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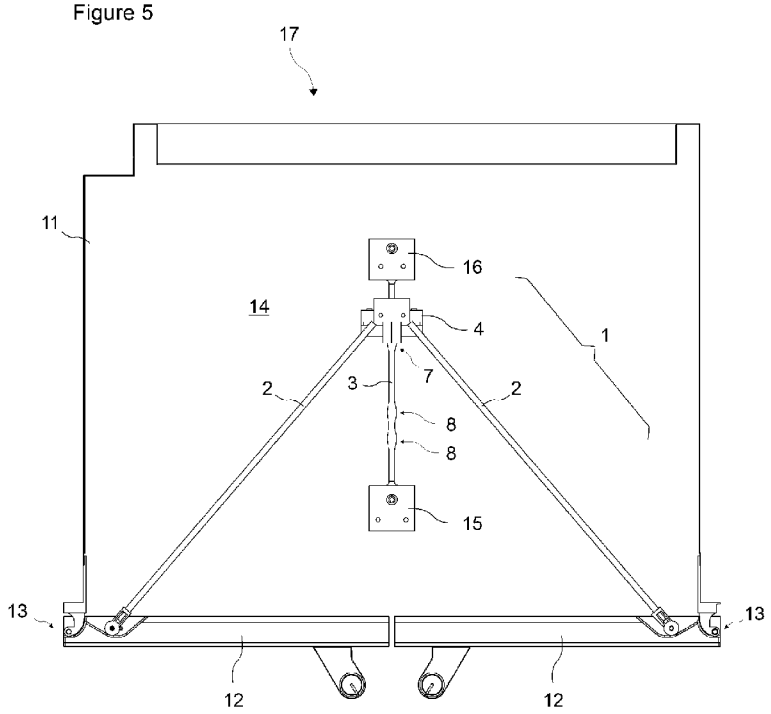
(54) **Title:** LINKAGE MECHANISM SUITABLE TO BE USED IN AN OVEN COMPRISING FRENCH STYLE DOORS

Figure 5



(57) **Abstract:** The present invention relates to a linkage mechanism (1) suitable to be used in ovens (17) comprising two side-by-side French style doors (12) connected to the front surfaces of opposite left and right vertical edges of a body (11) so as to be pivotable about the vertical axis by means of hinges (13), mounted on a horizontal plane (14) on the upper or the lower wall of the body (11), enabling both doors (12) to be opened or closed simultaneously by a user moving only one of the doors (12), and comprising two link arms (2) symmetrically connected by their front ends to the doors (12) so as to be pivotable about the vertical axis, movable parallel to the horizontal plane (14), and extending from both doors (12) by converging to each other towards the rear edge of the horizontal plane (14). The linkage mechanism further comprises: - a rail (3) fixed on the horizontal plane (14) in parallel to the horizontal plane (14) by means of a front mounting plate (15) and a rear mounting plate (16), - a carriage block (4) to which the rear ends of the link

WO 2019/166363 A1

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arms (2) are connected, moving on the rail (3) during opening and closing of the doors (12), and by - a linear slide bearing (5) enabling the carriage block (4) to be movably supported on the rail (3).

Description

LINKAGE MECHANISM SUITABLE TO BE USED IN AN OVEN COMPRISING FRENCH STYLE DOORS

[0001] The present invention relates to a linkage mechanism suitable to be used particularly in an oven or in domestic appliances such as a refrigerator or in furniture such as a wardrobe, comprising French style doors positioned side-by-side.

[0002] Known oven doors are opened in up-down direction by being pivoted about the horizontal axis. The door of an oven is pulled outwards the body by being held from its upper portion, and is brought to the horizontal and fully open position by being pivoted about the hinges with horizontal rotational axis provided on its lower edge. When the kitchen environment where the oven is being used lacks sufficient space, the area occupied by the door in horizontal position may create a problem for the users. In such a case, a user has to stand at the side of the oven to access the cooking volume when the oven door is fully opened. In the state of the art, ovens have been provided to solve this problem, comprising French style doors opening and closing by being pivoted about the vertical axis. In such type of ovens, symmetrically configured doors are used positioned side-by-side on the left and right sides. When one of the two French style side-by-side doors is opened and closed by a user, the other door also opens and closes simultaneously. A user can thus open both doors of the oven by a single hand, and can place into the oven the tray with the food products to be cooked thereon. Said simultaneous motion of French style doors is realized by a linkage mechanism coupling two doors to each other. These advantages of the French style doors are accompanied with certain disadvantages. Such doors simultaneously closing by a linkage mechanism are unable to provide a complete sealing. Moreover, since a linkage mechanism consists of metal parts with rather high friction forces in between, a user has to apply a strong force to be able to open and close the doors and cannot control the motion of the doors sufficiently.

[0003] Patent applications no. US2007039605 (A1) and US2009145031 (A1) disclose door linkage systems used in ovens having French style doors.

[0004] Patent application no. US2010206289 (A1) discloses a locking system in an oven, used for doors moving interdependently by means of a linkage system.

[0005] The aim of the present invention is to realize a linkage mechanism suitable to be used particularly in an oven comprising French style side-by-side doors, enabling a user to open both doors by pulling a single door with little force and enabling the doors to be sealingly closed.

[0006] The linkage mechanism realized to achieve the aim of the present invention, is suitable to be used in ovens, domestic appliances such as refrigerators or furniture such as wardrobes comprising French style side-by-side doors, and is mounted on a horizontal axis on the upper wall or the lower wall of the body of the appliance/item on which it is used, and enables both doors to be opened and closed simultaneously by a user pulling or pushing only one of the doors. The linkage mechanism comprises two link arms connected to the doors, a carriage block to which the rear ends of the link arms are connected, and a rail on which the carriage block moves. The link arm connected to the door being opened or closed transmits its movement by means of the carriage block to the other link arm and therefore to the other door. The carriage block is supported by means of a linear slide bearing so as to be movable on the rail.

[0007] In an embodiment of the invention, the linear slide bearing is a bearing bushing made of a material with low friction coefficient such as plastic or bronze.

[0008] In another embodiment of the invention, the linkage mechanism comprises bulges provided proximate to the rear end and the front end of the rail, enabling the doors to be sealingly closed and to be halted when the doors are brought to approximately 90 degrees open position. In this embodiment, the carriage block is supported by two split bushing halves so as to be able to pass over the bulges on the rail. The busing halves mutually contact the rail surface by means of two compression springs.

[0009] The linkage mechanism realized to achieve the aims of the present invention is illustrated in the accompanying drawings, wherein:

[0010] Figure 1 is a perspective view of an oven and a linkage mechanism with

the doors in closed position.

[0011] Figure 2 is a perspective view of an oven and a linkage mechanism with the doors in open position.

[0012] Figure 3 is a schematic sectional view of the linear slide bearing consisting of the carriage block and the one-piece bearing bushing provided in the linkage mechanism.

[0013] Figure 4 is a schematic sectional view of the carriage block and the linear slide bearing consisting of two bushing halves provided in the linkage mechanism.

[0014] Figure 5 is a view from above of an oven and the linkage mechanism provided thereon with the doors in closed position.

[0015] Figure 6 is a view from above of the rail provided in the linkage mechanism.

[0016] Figure 7 is a view from above of an oven and the linkage mechanism provided thereon with the doors open 90 degrees.

[0017] The elements in the figures are numbered individually and the correspondence of these numbers are given hereinafter.

1. Linkage mechanism
2. Link arm
3. Rail
4. Carriage block
5. Linear slide bearing
6. Bearing bushing
7. First bulge
8. Second bulge
9. Bushing half
10. Compression spring
11. Body
12. Door
13. Hinge
14. Horizontal plane
15. Front mounting plate
16. Rear mounting plate

17. Oven

[0018] The linkage mechanism (1), is suitable to be used in ovens (17) comprising two side-by-side French style doors (12) connected to the front surfaces of the opposite left and right vertical edges of a body (11) so as to be pivotable about the vertical axis by means of hinges (13), and is mounted on a horizontal plane (14) on the upper or the lower wall of the body (11).

[0019] The linkage mechanism (1) enables both doors (12) to be opened and closed simultaneously by a user moving only one of the doors (12).

[0020] The linkage mechanism (1) of the invention comprises
- two link arms (2) symmetrically connected by their front ends to the doors (12) so as to be pivotable about the vertical axis, movable parallel to the horizontal plane (14), and extending from both doors (12) by converging to each other towards the rear edge of the horizontal plane (14),
- a linear motion guide rail (3) (hereinafter referred to as 'rail (3)' in short) fixed on the horizontal plane (14) in parallel to the horizontal plane (14) by means of a front mounting plate (15) and a rear mounting plate (16),
- a carriage block (4) to which the rear ends of the link arms (2) are connected so as to be pivotable about the vertical axis, moving on the rail (3) during opening and closing of the doors (12), and
- a linear slide bearing (5) provided in the carriage block (4), enabling the carriage block (4) to be movably supported on the rail (3).

[0021] The link arm (2) connected to the door (12) being opened or closed transmits its movement by means of the carriage block (4) to the other (second) link arm (2) and therefore to the other (second) door (12), thereby enabling both doors (12) to be opened or closed simultaneously. The linear slide bearing (5) significantly reduces the friction forces acting on the linkage mechanism (1). A user can open and close the doors (2) by utilizing very little force, thereby providing ease of use and silent operation.

[0022] In an embodiment of the invention, the linkage mechanism (1) comprises a linear slide bearing (5) consisting of a cylindrical rail (3) and a one-piece bearing bushing (6) of hollow cylindrical structure provided in the carriage block (4), made of a material with low friction coefficient, whose inner

surface contacts all around the rail (3), enabling the carriage block (4) to slide on the rail (3).

[0023] The bearing bushing (6) is preferably made of a plastic material, e.g. acetal (POM), Teflon (PTFE) or polyamide (PA), or may be made of bronze or a graphite added material with self-lubricating properties.

[0024] In an embodiment of the invention, the linkage mechanism (1) comprises a first bulge (7) provided at the rear portion of the rail (3), enabling temporarily stopping or "halting" the carriage block (4) and therefore the doors (12) connected to the link arms (2) when the doors (12) are being brought to the fully closed position and from the closed position to the open position.

[0025] In an embodiment of the invention, the linkage mechanism (1) comprises at least one second bulge (8) provided at the front portion of the rail (3), enabling temporarily stopping the carriage block (4) and therefore the doors (12) connected to the link arms (2) when the doors (12) are being brought to approximately 90 degrees opened position.

[0026] The first bulge (7) and the second bulge(s) (8) are formed on the cylindrical rail (3) by means of a production method such as forging.

[0027] In the two embodiments described above, the linkage mechanism (1) comprises a linear slide bearing (5) consisting of two split bushing halves (9), provided in the carriage block (4), enabling the carriage block (4) to be supported during its linear sliding motion on the rail (3) so as to be able to pass over the first bulge (7) and/or the second bulge (8), and contacting the opposite semi-cylindrical surfaces of the rail (3). The linkage mechanism (1) further comprises two compression springs (10) connected between the bushing halves (9) and the carriage block (4), enabling the bushing halves (9) to mutually apply pressure on the rail (3) surface with a determined force

[0028] On the portions of the rail (3) with larger diameter where the first bulge (7) and/or the second bulge (8) are disposed and the other portions of the rail (3) with nominal diameter, the compression springs (10) enable the carriage block (4) to be supported without gaps at all positions on the rail (3) and with a predetermined pressure force by pushing the bushing

halves (9) towards each other.

[0029] During closing of the doors (12), the carriage block (4) moves from front to back on the rail (3) and passes over the first bulge (7) reaching the bulge's inclined portion behind the bulge in the narrowing direction thanks to the linear slide bearing (5) having two bushing halves (9) and the compression springs (10). The inclination of the first bulge (7) in the narrowing direction towards the back, forces the carriage block (4) to move towards the back side. The first bulge (7) backs up the closing force applied by the user, enabling the doors (12) to be sealingly closed. When the doors (12) are being opened, the carriage block (4) moves from back to front on the rail (3), passing over the first bulge (7) from back to front. The narrowing portion in front of the first bulge (7) backs up the forwards motion of the carriage block (4). The user easily opens both doors (12) by applying a little force to a single door (12). When the doors (12) are brought to approximately 90 degrees opened position, the carriage block (4) is halted by the second bulge (8). When the doors (12) are being brought to the fully opened position, the halt enforced by the second bulge (8) at approximately 90 degrees opened position, allows the user to check whether there is a unsafe obstacle for the doors (12) to be opened more than 90 degrees. The user opens the doors (12) fully when he/she does not observe any obstacles.

[0030] In addition, the linkage mechanism (1) of the invention is suitable to be used in domestic appliances such as refrigerators and furniture such as wardrobes comprising two French style side-by-side doors (12).

Claims

1. A linkage mechanism (1) suitable to be used in ovens (17) comprising two side-by-side French style doors (12) connected to the front surfaces of opposite left and right vertical edges of a body (11) so as to be pivotable about the vertical axis by means of hinges (13), mounted on a horizontal plane (14) on the upper or the lower wall of the body (11), enabling both doors (12) to be opened and closed simultaneously by a user moving only one of the doors (12), **comprising**

   - two link arms (2) symmetrically connected by their front ends to the doors (12) so as to be pivotable about the vertical axis, movable parallel to the horizontal plane (14), and extending from both doors (12) by converging to each other towards the rear edge of the horizontal plane (14), **characterized by**
   - a rail (3) fixed on the horizontal plane (14) in parallel to the horizontal plane (14) by means of a front mounting plate (15) and a rear mounting plate (16),
   - a carriage block (4) to which the rear ends of the link arms (2) are connected, moving on the rail (3) during opening and closing of the doors (12), and by
   - a linear slide bearing (5) enabling the carriage block (4) to be movably supported on the rail (3).
2. A linkage mechanism (1) according to claim 1, **characterized by** the linear slide bearing (5) consisting of a cylindrical rail (3) and a one-piece bearing bushing (6) of hollow cylindrical structure provided in the carriage block (4), made of a material with low friction coefficient, whose inner surface contacts all around the rail (3).
3. A linkage mechanism (1) according to claim 2, **characterized by** a bearing bushing (6) made of plastic material.
4. A linkage mechanism (1) according to claim 1, **characterized by** a first bulge (7) provided at the rear portion of the rail (3), enabling the carriage block (4) to be temporarily stopped when the doors (12) are being brought to the fully closed position and from the closed position to the open position.
5. A linkage mechanism (1) according to claim 1, **characterized by** at least one second bulge (8) provided at the front portion of the rail (3), enabling the carriage block (4) to be temporarily stopped when the doors (12) are being brought to approximately 90 degrees opened position.

6. A linkage mechanism (1) according to claim 4 or 5, **characterized by** the linear slide bearing (5) consisting of two split bushing halves (9), provided in the carriage block (4), enabling the carriage block (4) to be supported on the rail (3) so as to be able to pass over the first bulge (7) and/or the second bulge (8), and contacting the opposite semi-cylindrical surfaces of the rail (3).
7. A linkage mechanism (1) according to claim 6, **characterized by** two compression springs (10) connected between the bushing halves (9) and the carriage block (4), enabling the bushing halves (9) to mutually apply pressure on the rail (3) surface with a determined force.
8. A refrigerator comprising two doors side-by-side, **characterized by** a linkage mechanism (1) according to claim 1.
9. A wardrobe comprising two doors side-by-side, **characterized by** a linkage mechanism (1) according to claim 1.

Figure 1

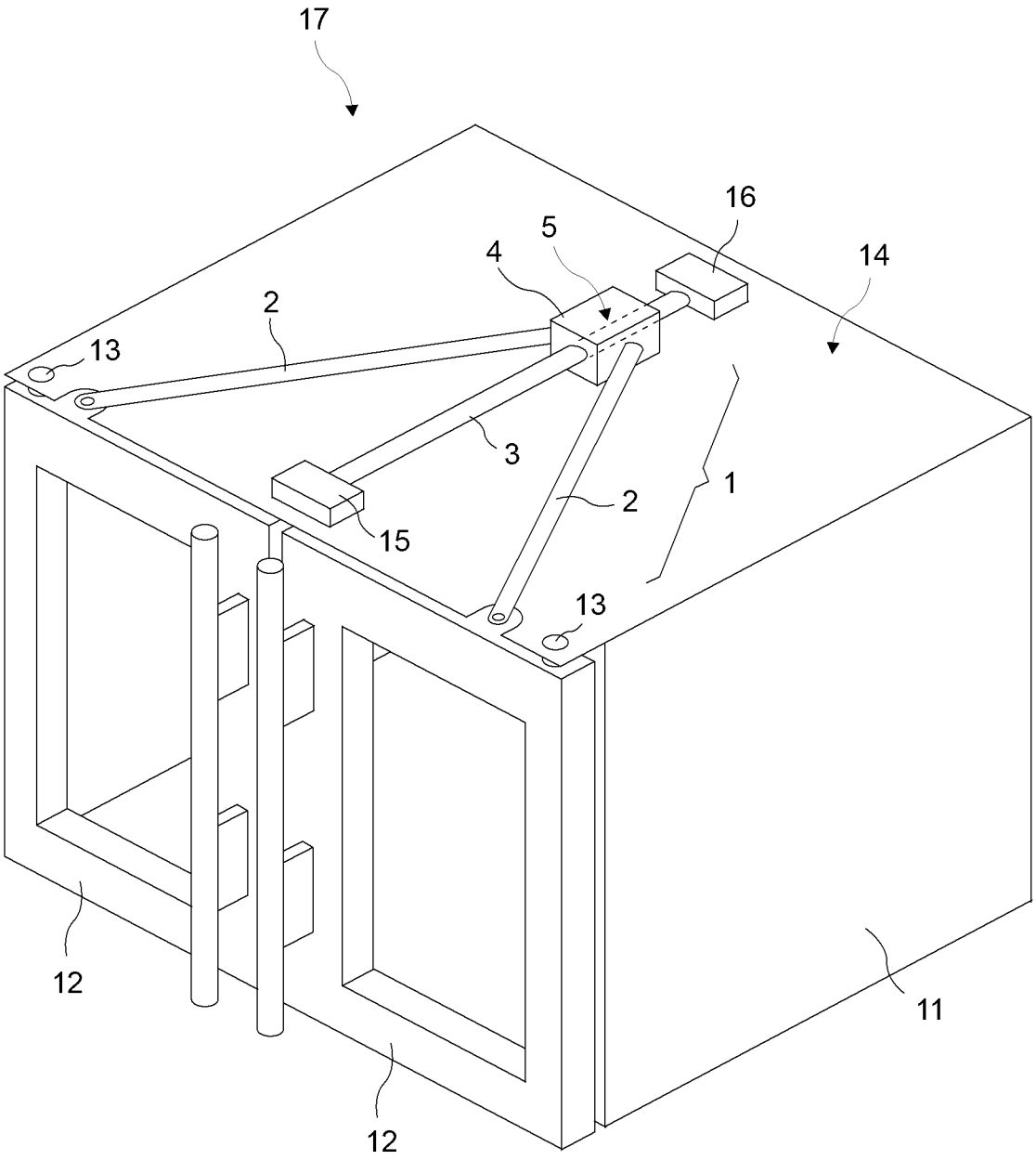


Figure 2

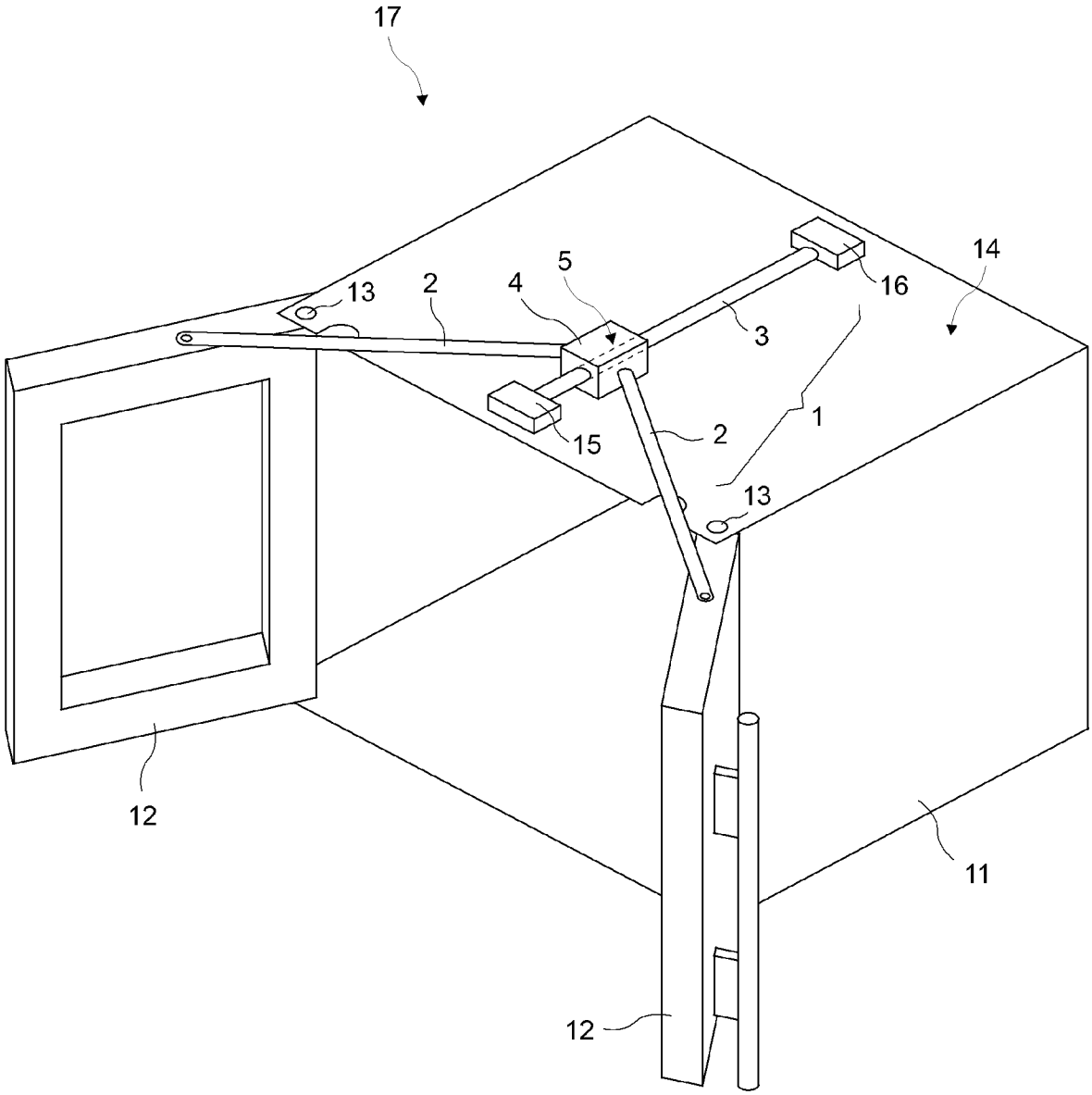


Figure 3

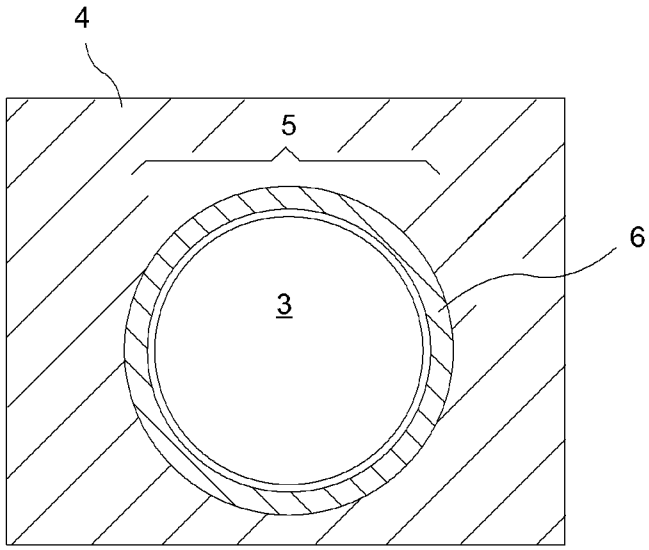


Figure 4

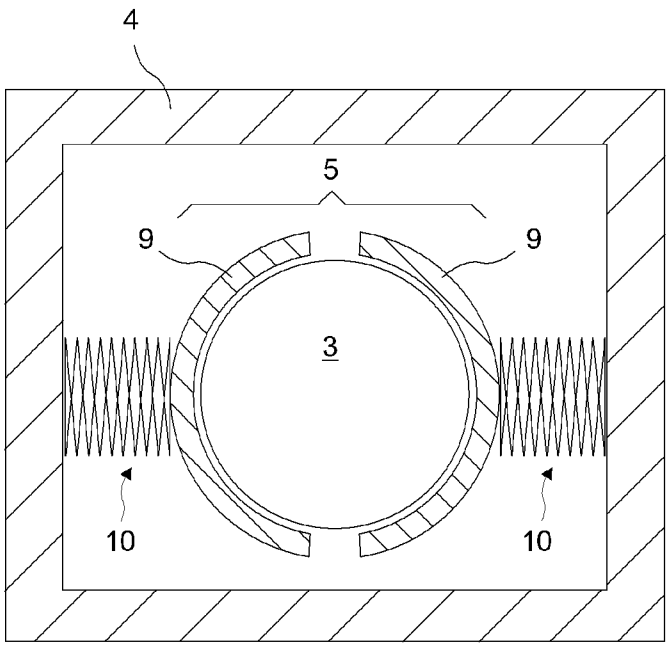


Figure 5

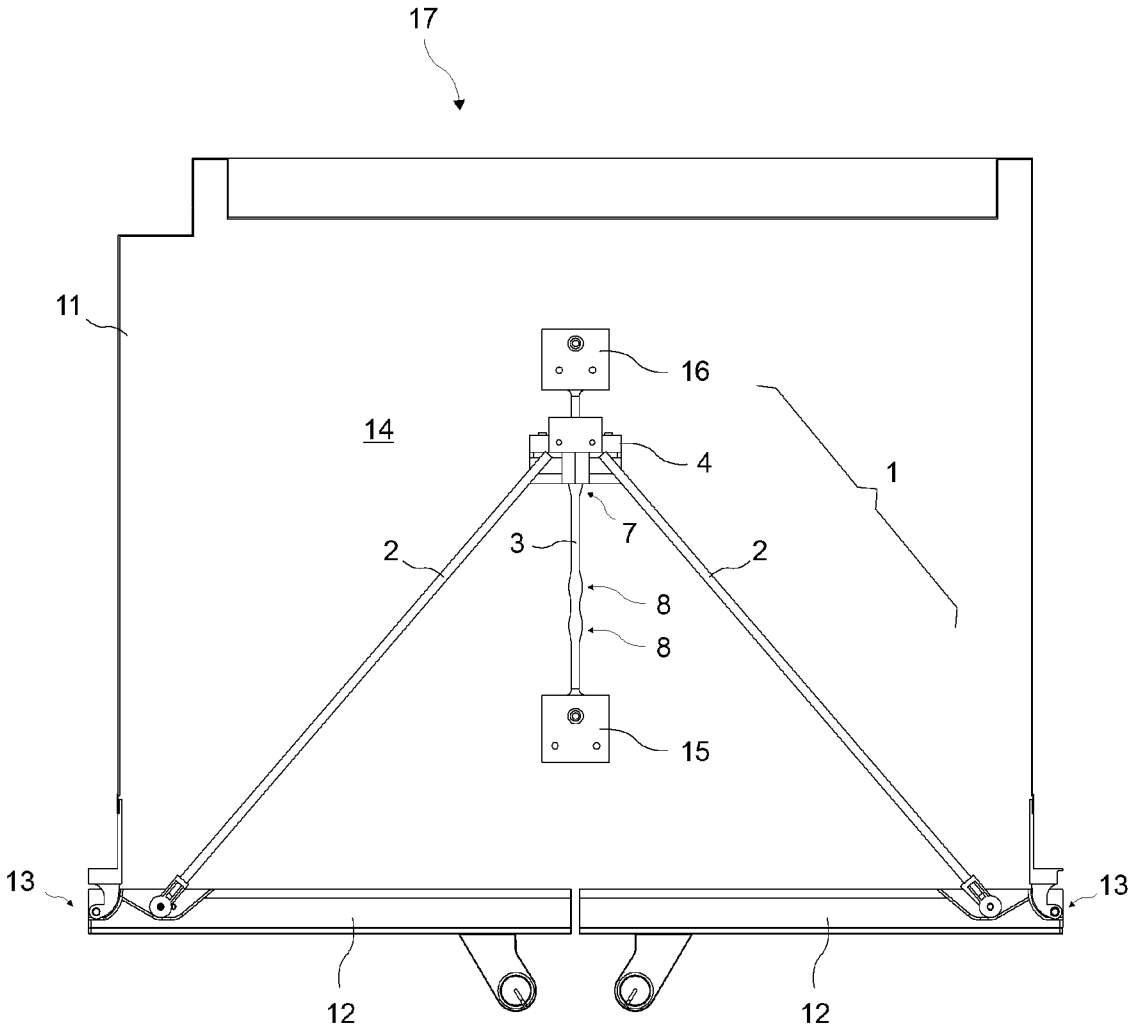


Figure 6

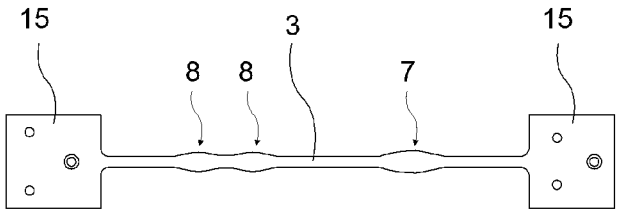
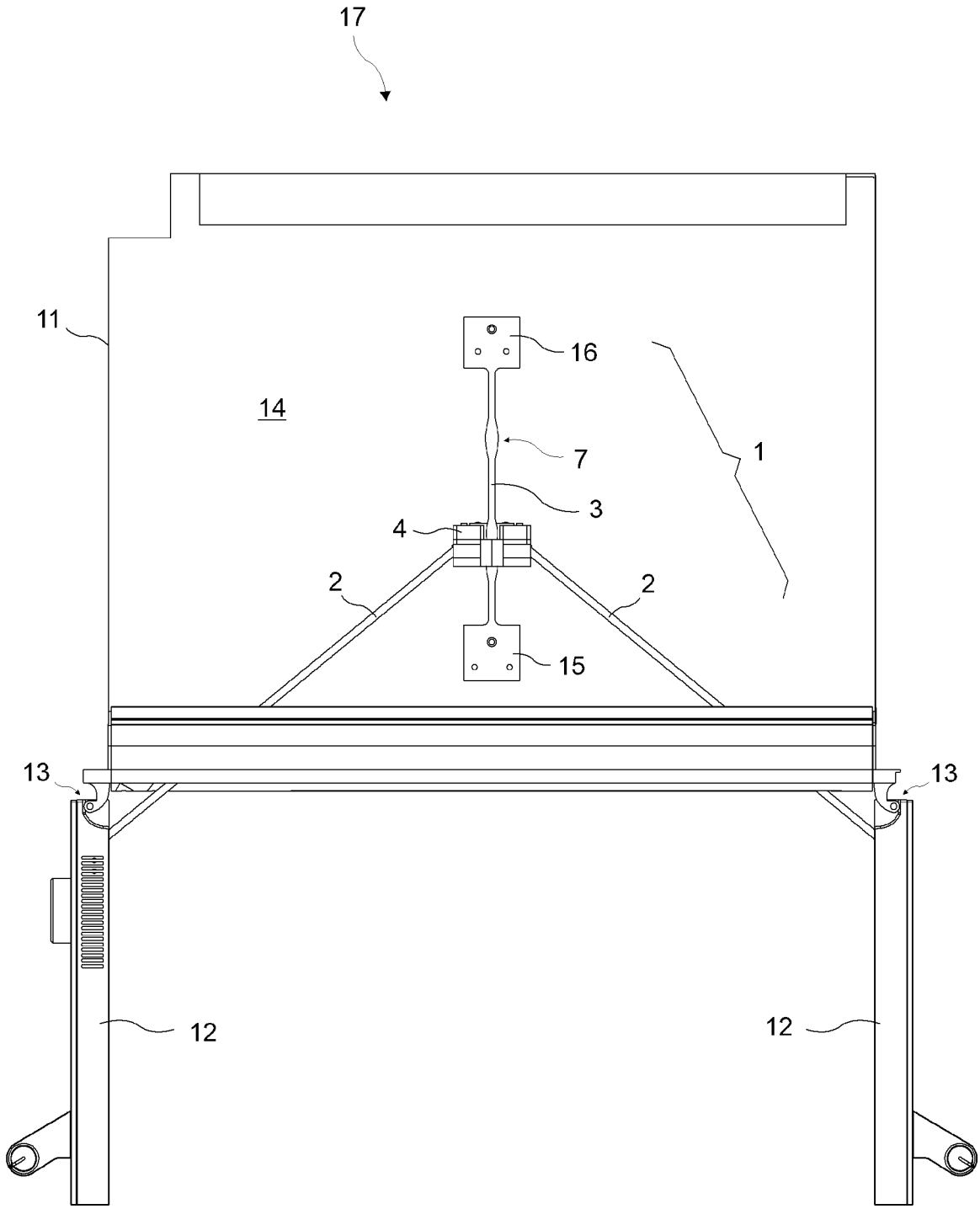


Figure 7



INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER
INV. F24C15/02
ADD. E05C17/28 E05F17/00

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)
F24C E05F E05C F25D

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.
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Y	figures 1,4-7 column 2, lines 36-55 column 4, lines 24-73	9

X	US 2 707 225 A (PEARCE GEORGE C) 26 April 1955 (1955-04-26) figures 1-4,7,8 column 1, lines 73-78 column 2, lines 48-55 column 3, lines 13-66	1-3

X	US 2 708 709 A (PEARCE GEORGE C) 17 May 1955 (1955-05-17) column 3, line 44 - column 4, line 22; figures 1-6 column 5, lines 15-31	1

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
7 May 2019	16/05/2019

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Fest, Gilles

1

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International application No
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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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