advantageous features and embodiments of the invention can be gathered from the dependent claims.

[0008] Thus it is more specifically provided that the elastomeric member can have a sleeve-shaped configuration, wherein the sleeve-shaped elastomeric member advantageously receives the drive device in its centre. This means that the drive device is virtually embedded in the elastomeric member, so that the drive device will not be damaged by shocks in the axial direction or by shocks in the radial direction.

[0009] In particular, it is furthermore provided that the torque transmission device has a coupling housing, wherein the sleeve-shaped elastomeric member is disposed in the cup-shaped coupling housing. In this context it is more specifically additionally provided that a force-fit connection is provided between the drive device and the sleeve-shaped elastomeric member on the one hand and/or the sleeve-shaped elastomeric member and the housing on the other hand. From this, it is clear that there

is a friction connection between the drive device and the sleeve-shaped elastomeric member on the one hand, wherein such a friction connection may also be provided between the housing and the elastomeric member. This means that a kind of slipping clutch is provided between the drive device on the one hand and the rotary post on the other hand, as has already been explained above.

[0010] According to another advantageous feature of the invention, the sleeve-shaped elastomeric member has a cone-shaped outer lateral surface, the more specifically cup-shaped coupling housing being advantageously also cone-shaped in accordance with the conical sleeve-shaped elastomeric member.

[0011] According to another feature of the invention, it is provided that the coupling housing has a slot along the length of the housing, wherein the coupling housing is advantageously pre-loadable against the sleeve-shaped elastomeric member by at least one tensioning member in the region of the slot. That way, the pressing force between the coupling housing and the elastomeric member on the one hand and the drive device and the elastomeric member on the other hand is adjustable, which means that the torque of the motor at which the friction connection between the elastomeric member and the drive device or the elastomeric member and the coupling housing no longer holds is thereby adjustable.

[0012] According to another feature of the invention, the vehicle has a door portal, the coupling housing being mounted in the door portal at least in the radial direction. The radial mounting of the coupling housing is such that the rotary member that is led out of the coupling housing is particularly not subjected to radial forces. This means that the rotary member is free of forces acting more specifically in the radial direction. As a consequence, the locking device also remains free of forces acting in the radial direction. The portal has a so-called head plate in the region of the door drive. The head plate has a bore through which the rotary member may be passed. On the upper side of the head plate, there is the locking or fixing device, which is connected to the rotary member. The bore for passing the rotary member through the head plate is chosen in such a manner that a radial bearing is disposed between the coupling housing on the one hand and the head plate on the other hand, so that, in any case, the rotary member is not subjected to forces applied in a radial direction, as has already been explained. That means the shaft of the motor just passes through the bore in the head plate.

[0013] According to another feature of the invention, the rotary post is mounted in the coupling housing so as to be axially displaceable relative to the coupling housing. A non-rotatable connection is provided between the rotary post and the coupling housing, the non-rotatable connection being however such that the rotary post is receivable by the coupling housing so that it is displaceable axially relative to the housing. This must be seen in the context of a bus traveling on a stretch of rough road, for example, which easily buckles or deforms in height

in the region of the door portal, thus leading to a shortening of the clear height of the door portal. Since the rotary post is mounted in the coupling housing so as to be axially displaceable, such changes can be compensated for. When the vertical movement made possible by the axial movability of the rotary post relative to the coupling housing is not sufficient and the rotary post is thus compressed to a block relative to the coupling housing, the elastomeric member can furthermore ensure that relevant axial shocks are absorbed due to the elasticity of the elastomeric member.

[0014] The drive device advantageously features a motor, more specifically an electric motor with a motor housing, a planetary transmission with at least one planetary transmission stage being disposed in the motor housing, the motor housing being connected to the elastomeric member. The motor housing, which receives the planetary transmission and the actual electric motor, is a part of the drive device, which rotates when the rotary member is fixed. When the motor housing rotates, the door can ultimately be transferred into an open or closed setting by way of the connection with the housing and the rotary motion of the rotary post, which is connected to the coupling housing.

Fig. 1 schematically shows a detail of the door portal of a vehicle with a rotary post, placed in the door portal, with pivot arms to which the door leaf is coupled;

Fig. 2 shows the detail X of fig. 1 in a magnified view;

Fig. 3 shows a section along line III-III in fig. 2.

[0015] In the illustration according to FIG. 1, the door portal is denoted by 1. Disposed in the door portal 1 is the rotary post, which is denoted by 10. The rotary post 10 has two mutually spaced-apart pivot arms 12 by which the rotary post 10 is connected with the door leaf 13. In addition, a guide arm 14 is arranged at the door leaf 13 as a connection with the door portal 1. The rotary post 10 is rotatably mounted at the lower end (arrow 15) in the portal 1. Disposed at the upper end of the rotary post 10 is the drive device 20 with the torque transmission device 30 and the locking device 40.

[0016] The arrangement of the drive device, the torque transmission device and the locking device may be gathered in more detail from fig. 2. The drive device 20 comprises a motor housing 22, which receives the actual electric motor as well as at least one planetary transmission stage. Such motors, i.e. motors that, as a housing, accommodate the electric motor as well as a planetary transmission are commercially available. They are sold for example by the company Dunker®. A rotary member 24, which is connected to the locking device 40, extends from the drive device 20. The locking device 40 either secures the rotary member against rotation, with the consequence that the drive device 20 ultimately sets the ro-

tary post in rotation by way of the motor housing 22, or the rotary member 24 is released by the locking device, with the consequence that the door leaf can be transferred from the closed setting into the open setting by hand. The locking device denoted by 40 is already known from the citation mentioned in the introduction, DE 10 2009 053 991 B3 and does not have to be described in more detail here. The disclosure thus explicitly refers to that citation. It should never the less be noted that the transmission between the motor and rotary member 24 is self-locking in order to prevent the possibility of opening or closing the door leaf by pushing or pulling it.

[0017] The drive device 20 is mounted in the elastomeric member, which is denoted by 32, the elastomeric member being disposed in the housing, which is denoted by 34. The elastomeric member 32 and the housing 34 have a conical configuration. The housing is advantageously slit in the longitudinal direction of the housing as can be gathered from fig. 3. The slot 39 allows adjusting the clamping force between the elastomeric member 32 on the one hand and the housing 34 on the other hand. This, of course, simultaneously also has an impact on the clamping force between the motor housing 22 and the elastomeric member 32. In the region of the slot 39, the housing has two straps 39a, 39b for adjusting the clamping force, wherein said straps may be pressed together by the tensioning member 39c in order to downsize or enlarge the slot 39.

[0018] The housing 34 has a floor 35, the floor having a polygonal opening 36 through which a correspondingly configured pivot 38 of the rotary post 10 is passed. This means that there is a positive-fit connection between the rotary post and the housing 34 by way of the polygonal pivot 38 in connection with the likewise correspondingly configured polygonal opening 36 in the floor 35 of the housing 34.

[0019] In addition, the housing 34 is disposed in the head plate 3 of the door portal 1 so as to be rotatable in the radial direction by way of an appropriate bearing. To this end, the head plate has a radial bearing 7 in the region of the passage for the rotary member 24, the housing having a collar 37 against which the radial bearing 7 rests. Thus it is achieved that the rotary member and consequently the locking device is free of a force in the radial direction. As a consequence, the locking device is always easily actuatable in an emergency.

List of reference numerals:

[0020]

| | |
|----|----------------|
| 1 | door portal |
| 7 | radial bearing |
| 10 | rotary post |
| 12 | pivot arm |
| 13 | door leaf |
| 14 | guide arm |
| 20 | drive device |

| | |
|-------|---------------------------|
| 22 | motor housing |
| 24 | rotary member |
| 30 | force transmission device |
| 32 | elastomeric member |
| 5 34 | coupling housing |
| 35 | floor |
| 36 | opening |
| 37 | collar |
| 38 | pivot |
| 10 39 | slot |
| 39a | strap |
| 39b | strap |
| 39c | tensioning member |
| 40 | locking device |

Claims

1. A door drive for a swing door of a passenger transportation vehicle, comprising a rotary post (10), which is arranged on the vehicle, with at least one pivot arm (12) for arrangement at a door leaf (13), wherein the rotary post (10) is connected with a drive device (20), wherein a rotary member (24), more specifically a pinion, which is fixable by a locking device (40), extends from the drive device (20), wherein a force transmission device (30) is provided between the drive device (20) and the rotary post (10) for driving the rotary post (10),

characterized in that

the force transmission device (30) comprises an elastomeric member (32), which is connected on the one hand with the drive device (20) and on the other hand with the rotary post (10).

2. The door drive according to claim 1, **characterized in that** the elastomeric member (32) has a sleeve-shaped configuration.

3. The door drive according to claim 2, **characterized in that** the sleeve-shaped elastomeric member (32) has the drive device (20) in its centre.

4. The door drive according to claim 2 or 3, **characterized in that** the force transmission device (30) comprises a housing (34), wherein the sleeve-shaped elastomeric member (32) is disposed in the housing (34).

5. The door drive according to claim 4, **characterized in that** a force-fit connection is provided between the drive device (20) and the sleeve-shaped elastomeric member (32) on the one hand and/or the sleeve-shaped elastomeric member (32) and the housing (34) on the other hand.

6. The door drive according to one of the claims 2 to 5,
characterized in that
the sleeve-shaped elastomeric member (32) has a
conical configuration at its outer lateral surface. 5
7. The door drive according to claim 6,
characterized in that
the housing (34) also has a conical configuration cor-
responding to the conical sleeve-shaped elastomer- 10
ic member (32).
8. The door drive according to one of the claims 4 to 7,
characterized in that
the housing (34) has a slot (39) along the length of
the housing (34). 15
9. The door drive according to claim 8,
characterized in that,
in the region of the slot (39), the housing (34) is pre- 20
loadable against the sleeve-shaped elastomeric
member (32) by at least one tensioning member
(39c).
10. The door drive according to one of the afore-men- 25
tioned claims,
characterized in that
the vehicle has a door portal (1), wherein the housing
(34) is mounted at least radially in the door portal (1).
11. The door drive according to one of the claims 4 to 10, 30
characterized in that
the rotary post (10) is mounted in the housing (34)
so as to be axially displaceable relative to the hous-
ing (34). 35
12. The door drive according to one of the claims 5 to 11,
characterized in that
the drive device (20) has a motor with a motor hous-
ing (22), wherein the motor housing (32) has a plan- 40
etary transmission, wherein the motor housing (22)
is connected to the elastomeric member (32).
13. The drive device according to one of the afore-men-
tioned claims, 45
characterized in that
the rotary post (10) is connected to the torque trans-
mission device (30) so that it transmits a force and
is axially displaceable. 50

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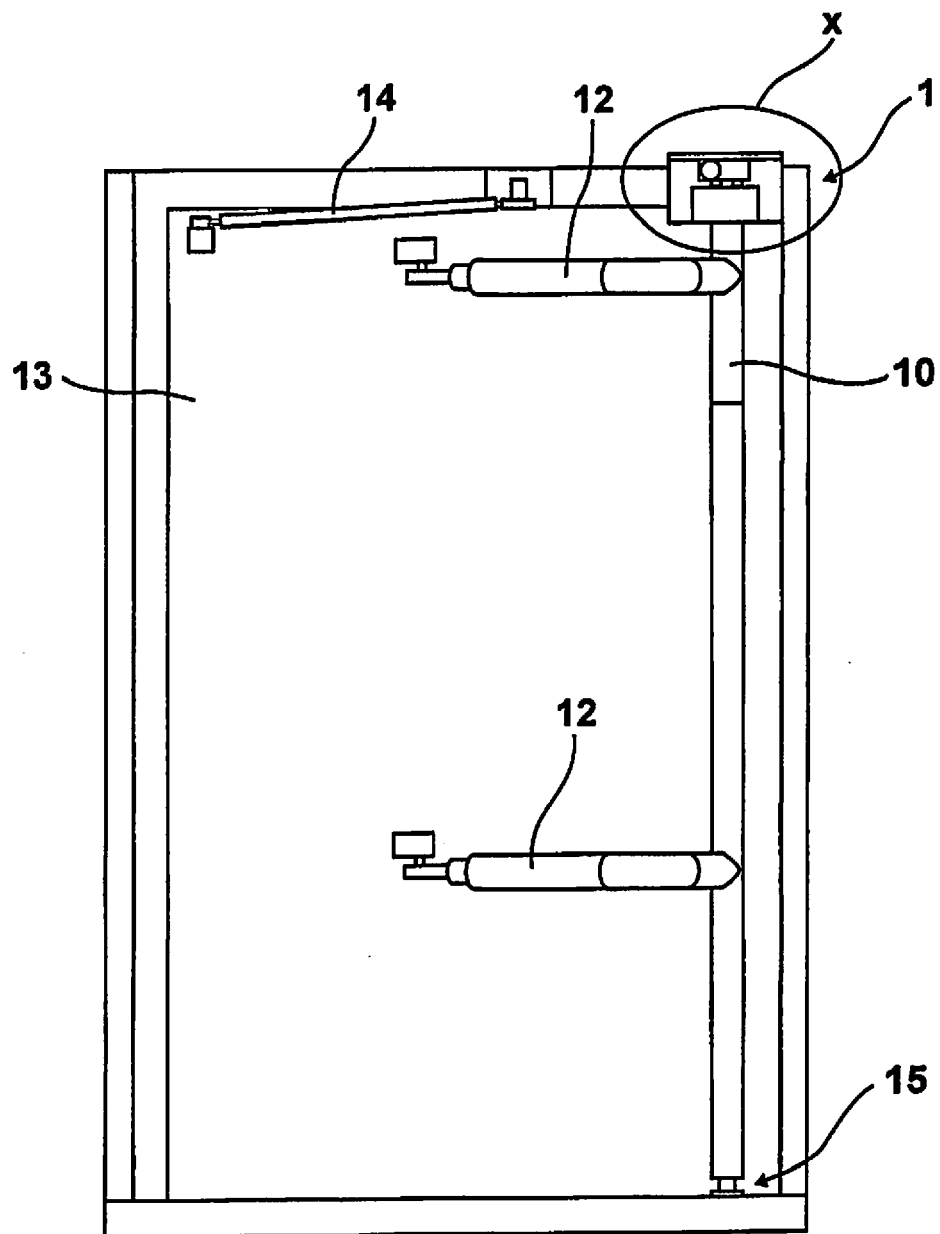


Fig. 1

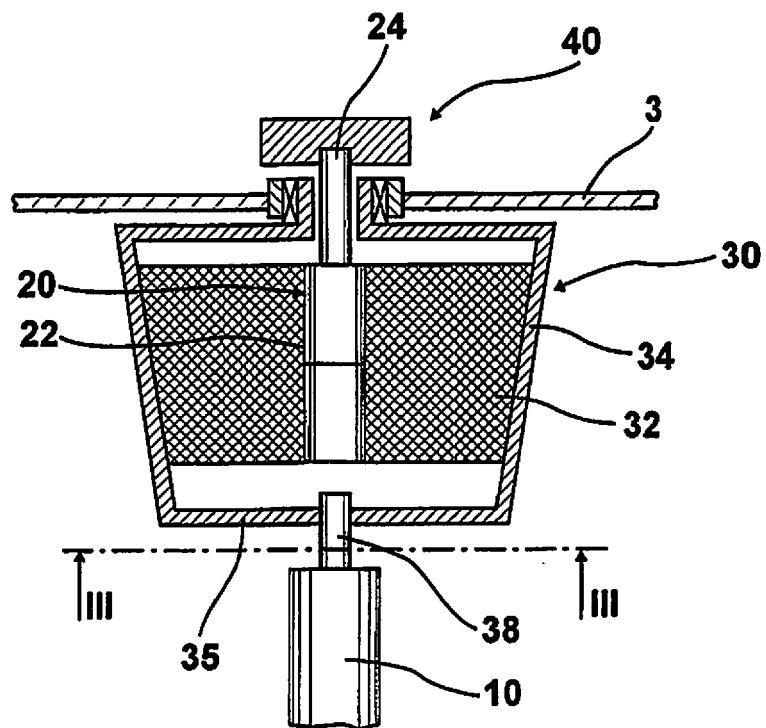


Fig. 2

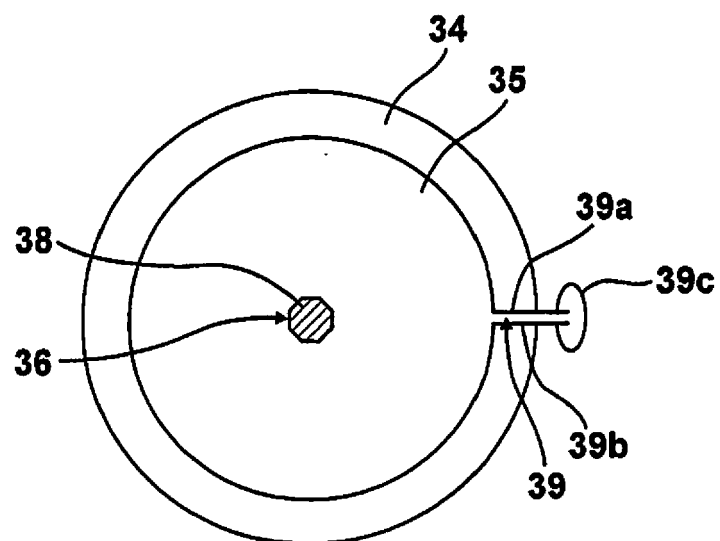


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 15 15 7719

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| The present search report has been drawn up for all claims | | | |
| Place of search The Hague | | Date of completion of the search 2 June 2016 | Examiner Berote, Marc |
| CATEGORY OF CITED DOCUMENTS 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 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 | | | |

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EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 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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02-06-2016

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