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(54) Bi-directional espagnolette gearbox and bi-directional espagnolette mechanism

(57) This invention relates to a bidirectional espagnolette gearbox (10) comprising a main gear (20). The main gear has gear teeth (26) in driving engagement with a first actuator (16), and a reverser gear (22) having gear teeth in driving engagement with a second actuator (18), rotation of the main gear (20) causing movement of the first actuator (16) and the second actuator (18) in opposite directions. The gear teeth (26) of the main gear (20) are in driving engagement with the gear teeth of the reverser gear (22). The invention also provides a bi-directional espagnolette mechanism comprising the gearbox and at least one locking member

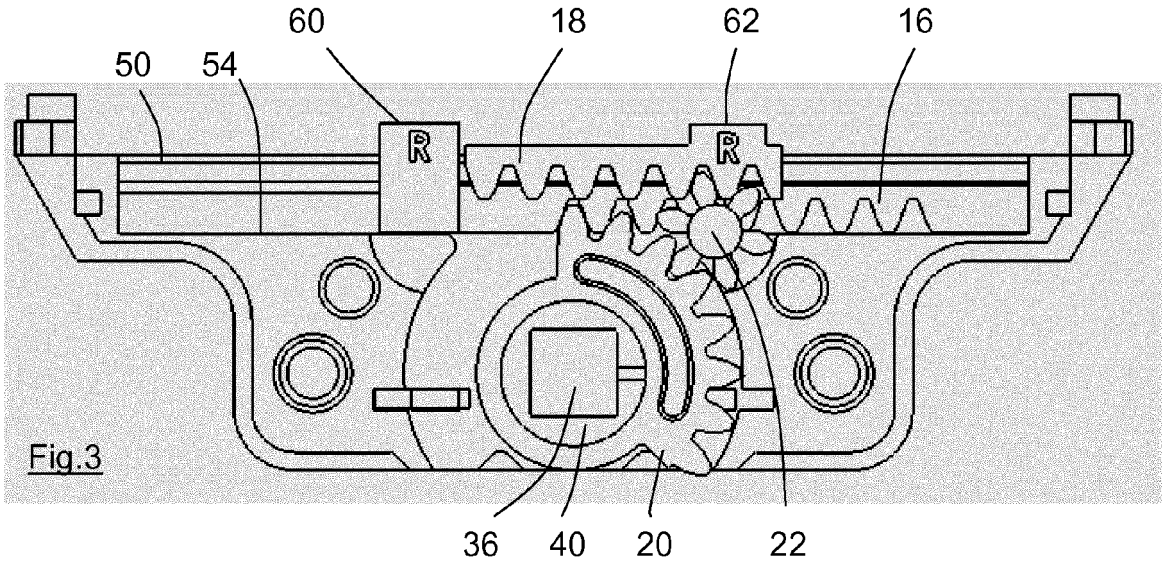

Fig.3

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Description

FIELD OF THE INVENTION

[0001] This invention relates to a bidirectional espagnolette gearbox and to a bi-directional espagnolette mechanism comprising the gearbox and at least one locking member.

BACKGROUND TO THE INVENTION

[0002] The following description and disclosure is for convenience directed to a bi-directional espagnolette gearbox designed to be fitted to a window, and in particular to a hinged window. It will, however, be understood that the invention could be used on other hinged panels such as doors, and on sliding panels such as patio windows or doors.

[0003] Also, in the following description the window is defined as being rectangular and having a hinged edge, a locking edge opposed to the hinged edge, and two connecting edges joining the hinged edge and the locking edge. (It is recognised that in some windows the hinges are in the form of friction stays which are mounted upon the connecting edges, but the above terminology will still be used for clarity.)

[0004] A hinged window is often locked or otherwise secured to the surrounding frame by a cockspur. The cockspur is typically carried by an operating handle which is pivotably mounted upon the locking edge of the window. When it is desired to lock the window the handle is pivoted so that the cockspur moves into engagement with a fixed keep located upon the frame.

[0005] A cockspur provides a single locking point for the window. Increased security can be provided by multi-point locking arrangements. In multi-point locking arrangements, the operating handle is connected to a plurality of locking members arranged along the locking edge, and pivoting movement of the operating handle causes each of the locking members to move into engagement with a respective keep located upon the window frame.

[0006] A cockspur is typically provided as an extension of the operating handle, so that the cockspur pivots with the operating handle between its locking and unlocking conditions. In many multi-point locking arrangements there is an indirect connection between the operating handle and the locking members. A known connection is by way of an espagnolette mechanism comprising a gearbox and at least one locking bar. The operating handle is connected to the gearbox, and pivoting movement of the operating handle is converted by the gearbox into linear movement of the locking bar(s), the locking bar(s) carrying the locking members. The linear movement of the locking members enables greater security than the pivoting movement of a cockspur, further enhancing the security offered by the multi-point locking.

[0007] If the window is made of aluminium or plastics it will typically incorporate extruded lengths of largely-hollow profile, and some or all of the lock componentry can be located within the profile and so be substantially hidden from view. Plastics windows in particular will typically have a profile which is unique to a particular manufacturer, but will include a "Euro-groove" as part of the profile. The Euro-groove has standard dimensions, so that the manufacturers of espagnolette mechanisms and other locking mechanisms can make their componentry compatible with the Euro-groove and thereby ensure that their componentry can be fitted to the windows and doors of many manufacturers.

DESCRIPTION OF THE PRIOR ART

[0008] Many different espagnolette mechanisms are known. The locking members are typically mushroom-headed bolts. An early multi-point locking arrangement of this type is described in GB 2 072 740 by GKN Crompton Limited.

[0009] In the GKN design, and many similar designs, the mushroom-headed bolts typically locate into one of a pair of channels of the keep, one channel of each pair defining a fully closed position of the window, the other channel a slightly-open or "night vent" position. The GKN design also shows a keep with two pairs of channels, so that a single design of keep can be used regardless of the direction of movement of the locking bar towards its locked condition.

[0010] In the GKN design the gearbox drives a single locking bar in a first direction to lock the window, and in the opposite direction to unlock the window. Bi-directional espagnolette gearboxes are also known in which the gearbox drives two locking bars in opposite directions. Bi-directional espagnolette gearboxes have the significant advantage that the locking bars can carry shoot bolts which project into respective keeps in the connecting edges of the window, so that locking is not restricted to the locking edge. This increases the security of the window in the locked condition. A bi-directional espagnolette gearbox is disclosed in GB 2 257 745.

[0011] GB 2 257 745 discloses a gearbox arrangement which is common to most bi-directional espagnolette mechanisms. The drive shaft which is connected to the operating handle engages a main gear, the gear being drivingly connected to a first actuator in the form of a rack. A separate (reverser) gear is provided which engages the first actuator and also engages a second actuator, also in the form of a rack. Pivoting movement of the operating handle is converted by the main gear into linear movement of the first actuator in a first direction, and the movement of the first actuator the first direction causes the reverser gear to rotate and drive the second actuator in the opposite direction. The first and second actuators are designed to be connected to respective locking bars whereby the gearbox can drive the locking bars (and the locking members carried thereby) to move in opposing directions.

[0012] Such an arrangement typically requires the second actuator to lie underneath the first actuator (i.e. the first actuator lies between the second actuator and the main gear). It is therefore not possible to mount a locking bar or locking member to each of the actuators within the region of the gearbox, and the locking members must be located upon locking bars beyond the limits (ends) of the gearbox.

SUMMARY OF THE INVENTION

[0013] The inventors have sought to provide a bi-directional espagnolette gearbox of reduced size and complexity. In the bi-directional espagnolette mechanism one or more locking members is fitted to the gearbox, either directly or indirectly by way of a locking bar. The invention enables the locking member(s) to be located within the region of the gearbox, and in particular between the ends of the gearbox. The provision in particular of oppositely moving locking members in the region of the gearbox is particularly advantageous, and enables the use of a single keep adjacent to the gearbox, in place of two keeps located away from the gearbox.

[0014] According to the invention there is provided a bi-directional espagnolette gearbox comprising a main gear having an opening to receive the drive shaft of an operating handle, the main gear having gear teeth in driving engagement with a first actuator, a reverser gear having gear teeth in driving engagement with a second actuator, rotation of the main gear causing movement of the first actuator and the second actuator in opposite directions, characterised in that the gear teeth of the main gear are in driving engagement with the gear teeth of the reverser gear.

[0015] In the present invention therefore, the main gear drives the first actuator directly, and also drives the reverser gear directly. The second actuator is therefore driven (indirectly) by the main gear regardless of the movement of the first actuator.

[0016] In order to prevent the main gear engaging the second actuator the gear teeth of the second actuator are spaced away from the main gear, the distance between the main gear and the gear teeth of the second actuator being spanned by the reverser gear.

[0017] Preferably, the first actuator lies alongside the second actuator adjacent to the main gear. Preferably also, a locking member is mounted to each of the first actuator and the second actuator in the region of the gearbox. This permits a single keep to be mounted to the frame for engagement by the respective (oppositely moving) locking members. The locking member may be directly connected to its actuator, or it may be indirectly connected thereto by way of a locking bar.

[0018] There is also provided a bi-directional espagnolette mechanism comprising a bi-directional espagnolette gearbox as herein defined, and at least one locking member connected to the first actuator. Preferably there is also at least one locking member connected to the second actuator. Desirably, the respective locking member(s) is/are connected to the first actuator indirectly by way of a first locking bar. Desirably also, the respective locking member(s) is/are connected to the second actuator indirectly by way of a second locking bar.

[0019] Desirably, the main gear and the reverser gear are located within a gearbox housing. Preferably, the gearbox housing is offset from the centre-line of the locking member(s) (and locking bar(s) if present). This can permit the gearbox to be mounted upon window profiles which have a Euro-groove, and also to window profiles which do not have a Euro-groove. Typically, window profiles of plastics will have a Euro-groove, whereas many aluminium window profiles do not have a Euro-groove. The present gearbox can be designed to fit many aluminium window profiles without a Euro-groove, and yet can be fitted into a Euro-groove with the addition of a suitable packer.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] The invention will now be described in more detail, by way of example, with reference to the accompanying drawings, in which:

Fig.1 shows an exploded view of the bi-directional espagnolette gearbox according to the present invention;

Fig.2 shows a side view of the gearbox containing the first and second actuators, prior to fitment of the reverser gear and the main gear;

Fig.3 shows a view similar to that of Fig.2, but with the reverser gear and main gear fitted;

Fig.4 shows an end view of the assembled bi-directional espagnolette mechanism; and

Fig.5 shows an end view of the mechanism with a packer.

DETAILED DESCRIPTION

[0021] The bi-directional espagnolette gearbox 10 is shown in exploded view in Fig.1. The gearbox 10 comprises a housing 66 (see Fig.4) formed from a first housing part 12 and a second housing part 14. Within the housing 66 are located a first actuator 16, a second actuator 18, a main gear 20 and a reverser gear 22.

[0022] In this embodiment the first and second actuators 16, 18 comprise racks having gear teeth adapted to cooperate with the gear teeth of the main gear 20 and the reverser gear 22 as explained below.

[0023] Also in this embodiment the first housing part 12 is a cast or pressed component which includes pockets or depressions for location of the actuators 16, 18

and gears 20, 22, with the housing part 14 being a substantially flat cover plate which serves to secure the components in position. It will be understood that in other embodiments the second housing part could include pockets or depressions to locate some of the internal components.

[0024] The housing part 12 has a pocket 24 which is designed to locate the main gear 20. It will be observed that only slightly more than one quarter of the periphery of the main gear 20 carries gear teeth 26. Such a small proportion of the main gear is sufficient, however, since it is arranged that the range of pivoting movement of the operating handle (not shown) between the locked and unlocked conditions of the espagnolette mechanism is approximately 90° (in common with many prior art espagnolette mechanisms).

[0025] The region of the main gear 20 which does not have gear teeth is formed as a part-circular wall 30 which in the assembled condition of Fig.3 engages the (similarly part-circular) wall 32 of the pocket 24. The gear teeth 26 move within the region 34 of the pocket 24 as the operating handle is pivoted in use.

[0026] In common with other espagnolette gearboxes, the main gear 20 has a square opening or through-hole 36 which is sized to receive the square drive shaft (not shown) carried by the operating handle. A raised circular boss 40 surrounds the through-hole 36, the circular boss being located within the circular hole 42 in the housing part 14 in the assembled gearbox. It will be understood that the rear side of the main gear 20 which is not visible in Fig.1 has a similar circular boss which lies within the circular hole 44 in the first housing part 12.

[0027] In the assembled gearbox therefore, the main gear 20 engages the circular holes 42, 44 and the part-circular wall 32, the circular holes and part-circular wall allowing the main gear 20 to rotate through approximately 90° whilst preventing significant lateral movement.

[0028] The housing part 12 has a second ledge 50 which runs substantially the full length of the first housing part 12. The second actuator 18 is of right-angled form, with a flange 52 which rests upon the second ledge 50, the second actuator being substantially free to slide along the second ledge 50.

[0029] The housing part 12 has a first ledge 54. The first actuator 16 lies upon the first ledge 54 and is substantially free to slide along the first ledge 54. It will be seen that the first ledge 54 is in two parts, the two parts being separated by a gap due to the pocket 24. The first actuator is long enough to span the gap and is supported by the two parts of the first ledge 54.

[0030] The first ledge 54 is positioned closer to the main gear 20 than is the second ledge 50. As shown in Fig.3 this means that in the assembled gearbox the gear teeth 26 of the main gear can engage the gear teeth of the first actuator 16, but do not engage the gear teeth of the second actuator 18. Alternatively stated, notwithstanding that the gear teeth of the second actuator 18 span the main gear 20 (and move past the main gear 20 during movement of the second actuator), they are spaced from the rotational axis A of the main gear 20 by a distance greater than the radius R of the peripheral tips of the gear teeth 26.

[0031] The reverser gear 22 lies within a part-circular pocket 56 of the housing part 12, the reverser gear being substantially free to rotate within the pocket 56. The pocket 56 intersects the pocket 24, such that the gear teeth 26 of the main gear 20 engage the gear teeth of the reverser gear 22. The reverser gear 22 lies alongside the first actuator 16 (it is behind the first actuator in the view of Fig.3). Importantly, the teeth of the reverser gear 22 engage the gear teeth of the second actuator 18 but do not engage the gear teeth of the first actuator 16.

[0032] It will be understood that the main gear 20 is rotated through approximately 90° by the operating handle between its unlocking and locking conditions. If the main gear 20 is rotated counter-clockwise from the position shown in Fig.3, the first actuator 16 is directly driven to move towards the left as drawn. The reverser gear 20 is driven to rotate clockwise within its pocket 56, whereby the second actuator 18 is driven to move towards the right as drawn. Bi-directional movement of the actuators 16, 18 is therefore achieved by way of a gearbox of relatively small size, and in particular relatively short length (where "length" is measured along the Z-axis of Fig.1, i.e. in the direction of movement of the actuators 16, 18).

[0033] It is a particular advantage of the gearbox 10 that the first actuator 16 and the second actuator 18 lie alongside one another, i.e. the second actuator 18 is behind the first actuator 16 in the orientation of Figs. 2 and 3. This is achieved by having a first planar region in which the gear teeth of the main gear 20 and the first actuator 16 engage, and a second planar region in which the gear teeth of the reverser gear 22 and the second actuator 18 engage, the first planar region lying alongside the second planar region (it is not appropriate to refer to the gear-engagement regions as "planes" directly, since they have some thickness). The gear teeth of the main gear 20 are therefore wider (i.e. of larger dimension in the direction Y) than the gear teeth of the reverser gear 22 and the actuators 16, 18, so that the main gear 20 spans both of the gear-engagement planar regions.

[0034] Alternatively stated, when viewed along the Z-axis of Fig.1, the gear teeth of the main gear 20 engage the gear teeth of the first actuator 16 within a first volume, and the gear teeth of the reverser gear 22 engage the gear teeth of the second actuator 18 within a second volume. The first volume and the second volume are spaced apart in the direction of the X-axis and also in the direction of the Y-axis.

[0035] Arranging the first and second actuators 16, 18 alongside one another enables each of the actuators to carry a respective lug 60, 62, the lugs 60, 62 moving in opposing directions. It will be understood that in an espagnolette locking mechanism according to the present invention, one or both of the lugs 60, 62 can carry a locking member such as the locking member 64 shown in

Figs. 4 and 5.

[0036] Whilst a single locking member could be provided upon only one of the lugs 60, 62, the main benefit of the invention lies in providing oppositely-moveable locking members in the region of the gearbox, and specifically oppositely-movable locking members between the ends of the gearbox housing. In one practical embodiment a respective locking member is mounted directly to each of the lugs 60, 62.

[0037] Significantly, a single keep can be provided with respective channels to accommodate the two locking members secured to the lugs 60, 62. It can be arranged that the lugs 60, 62 move towards one another to their locking positions, or move apart from one another to their locking positions, as desired. The latter arrangement will be utilised if the espagnolette locking mechanism has shoot bolts which can be driven into keeps along the connecting edge of the window.

[0038] Whilst a locking mechanism with just two oppositely-movable locking members in the region of the gearbox would be significantly more secure than a conventional cockspur, the locking mechanism will ideally utilise locking bars extending along the locking edge of the window as in a conventional multi-point locking arrangement. One locking bar could be secured to the lug 60 and another locking bar could be secured to the lug 62, a chosen number of locking members being mounted upon each of the locking bars.

[0039] Rather than connecting the locking bars to the lugs 60, 62, in other embodiments the actuators 16, 18 could themselves be extended to project beyond the gearbox 10 and carry the locking members. However, it is preferred to provide the lugs 60, 62 to which separate locking bars can be connected so as to allow the gearbox 10 to be used with a variety of locking bars, i.e. the installer can choose the particular style and length of the locking bars to suit the particular window. The espagnolette locking mechanism can also include a face plate which overlies the locking bars and allows the locking bars to be movably mounted to a window, in known fashion.

[0040] Figs. 4 and 5 show end views of a bi-directional espagnolette mechanism comprising the gearbox 10, a locking bar 70 and a locking member 64. It will be understood that the locking bar 70 is connected by a suitable fastening to the lug 62 and a separate locking bar (not seen) is connected by a suitable fastening to the lug 60. Whilst only one locking member 64 is seen, it will also be understood that a chosen number of locking members are mounted to the locking bars, but only one is visible in these end views.

[0041] It will be seen that the housing 66 (comprising the assembled housing parts 12, 14) has a width w which is significantly less than the width W of the locking bar 70. Also, the assembled housing 66 is offset from the centre-line of the locking bar 70 and locking members 64. The offset feature, in the configuration of Fig.4, makes the gearbox 10 suitable for use on windows (for example aluminium windows) which do not have a Euro-groove.

[0042] If it is desired to use the gearbox 10 on a plastic window, or any window with a Euro-groove, a packer 68 is used alongside the housing 66, the housing 66 and packer 68 together occupying the full width of the Euro-groove. The provision of the packer 68 enables the gearbox 10 to be securely mounted within the Euro-groove, in known fashion.

[0043] The same gearbox 10 can therefore be used for window profiles both with and without a Euro-groove, reducing the complexity of the manufacturing procedure, and reducing the requirement to stock different variants of the gearbox.

Claims

1. A bi-directional espagnolette gearbox (10) comprising a main gear (20) having an opening (36) to receive the drive shaft of an operating handle, the main gear having gear teeth (26) in driving engagement with a first actuator (16), a reverser gear (22) having gear teeth in driving engagement with a second actuator (18), rotation of the main gear (20) causing movement of the first actuator (16) and the second actuator (18) in opposite directions, **characterised in that** the gear teeth (26) of the main gear (20) are in driving engagement with the gear teeth of the reverser gear (22).

2. A bi-directional espagnolette gearbox (10) according to claim 1 in which the gear teeth of the second actuator (18) are spaced away from the main gear (20).

3. A bi-directional espagnolette gearbox (10) according to claim 2 in which the distance between the gear teeth (26) of the main gear (20) and the gear teeth of the second actuator (18) is spanned by the reverser gear (22).

4. A bi-directional espagnolette gearbox (10) according to any one of claims 1-3 in which the first actuator (16) lies alongside the second actuator (18) adjacent to the main gear (20).

5. A bi-directional espagnolette gearbox (10) according to any one of claims 1-4 in which the main gear has a rotational axis (A), in which the gear teeth of the second actuator (18) span the rotational axis (A), in which the peripheral tips of the gear teeth (26) of the main gear (20) lie at a radial distance (R) from the rotational axis (A), and in which the gear teeth of the second actuator lie farther from the axis (A) than the radial distance (R).

6. A bi-directional espagnolette gearbox (10) according to any one of claims 1-5 in which each of the gear teeth (26) of the main gear has a first region and a

second region, the first and second regions being separated across the width of the gear teeth (26), in which the first region of the gear teeth (26) engage the first actuator (16), and in which the second region of the gear teeth engage the reverser gear (22).

7. A bi-directional espagnolette gearbox (10) according to any one of claims 1-6 in which the first actuator (16) is movable along a first ledge (54), and in which the second actuator (18) is movable along a second ledge (50), the first ledge (54) being closer to the rotational axis (A) of the main gear than the second ledge (50).

8. A bi-directional espagnolette gearbox (10) according to claim 7 in which the first ledge (54) and the second ledge (50) are spaced apart in the direction along the rotational axis (A) of the main gear (20).

9. A bi-directional espagnolette gearbox (10) according to claim 7 or claim 8 in which the first ledge (50) is in two parts, the parts being separated by a gap, and in which the first actuator (16) spans the gap.

10. A bi-directional espagnolette mechanism comprising a bi-directional espagnolette gearbox (10) according to any one of claims 1-9 and at least one locking member (64) connected to the first actuator (16).

11. A bi-directional espagnolette mechanism according to claim 10 in which there is at least one further locking member (64) connected to the second actuator (18).

12. A bi-directional espagnolette mechanism according to claim 10 or claim 11 in which the at least one locking member is connected to the first actuator indirectly by way of a first locking bar (70).

13. A bi-directional espagnolette mechanism according to claim 11 in which the at least one further locking member is connected to the second actuator indirectly by way of a second locking bar (70).

14. A bi-directional espagnolette mechanism according to any one of claims 10-13 in which the main gear (20) and the reverser gear (22) are located within a gearbox housing (66), and in which the gearbox housing is offset from the centre-line of the at least one locking member (64).

15. A bi-directional espagnolette mechanism according to claim 14 having a packer (68) adjacent to the housing (66).

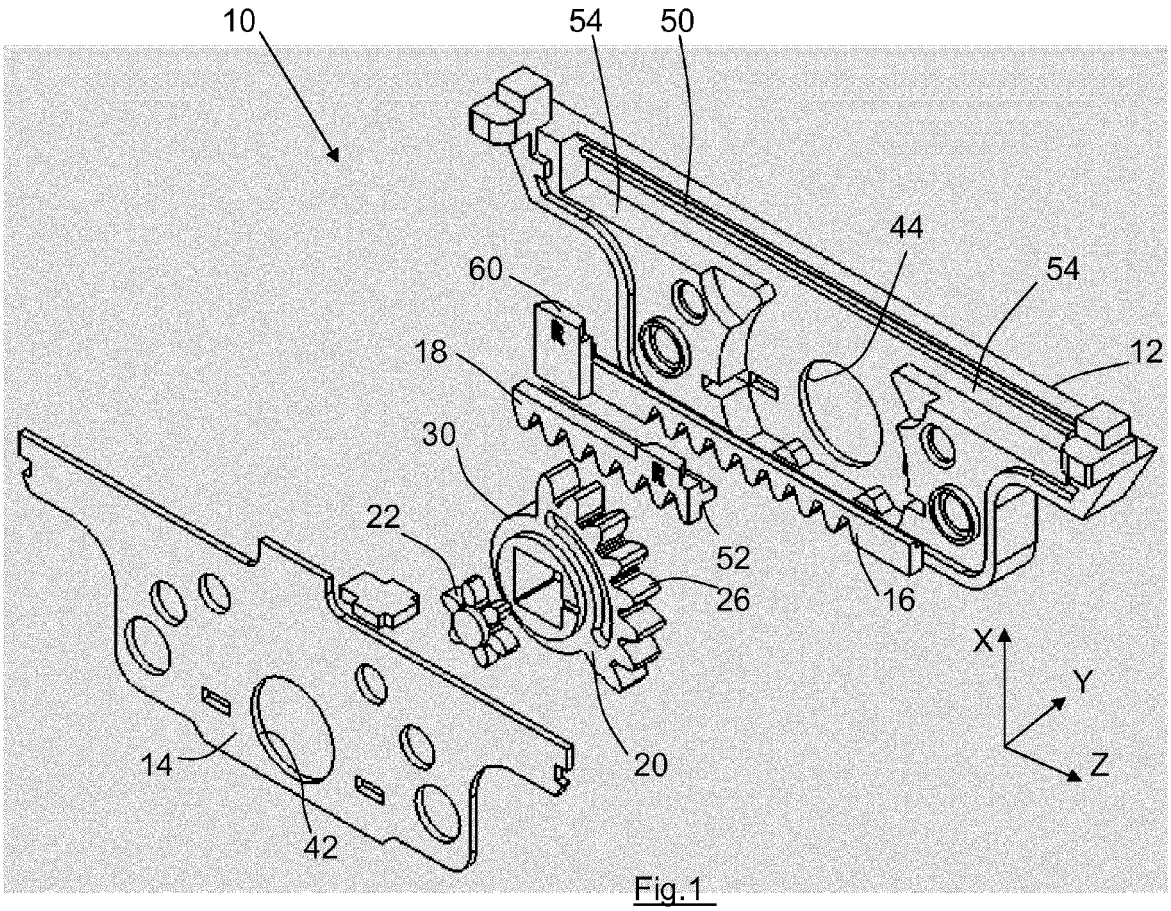
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Fig.1

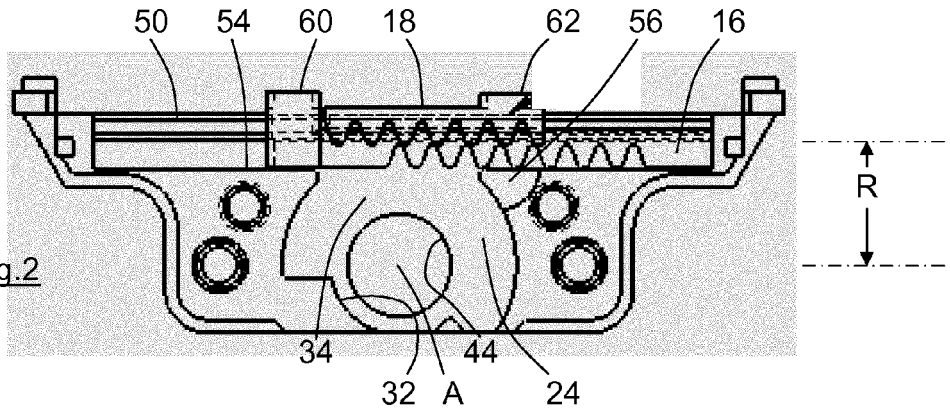
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Fig.2

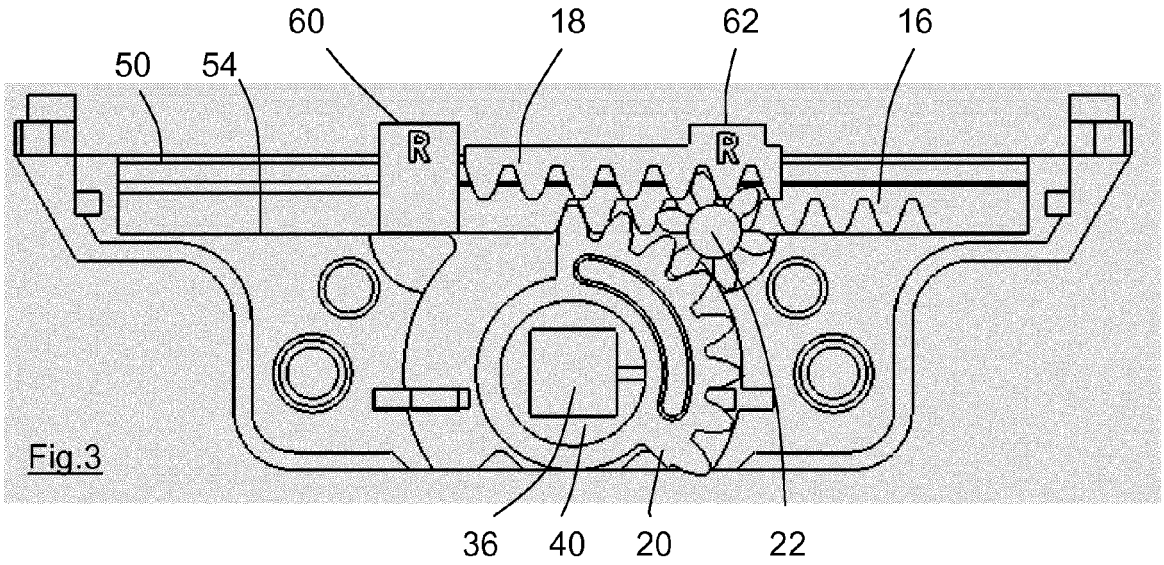

Fig.3

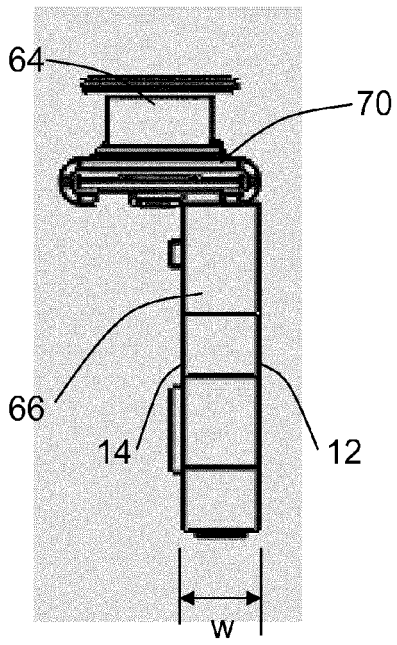

Fig.4

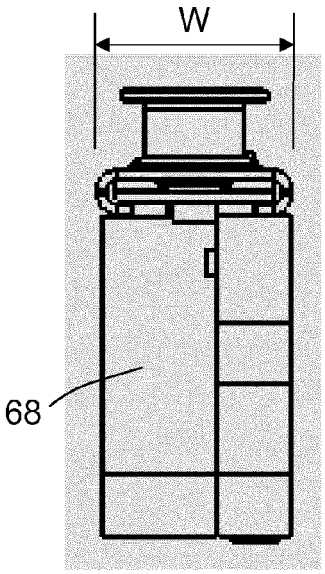

Fig.5

REFERENCES CITED IN THE DESCRIPTION

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