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[Continued on next page]

(54) Title: ELEVATOR SYSTEM WITH A DISC SPRING BUFFER

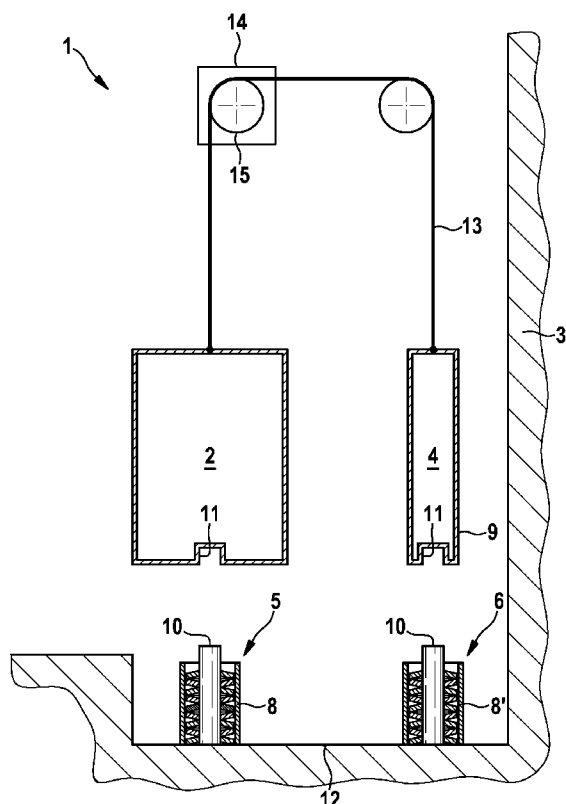


Fig. 3

(57) Abstract: An elevator system (1) with at least one elevator cabin (2) and optionally a counterweight (3) movably mounted in an hoistway (4) and a buffer assembly (5, 6) for dampening the elevator cabin (2) and/or the counterweight (3). According to the invention, the buffer assembly (5, 6) comprises at least one disc spring (7).



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Elevator system with a disc spring buffer

The present invention relates to an elevator system according to the preamble of claim 1.

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It is known from the prior art to dampen an elevator cabin and a counterweight of an elevator system at its lowest position with a compression helical spring or an hydraulic buffer. A problem connected with the use of helical springs is that, depending on the intended use and technical features of the elevator system, a specifically designed helical spring with a predefined spring rate must be provided. Since elevator systems are often customized, a wide range of helical springs must be stored at a production and/or maintenance site, thus leading to high storage costs and surfaces. Furthermore, depending on the purpose of the helical spring, its dimension and weight may make an installation and/or a replacement, e.g. in an elevator pit, very difficult. The same applies to hydraulic buffers, which are even more cost intensive, wherein their dampening characteristics are also temperature and humidity dependent.

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It is therefore aim of the present invention to provide an elevator system with a buffer assembly which solves the problems related to the prior art and in particular which allows a flexible and lesser cost intensive production and/or replacement of dampeners for elevator systems.

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This problem is solved with an elevator system according to the characterizing part of the claim 1.

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An elevator system according to the present invention comprises at least one elevator cabin movably mounted in a hoistway. Depending on the elevator type, a counterweight also movably mounted in the hoistway and preferably connected to the cabin via suspension and/or traction means is also comprised. The elevator system further comprises a buffer assembly for dampening the elevator cabin and/or the counterweight (if present). According to the present invention, the buffer assembly comprises at least one disc spring. Preferably, the buffer assembly only comprises one or more disc springs as a dampening element.

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It is therefore clear that in an elevator system according to the present invention, the buffer assembly can be assembled flexibly and according to client's requirements with commercially available disc springs.

- 5 Preferably, the buffer assembly comprises a plurality of disc springs, wherein in a preferred embodiment of the present invention, the disc springs are arranged in series and/or in parallel. It is therefore possible to adjust the buffer assembly characteristics such as a buffer stroke and/or spring rate, preferably using a single type of disc spring, also by the parallel or serial arrangement of the disc springs.

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Disc springs usually have a cup shape. An arrangement "in parallel" of disc springs means that the disc springs are stacked with the convex side on the same side. In a parallel arrangement of disc springs, the buffer stroke corresponds to the buffer stroke of one disc spring of the arrangement, wherein the spring rate is a sum of the spring rates of the disc springs used. On the other hand, a "in series" arrangement means that the disc springs are arranged with a facing convex side of two disc springs or two convex sides facing away. The spring rate corresponds to the spring rate of a single disc spring used, wherein the buffer stroke is a sum of the buffer strokes of the disc spring used.

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- 20 Preferably the at least one disc spring is arranged in a bearing shell, wherein the bearing shell has in particular a cylindrical shape.

Disc springs usually have a circular basic shape. It is therefore advantageous to arrange the disc spring(s) in a cylindrical sleeve in order to simplify the construction of the buffer assembly. However, the bearing shell must not be necessarily of a cylindrical shape, other shapes apt to contain the disc spring(s) and prevent their displacement, e.g. a peripheral bar assembly arranged around the disc spring(s), are possible.

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Preferably, the elevator cabin and/or the counterweight (if present) are provided with guiding means, wherein the guiding means can cooperate with the bearing shell.

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In order to assure a safe operation of the elevator system, the guiding means are designed such as being able to cooperate, e.g. with a matching shape, with the bearing shell, in order to reliably guarantee that the direction of the force applied to the buffer assembly is optimal, in particular in elevator system where the cabin and the counterweight may displace due to vibrations, movement of the load in the cabin, shrinkage of the building, etc.

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Preferably, the guiding means have a shape matching the shape of the bearing shell. In particular, the guiding means are insertable into the bearing shell.

5 With such a design of the bearing shell and the guiding means, the operation of the buffer assembly is improved. As an example, only one buffer assembly may be arranged to dampen the elevator cabin, wherein, as cited above, a possible displacement of a load in the cabin resulting in change of the orientation of the elevator cabin known as “tilting” does not interfere with the correct operation of the buffer assembly.

10 The at least one disc spring is preferably mounted on a bearing stud. In particular, the bearing stud has a cylindrical shape.

15 Since disc springs usually have, as cited above, a circular basis shape with a concentric round opening, a bearing stud may be used for the alignment of the disc spring(s). In particular, the bearing stud has a cylindrical shape matching the round opening of the disc spring. The disc spring(s) can therefore be slipped onto the bearing stud, assuring that a lateral displacement of the disc spring(s) is prevented.

20 Preferably, the elevator cabin and/or the counterweight (if present) are provided with guiding means, wherein the guiding means can cooperate with the bearing stud.

25 As already cited above with regard to bearing shell, the guiding means may be designed such as to cooperate with the bearing stud in order to improve the reliability of the buffer assembly.

Preferably, the guiding means have a shape matching the shape of the bearing stud. In particular, the bearing stud is insertable into the guiding means.

30 This particular design is an alternative to the above cited guiding means being insertable into the bearing shell and features the same advantages. However, depending on the purpose of the buffer assembly, a mixed construction including a bearing stud and a bearing shell, with guiding means correspondingly designed, is also possible.

35 The buffer assembly is preferably arranged in a pit of the hoistway. However, since the present invention is not limited to vertical moving elevator but may also be used in horizontal or sloping moving elevators, this arrangement is not limiting.

Preferably, the elevator system comprises a plurality of buffer assemblies.

In particular, an elevator system including an elevator cabin and a counterweight comprises at least one buffer arrangement for the elevator cabin and at least one buffer arrangement for the counterweight.

The invention further relates to a buffer assembly for an elevator system as described in the present application.

Such a buffer assembly is particularly advantageous as a replacement buffer assembly in already existing elevator systems.

It is further aim of the present invention to provide a reliable buffer assembly for an elevator system which solves the problems related to the prior art and in particular allows a flexible and lesser cost intensive production and/or replacement of dampeners for elevator systems

This problem is solved with the use of at least one disc spring for dampening an elevator cabin and/or a counterweight of an elevator system.

It is clear from the above that the use of at least one disc spring represents an innovative and flexible possibility for the construction of a buffer assembly for an elevator cabin and/or a counterweight.

The advantages of disc springs are, inter alia, that standard components, e.g. according to DIN 2093, are available on the market and can be combined in numerous configurations and used as a modular spring element. Furthermore, disc springs show no deformation or fatigue under the normal loads that occur during use in an elevator system and have a high energy storage capacity compared to helical springs. The service life is longer compared to helical springs; they need less storage space and have lower maintenance costs. In addition, they make an efficient use of space when arranged as a buffer and have better spring force characteristics as helical springs.

The present invention will be described hereinafter on the basis of a preferred embodiment together with the figures: It is shown in:

Fig. 1a a sectional view of disc springs arranged in series;

Fig. 1b a sectional view of disc springs arranged in parallel

5 Fig. 1c a sectional view of disc springs arranged in parallel and in series;

Fig. 1d a sectional view of a disc spring with the typical design parameters;

10 Fig. 2 a partial sectional perspective view of a preferred embodiment of a buffer arrangement;

Fig. 3 a schematical view of an elevator system with buffer arrangements according to figure 2.

15 In the figures 1a, 1b and 1c, different possible arrangements of disc springs 7 are shown. In the figure 1a, six disc springs 7 are arranged in series, with a convex side facing the convex side of a neighbouring disc spring 7' and the concave side facing the concave side of another neighbouring disc spring. The total deflection of the arrangement of the figure 1a under load is six times the deflection of a single disc spring 7, wherein the maximum
20 load is the load that may be carried by one single disc spring 7.

In the figure 1b, the disc springs 7 are arranged in parallel, with a convex side of the disc spring 7 facing the concave side of a neighbouring disc spring 7'. The total deflection of the arrangement of the figure 1b under load is the deflection of a single disc spring 7,
25 wherein the maximum load is three times the load that may be carried by one single disc spring 7.

In the figure 1c, a mixed arrangement consisting of four clusters of disc springs arranged in series, wherein each cluster consists of two disc springs 7 and 7' arranged in parallel, is
30 shown. The total deflection is in this case four times the deflection of a single disc spring 7, wherein the maximum load is twice the load that may be carried by a single disc spring 7.

In figure 1d, the typical parameters of a disc spring 7 are shown. The disc spring 7 is typically made of metal with a thickness t , an outer diameter D_0 and a diameter of an inner concentric opening D_i . The height of the disc spring 7 without load is L_0 , wherein under
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load the height is reduced to L_1 . The total deflection of the disc spring 7, also referred to as buffer stroke, is therefore equal to the difference between the disc spring height without load L_0 and the disc spring height under load L_1 ($L_0 - L_1$).

- 5 A preferred buffer assembly 5 or 6 is shown in figure 2. For better understanding, an upper portion of disc springs 7 of the assembly has been cut out, showing the serial arrangement of the disc springs 7. The disc springs 7 are stacked onto a bearing stud 10 with an outer diameter slightly inferior to the diameter D_i of the disc springs 7 used, since under load D_i decreases and a bearing stud 10 without tolerance would lead to jamming
10 of the buffer assembly 5 or 6.

Assuming that a buffer with a buffer stroke of 65 mm with a maximum load of 724 Kg, corresponding to 7103 N is necessary, a standard helical spring usually installed in elevator systems has an height (fully extended) of 169 mm. Using disc springs according to
15 DIN 2093 with $D_0 = 90$ mm, $D_i = 46$ mm and $L_0 = 5,7$ mm, with a maximal compression for a single disc spring 7 of 3,2 mm with a load of 7684 N, 21 disc springs 7 are required for a 67,2 mm buffer stroke. The total height of the buffer assembly will however be 119,7 mm (compared to 169 mm of an equivalent helical spring). The weight of the buffer assembly will be about 15 to 25% of the equivalent helical spring.

20 According to figure 3, an elevator system comprising an elevator cabin 2 and a counterweight 4 arranged in a hoistway 3 is schematically shown. The elevator cabin 2 is connected via traction and suspension means 13 to the counterweight 4. Movement of the elevator cabin 2 and the counterweight 4 is achieved via a motor 14 with a traction sheave
25 15.

In a hoistway pit 12 there are arranged a buffer assembly 5 for the elevator cabin 2 and a buffer assembly 6 for the counterweight 4. Both the buffer assembly 5 and 6 are arranged such as the elevator cabin 2 and the counterweight 4 are only dampened if they leave their
30 normal travel range within the hoistway 3 (meaning they reach a lower position than planned).

The general arrangement of the buffer assembly 5 or 6 corresponds to the assembly shown in figure 2. The elevator cabin 2 and the counterweight 4 are provided with a hole
35 11 matching the bearing stud 10 of the buffer assembly 5 and 6 respectively, assuring alignment of the elevator cabin 2 and of the counterweight 4 when engaging with each

other and thus leading to the desired load transmission. A protection shell 8 and 8' is arranged surrounding the disc springs 7 of the buffer assembly 5 and 6 respectively in order to protect the latter from dirt. The inner shape of the protection shell 8' is complementary to the outer shape of a lower portion 9 the counterweight 4, thus performing a supplementary guiding function when the counterweight is being dampened.

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Claims

1. Elevator system (1) with at least one elevator cabin (2) and optionally a counterweight (4) movably mounted in an hoistway (3) and a buffer assembly (5, 6) for dampening the elevator cabin (2) and/or the counterweight (4),
5 characterized in that the buffer assembly (5, 6) comprises at least one disc spring (7).
2. Elevator system (1) according to claim 1, characterized in that the buffer assembly (5, 6) comprises a plurality of disc springs (7)
10
3. Elevator system (1) according to claim 2, characterized in that the disc springs (7) are arranged in series and/or in parallel.
4. Elevator system (1) according to one of the preceding claims, characterized in that the disc spring(s) (7) is/are arranged in a bearing shell (8), the bearing shell (8) having in particular a cylindrical shape.
15
5. Elevator system (1) according to claim 4, characterized in that the elevator cabin (2) and/or the counterweight (4) are provided with guiding means (9), wherein the guiding means (9) can cooperate with the bearing shell (8).
20
6. Elevator system (1) according to claim 5, characterized in that the guiding means (9) have a shape matching the shape of the bearing shell (8), in particular the guiding means (9) are insertable into the bearing shell (8).
25
7. Elevator system (1) according to one of the preceding claims, characterized in that the disc spring(s) (7) is/are mounted on a bearing stud (10), the bearing stud (10) having in particular a cylindrical shape.
8. Elevator system (1) according to claim 7, characterized in that the elevator cabin (2) and/or the counterweight (4) are provided with guiding means (11), wherein the guiding means (11) can cooperate with the bearing stud (10).
30
9. Elevator system (1) according to claim 7, characterized in that the guiding means (11) have a shape matching the shape of the bearing stud (10), in particular the bearing stud (10) is insertable into the guiding means (11).
35

10. Elevator system (1) according to one of the preceding claims, characterized in that the buffer assembly (5, 6) is arranged in a pit (12) of the hoistway (3).
11. Elevator system (1) according to one of the preceding claims, characterized in that it
5 comprises a plurality of buffer assemblies (5, 6).
12. Buffer assembly (5, 6) for an elevator system (1) according to one of the preceding claims.
- 10 13. Use of at least one disc spring (7) for dampening an elevator cabin (2) and/or a counterweight (4) of an elevator system (1).

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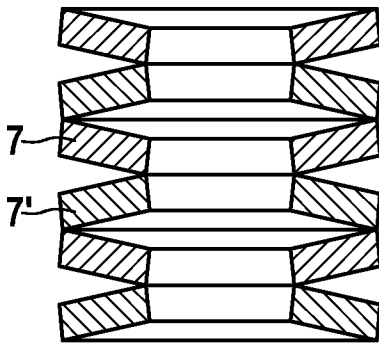


Fig. 1a

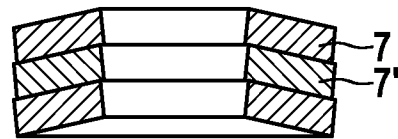


Fig. 1b

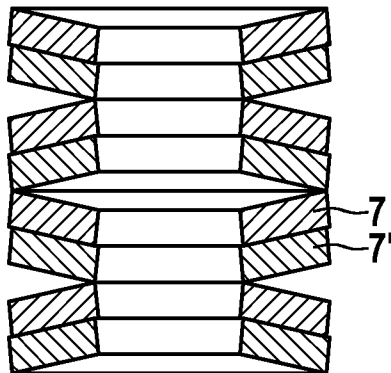


Fig. 1c

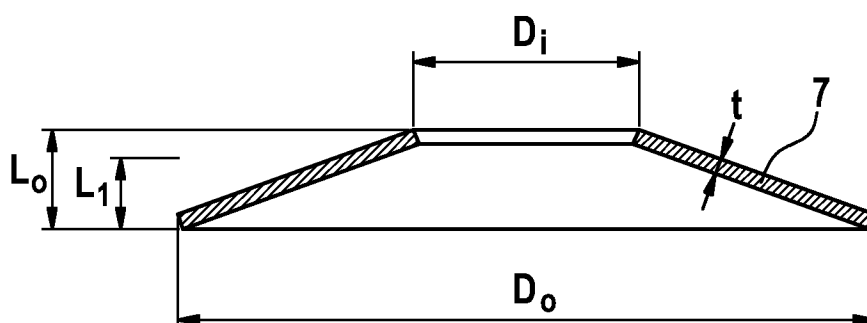


Fig. 1d

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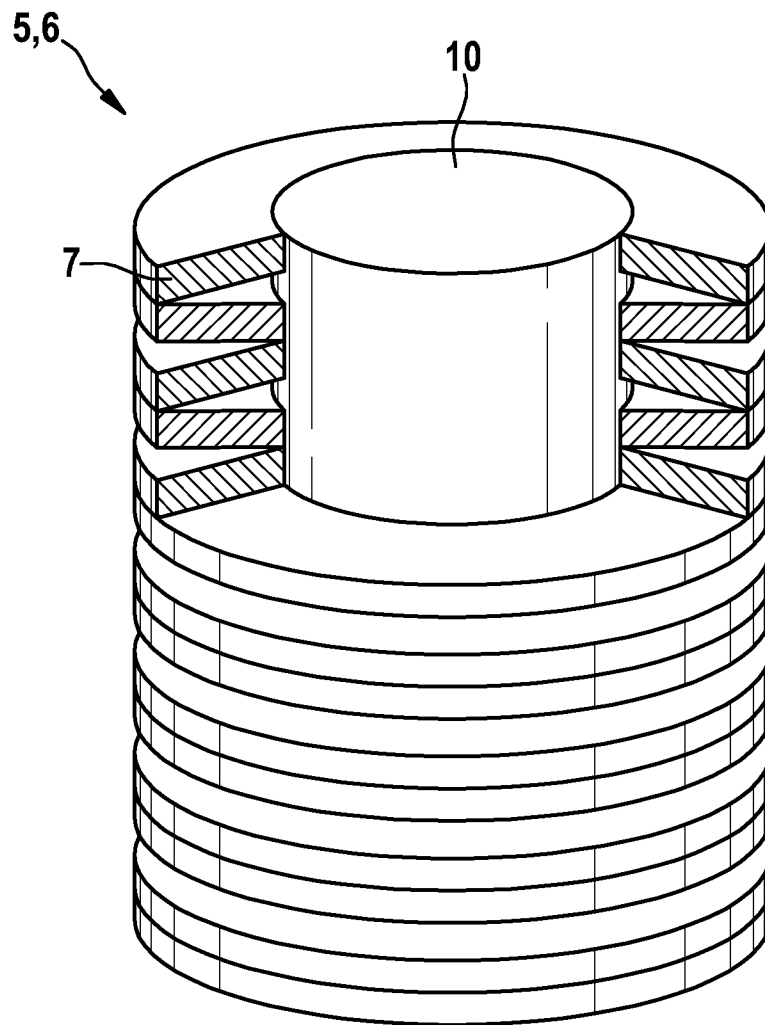


Fig. 2

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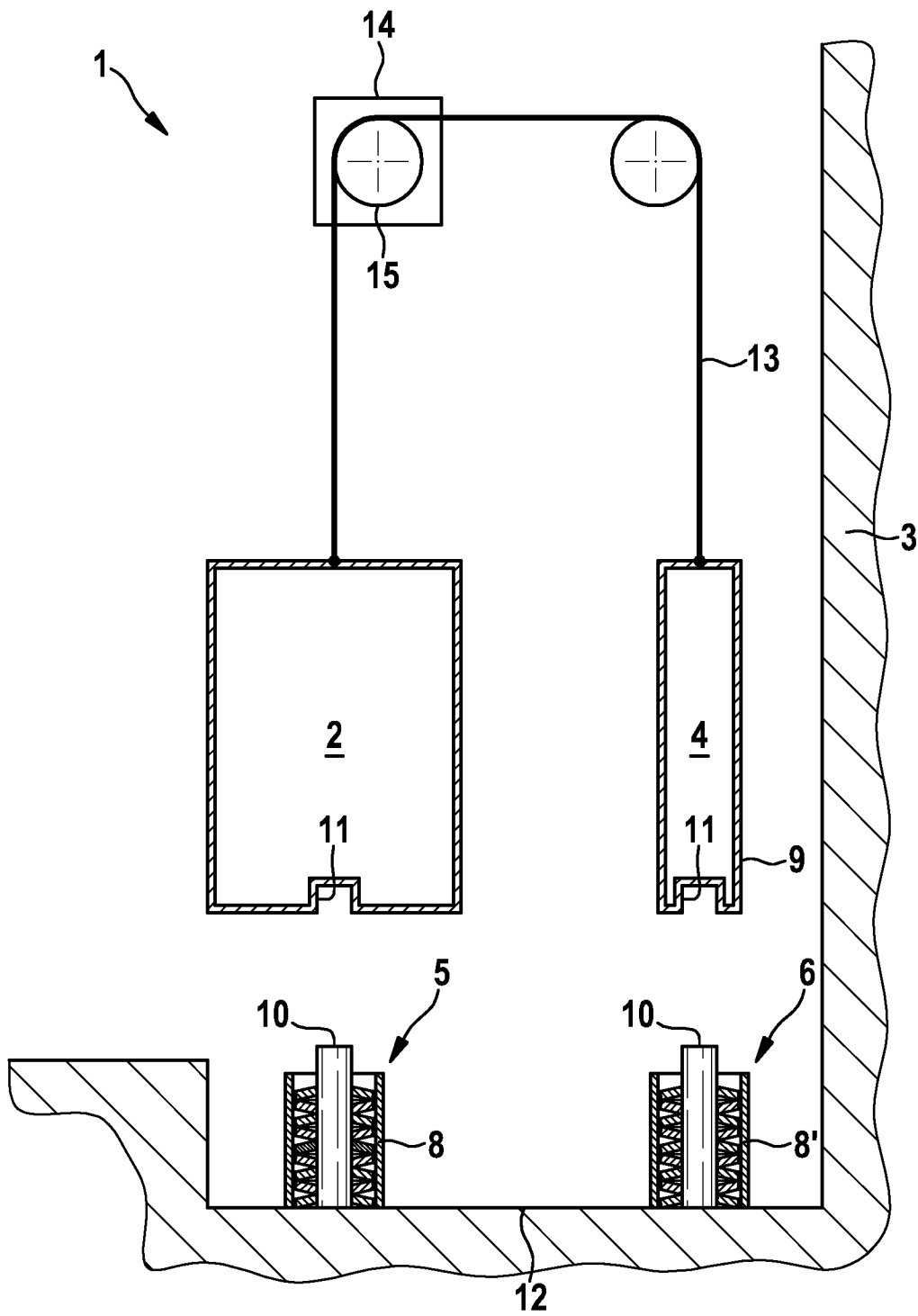


Fig. 3

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2015/079749

A. CLASSIFICATION OF SUBJECT MATTER

INV. B66B5/28

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B66B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	FR 1 008 953 A (CREUSOT FORGES ATELIERS) 23 May 1952 (1952-05-23)	1-7, 11-13
Y	the whole document	8-10
X	----- CN 203 319 444 U (BEIJING SHENGHUA ELEVATOR GROUP CO LTD) 4 December 2013 (2013-12-04)	12
Y	figures 1, 3	8-10
A	-----	1
A	JP 2001 151435 A (HITACHI LTD) 5 June 2001 (2001-06-05) abstract figures 1, 8	5,6



Further documents are listed in the continuation of Box C.



See patent family annex.

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2015/079749

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
FR 1008953	A	23-05-1952	NONE	

CN 203319444	U	04-12-2013	NONE	

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