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(54) **Sectional overhead door arrangement**

(57) A sectional overhead door arrangement for closing a doorway (2) of the kind comprising a drive shaft (19) rotatably mounted in bearings (20) on at least two bearing plates (21) which directly or indirectly are attached to areas at the doorway (2), drive means for during operation rotating the shaft (19), two cable drums (22) secured at a distance from each other on the shaft (19), and two traction cables (23) each attached to a lower part of a door leaf (4) of the door arrangement (1) and to each their cable drum (22). The drive shaft (19) is mounted axially slidable in the bearings (20), and the two cables (23) are wound around their cable drum (22) in the same direction. The door arrangement has a simple, inexpensive and compact structure and is easy to mount and adjust on site.

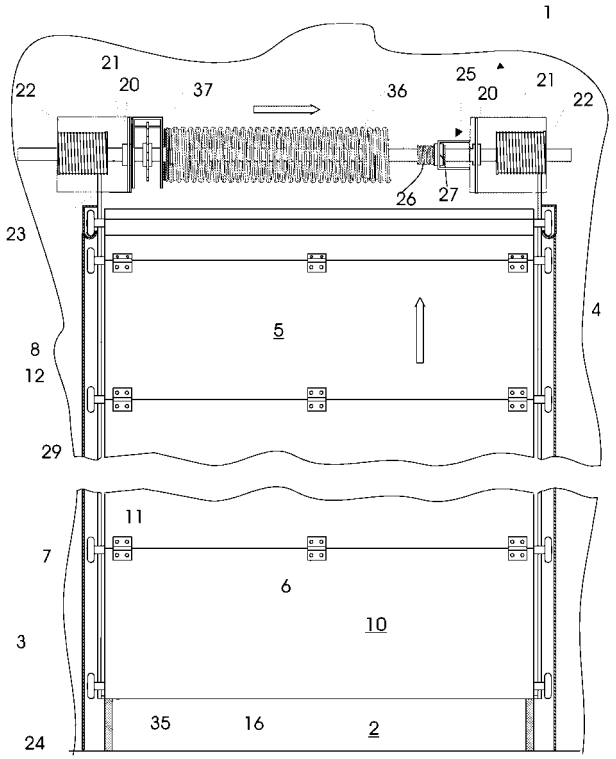

Fig. 1

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Description

[0001] The present invention relates to a sectional overhead door arrangement for closing a doorway and of the kind which comprises a drive shaft rotatably mounted in bearings on at least two bearing plates which directly or indirectly are attached to areas at the doorway, drive means for rotating the shaft during operation, two cable drums secured at a distance from each other on the shaft, and two traction cables each attached to a lower part of a door leaf of the door arrangement and to each their respective cable drum too.

[0002] Sectional overhead door arrangements have been commonly used for many years for closing doorways ranging from larger openings in for example hangars to smaller doorways in for example garages.

[0003] The subdividing of the door leaf in sections which are interconnected with hinges makes the door leaf flexible so it can be moved in a curve between a vertical position in which the door leaf serves to close the doorway and a horizontal or inclined position in which the door leaf does not constitute an obstacle to the traffic through the doorway.

[0004] Lifting and lowering of the door leaf takes place by means of traction cables attached to the bottom of the door leaf and to cable drums arranged for storing the cables. The cable drums are normally placed proximate the end of a drive shaft which, during operation, is rotated by a motor or by manual power.

[0005] The drive shaft is rotatably mounted in stationary bearings and axially kept in a stationary position.

[0006] The cables are wound around the outside of each their respective cable drum. This implies that the position on the drum, where the cable is entering or leaving the drum, is displaced in axial direction on the drums during lifting or lowering of the door leaf since the axial position of the shaft and thereby of the drums is stationary.

[0007] As can be appreciated, lifting of the door leaf therefore causes the cables to pass in front of the door leaf with the risk of the cables being caught or hanged up on the door leaf.

[0008] The door leaf is, when being moved between its closed and open positions, guided by a number of guide rollers which are mounted directly or indirectly on each lateral edge of the door leaf and are running in two guide rails placed at said lateral edges.

[0009] Each guide rail has an upwardly directed part, a horizontally or inclined directed part and a curved part extending between said two parts. In order to reduce the above mentioned risk of the cables being caught or hanged up on the door during operation, the upwardly directed part of the guide rails is arranged in such way that it forms an angle with a plane parallel with the doorway. This arrangement is however relatively expensive to mount and adjust.

[0010] Each of the drums is usually provided with helical grooves for guiding the associated cable on and off of the drum and preventing the coils from rubbing against each other or coiling on top of each other.

[0011] The cables do, as can be appreciated, not extend vertically from the bottom of the door leaf to the drums. They are on the contrary forming an angle with a vertical plane perpendicular to the doorway whereby each cable is loading the groove with an axially directed force at least at the position where the cables are entering or leaving the drums.

[0012] Said axial force causes attrition of the cables and drums and the risk of the cables dislodging from their original position in the grooves so that the door no more is able to function correctly when lifting and lowering the door leaf.

[0013] One of the drums is equipped with a left-handed helical groove while the other one is equipped with a right-handed helical groove whereby said axial forces are acting also on the connections between the cables and the shaft.

[0014] The cables are, as mentioned above, passing in front of the door leaf when being wound up on the drums. This results in the cables also needing to be attached at front of the door leaf whereby the door leaf is acted upon by an unfavourably large bending moment which tends to turn the sections in the opposite direction of the curve which the door leaf traverses during opening and closing of the door.

[0015] The drawbacks of the prior art sectional overhead door arrangements are remedied according to the present invention in which a first aspect is to provide a sectional overhead door arrangement of the kind mentioned in the opening paragraph that has a simple and inexpensive structure.

[0016] A second aspect of the present invention is to provide a sectional overhead door arrangement of the kind mentioned in the opening paragraph that has a compact structure.

[0017] A third aspect of the present invention is to provide a sectional overhead door arrangement of the kind mentioned in the opening paragraph that is easy to mount and adjust on site.

[0018] A fourth aspect of the present invention is to provide a sectional overhead door arrangement of the kind mentioned in the opening paragraph where the wear of the cable drums and cables is less than hitherto known.

[0019] A fifth aspect of the present invention is to provide a sectional overhead door arrangement of the kind mentioned in the opening paragraph where the risk of the cables being caught or hanged up on the door leaf is eliminated.

[0020] A sixth aspect of the present invention is to provide a sectional overhead door arrangement of the kind mentioned in the opening paragraph where the risk of the cables being completely or partly dislodged from the cable drums is eliminated.

[0021] A seventh aspect of the present invention is to provide a sectional overhead door arrangement of the kind mentioned in the opening paragraph where the con-

nections between the drums and the shaft are kept clear of axial loadings during operation of the door.

[0022] An eight aspect of the present invention is to provide a sectional overhead door arrangement of the kind mentioned in the opening paragraph where the cables, during operation of the door, are acting on the door leaf with a bending moment which is zero or relatively small.

[0023] The novel and unique features whereby this is achieved are the fact that the shaft is mounted axially slidable in the bearings, and that the two cables are wound around their cable drums in the same direction whereby it is advantageously obtained that the stretch of each cable extending between the door leaf and the associated drum is at least approximately able to maintain its position in a vertical plane perpendicular to the doorway while lifting or lowering the door leaf.

[0024] This implies that the cables can now be placed alongside the lateral edges of the door leaf instead of, as conventional, on the front of the door leaf so that the door can be designed with a simple and inexpensive structure where the wear on the cables and the drums at the same time is reduced and the risk of the cables engaging the outside of the door leaf is eliminated.

[0025] In order to secure a fixed position of each cable along the lateral edges of the door leaf, the drive shaft can, according to the invention, be equipped with an outer screw thread cooperating with an inner screw thread in a screw nut which directly or indirectly is attached to an area at the doorway. The screw nut can for example directly or indirectly be attached to one of the bearing plates.

[0026] As mentioned above each of the cable drums is normally formed with a helical groove. The pitch of such helical groove can according to the invention correspond to the pitch of said screw threads whereby it is advantageously obtained that the winding and unwinding of the cables on their drums are accurately controlled.

[0027] According to the invention the screw thread on the shaft can moreover be either right-handed or left-handed so that the door can be adapted to the construction of the building in which the doorway is arranged.

[0028] Lowering the door leaf from its open to its closed position requires a sufficiently large length of each cable. Each drum therefore needs to be at least so long that it can accommodate such cable length in upwound condition. In order to be able to unwind the accommodated cable when lowering the door leaf from its closed position the axial distance, which the shaft is allowed to slide in the bearings, can according to the invention be the same or larger than the length of each drum.

[0029] Conventionally a sectional overhead door comprises two guide rails for guide rollers on axles mounted at each of the lateral edges of the door leaf whereby each of the guide rails has an upwardly directed rail part.

[0030] In order to obtain a compact structure of the door this upwardly directed rail part can, according to the invention, be mounted on the wall around the doorway or on jambs mounted on said wall.

[0031] A sectional overhead door is normally equipped with at least one torsion spring. One end of this torsion spring is secured against rotation while the other end is attached to the shaft. The torsion spring is tensioned in order to counterbalance the weight of the door leaf. Should the torsion spring by accident break, the door leaf will fall with the risk of people at the door being harmed.

[0032] Such doors are therefore equipped with a spring-break protection. According to the invention the end of the torsion spring, which is secured against rotation, can be mounted on the spring-break protection which again is mounted on one of the bearing plates so that the spring-break protection is activated when the torsion spring breaks.

[0033] According to the invention the spring-break protection can more specifically comprise a pawl wheel which is secured against rotation on the shaft and is equipped with at least one pawl, and a pawl housing upon which the torsion spring is attached and which is pivotally mounted on said bearing plate between a spring-break position, in which the least one pawl of the pawl wheel abuts a stop on the pawl housing when the torsion spring is in a non-tensioned condition and an operational position, in which the least one pawl cannot abut said stop when the torsion spring is in a tensioned condition.

[0034] The tension of the torsion spring will turn the housing so that the stop on the pawl housing is turned beyond the pawl's reach.

[0035] This implies that the pawl wheel can rotate freely in the pawl housing while the door leaf is properly counterbalanced by the tension of the torsion spring.

[0036] When the torsion spring however breaks, the tension of the torsion spring does not act anymore on the pawl housing, which then turns the opposite way with the result that the pawl now abuts the stop on the pawl housing thereby preventing the pawl wheel and thereby the shaft to rotate in the direction where the door leaf would fall.

[0037] In an advantageous embodiment according to the invention the pawl wheel can be mounted axially displaceable on the shaft so that the spring-break protection can be designed with an axially extending length which is shorter than the distance that the shaft is displaced in the bearings during operation of the door.

[0038] The invention will be explained in greater detail below, giving further advantageous features and technical effects and describing an exemplary embodiment with reference to the drawing, in which

Fig. 1 is a fractional rear view of a sectional overhead door arrangement according to the invention mounted at a doorway but with some parts removed for illustrative reasons,

Fig. 2 is a lateral view of the sectional overhead door arrangement shown in fig. 1 but with some parts removed for illustrative reasons,

Fig. 3 shows a horizontal cross section of the sectional overhead door arrangement shown in figs. 1 and 2,

Fig. 4 is an enlarged fractional view of a control mechanism for controlling the winding and unwinding of cables attached to a door leaf of the sectional overhead door shown in figs. 1 and 2 on cables drums of the door,

Fig. 5 is an enlarged fractional rear view of a spring-break protection of the sectional overhead door arrangement shown in figs. 1 and 2,

Fig. 6 shows the same, seen from the top,

Fig. 7 is a lateral view taken along the line VII - VII in fig. 5, and

Fig. 8 is a lateral view taken along the line VIII - VIII in fig. 6.

[0039] Figs. 1, 2 and 3 show a sectional overhead door arrangement 1 for closing a doorway 2 in a wall 3 of a building (not seen).

[0040] The door arrangement comprises a door leaf 4 with a number of door sections 5 which are interconnected by means of hinges 6.

[0041] Each door section has, as seen in figs. 2 and 3, a rectangular shape. A guide roller 7 is mounted at the top of the lateral edges 8 of each door section. The uppermost and lowermost door sections 9 and 10 are furthermore mounted with a guide roller at the bottom. Each guide roller is mounted on the lateral edge 8 of the respective door section by means of an axle 11.

[0042] Two guide rails 12 for the guide rollers are placed at said lateral edges of the doorway. Each guide rail consists of an upwardly directed first rail part 13, a horizontally directed second rail part 14 and a curved third rail part 15 extending between the first and second rail parts 13 and 14.

[0043] In the embodiment shown, the first rail part 13 is attached directly to the wall 3 whereby a simple, compact and inexpensive structure is obtained. In another embodiment the first rail part is attached to the wall via a jamb (not seen).

[0044] The second rail part can, depending on the structure of the actual building, form an angle with a horizontal plane instead of extending in a horizontal direction (this variant is not shown).

[0045] The door leaf is flexible, owing to the fact that the door sections are hinged together. This implies that the door leaf can be moved between a vertical position in which the doorway is closed and a horizontal position in which the door leaf is completely free of the doorway.

[0046] In figs. 1 and 2 the door leaf 4 is in process of being opened by being moved in the direction of the arrow. During this movement the door leaf is guided by means of the guide rollers 7 which are running in the guide rails 12.

[0047] The lowermost door section 10 is guided by the first guide rail 13 and is now at a distance from the floor 16 of the building (not shown) while the uppermost door section 9 has entered the second guide rail 14. Some of the doorway 2 can be seen at the bottom of fig. 1.

[0048] The door sections 5, which are passing the third guide rail 15, are turned about their hinges 6 in relation to each other and to the adjacent door sections too whereby opposite end faces 17 and 18 of said door sections 5 are also turning in relation to each other.

[0049] In the embodiment shown, the opposite end faces 17 and 18 of the sections have a shape which ensures that a person cannot get the fingers caught between the end faces when closing the door leaf. This detail is not a part of the present invention and will therefore not be discussed further here.

[0050] The sectional overhead door arrangement 1 also comprises a drive shaft 19 which is rotatably mounted in bearings 20 on two bearing plates 21 attached to the wall 3 at the doorway. In other embodiments (not shown) there can be more bearings and more bearing plates.

[0051] The drive shaft of larger door arrangements is normally rotated by a motor (not shown) during operation. The drive shaft of smaller door arrangements can instead be rotated by manual power (not shown).

[0052] Two cable drums 22 are secured on opposite end parts of the drive shaft while two traction cables 23 are attached to each their cable drum at one end and at the other end to the bottom 24 of the lowermost door section 10.

[0053] The cables are wound around each their cable drums by rotating the drive shaft and thereby the cable drums in the direction shown with the arrow in figs. 1 and 2 whereby the door leaf is lifted. Rotating the drive shaft in the opposite direction subsequently lowers the door leaf.

[0054] As mentioned above, both cable drums are secured to the drive shaft which according to the invention is mounted axially slidable in the bearings while the two cables are wound around their cable drums in the same direction.

[0055] The consequence of this inventive combination of features is that the cables maintain their positions in relation to a vertical plane perpendicular to the doorway while lifting or lowering the door leaf owing to the fact that the positions, where the cables are entering or leaving their drums, are kept at the same place in relation to the door leaf since the shaft is displaced in its bearings concurrently with the lifting or lowering of the door leaf.

[0056] In figs. 1 and 2 the door leaf is in process of being lifted in the direction shown with the vertical arrow in figs. 1 and 2 while the drum 22 is rotating clockwise as shown with the curved arrow in fig 2. The shaft with the drums is simultaneously displaced to the right (seen in fig. 1) in the direction of the horizontal arrow.

[0057] The obtained important advantage implies that

the cables now can extend in a vertical direction along the lateral edges of the door leaf, thereby eliminating the risk of the cables engaging the outside of the door leaf and reducing the wear on the cables and drums.

[0058] Fig. 4 shows a control mechanism 25 for ensuring that the positions, where the cables are entering or leaving their drums, always are exactly the same in relation to the door leaf so that the cables can be kept in exactly the same vertical position in relation to the door leaf when opening or closing the door.

[0059] The control mechanism consists of an outer screw thread 26 on the shaft 19 cooperating with an inner screw thread in a screw nut 27 directly or indirectly attached to one of the bearing plates 21.

[0060] In the embodiment shown in fig. 4, the screw nut is attached to a projection which again is attached to the bearing plate. In another embodiment (not shown), the bearing 20 can serve as both bearing and screw nut. The screw threads can be a flat screw thread or be of any other appropriate kind.

[0061] The outer surface of each drum is formed with a helical groove 28 which has a shape fitting the cable. The helical groove of one of the drums is turning in the same direction as the helical groove of the other drum and also in the same direction as the outer screw thread 26. The pitch of the helical grooves is moreover the same as the pitch of the outer screw thread.

[0062] The door leaf 4 is lifted or lowered by turning the shaft whereby the outer screw thread 26 is screwed in or out of the inner screw thread in the screw nut 27. This implies that the shaft is axially displaced a distance in the bearings. The number of revolutions of the shaft multiplied by the size of the pitch of the outer thread determines said distance.

[0063] The cables are, as can be appreciated, displaced the same distance and in the same direction in relation to the door leaf as the shaft. The positions, where the cables are entering or leaving the drums, are however displaced exactly the same distance in the opposite direction since the pitch of the helical groove and the pitch of the outer screw thread are identical. The stretch 29 of each cable extending between the bottom of door leaf and the drum therefore has a stationary position.

[0064] In fig. 3 it can be seen that said stretch 29 is positioned in an area between the roller 7, the roller axle 11 and the door section 5. In other embodiments the stretch can be positioned in another way in relation to the rollers and the sections.

[0065] The door section 11 shown in fig. 3 consists of a metal-sheet 30 coating a foamed insulation 31. The roller axle 11 is extending perpendicular to the lateral edge of the door section between the front and the back of the door section. Other positions are possible within the scope of the invention.

[0066] The guide rail 12 which, during lifting and lowering of the door leaf 4 are guiding the guide rollers 7, is, seen in cross section, formed as a L which has a first flange 32 attached to the wall 3 and another flange 33 which has a curved end part 34 which fits the guide roller 7.

[0067] A sealing strip 35 is moreover placed between the first flange of the guide rail and the front of the door section.

[0068] The door arrangement comprises in this case a single torsion spring 36. In other embodiments (not shown) the door arrangement can comprise two or more torsion springs.

[0069] The torsion spring 36 is at one end attached to the shaft 19 and at the other end to a spring-break protection 37, which is mounted on the other bearing plate 21. Tensioning the spring results in a torsion moment acting between the shaft and the spring-break protection. The weight of the door leaf is counterbalanced by means of this torsion moment. The door leaf therefore would fall with the risk of somebody getting hurt if the torsion spring should break or disengage the connections with the shaft and/or the spring-break protection so that the torsion moment disappears and the door leaf therefore no longer is counterbalanced.

[0070] The spring-break protection 37 shown in figs. 5 - 8 comprises a pawl housing 38 bent of a metal plate into a shape like a U which has a first flange 39, a second flange 40 and a third flange 41. A window 42 with a stop edge 43 is cut out of the third flange.

[0071] The first flange 39 of the pawl housing is pivotally connected with the bearing plate 21 by means of a pivot 44 placed to the right of the shaft, seen in the figure, and in such way that the third flange 41 with the window 42 and the stop edge 43 faces upwards.

[0072] A slit 45 is concentric with the shaft formed in the first flange to the left of the shaft. A pin 46 which is attached to the bearing plate is extending through the slit.

[0073] The torsion spring is tensioned in such a way that the torsion moment turns right and thereby pivots the pawl housing to the inclined position shown in fig. 7. The gravitational force turns the pawl housing to the position shown in fig. 8 without that torsion moment.

[0074] A pawl wheel 47 with a hub 48 is between the first and second flange of the pawl housing 38 mounted on the shaft in such a way that it can slide axially but not revolve on the shaft.

[0075] Along the periphery of the pawl wheel a number of pawls 49 with undercut lateral edges 50 are placed. The radius of the pawl wheel, measured to the outer edge of the pawls, has such a size that the pawls 48 are free of the third flange 41 of the housing in the position shown in fig. 7 but not in the position shown in fig. 8 where a pawl can extend through the window 42.

[0076] The pawl housing 38 will, as can be appreciated, normally be kept in the inclined position shown in fig. 7 by the torsion moment from the tensioned torsion spring. In this position the pawl wheel is therefore allowed to rotate freely below the third flange of the pawl housing whereby the door leaf without hindrance from the spring-break protection 37 can be lifted and lowered as desired.

[0077] The torsion moment will however disappear if

the torsion spring should break or disengage the connections with the shaft and/or the second flange of the pawl housing. In this case the gravitational force will, as mentioned above, turn the pawl housing to the position shown in fig. 8. One of the pawls on the still rotating pawl wheel will then enter the window and hit the stop edge in the window with its lateral edge whereby said rotation of the pawl wheel and thereby of the shaft is stopped instantaneously with the consequence that the door leaf safely is prevented from falling.

Claims

1. A sectional overhead door arrangement for closing a doorway (2) and of the kind which comprises

- a drive shaft (19) rotatably mounted in bearings (20) on at least two bearing plates (21) which directly or indirectly are attached to areas at the doorway (2),
- drive means for rotating the drive shaft (19) during operation,
- two cable drums (22) secured at a distance from each other on the drive shaft (19), and
- two traction cables (23) each attached to a lower part of a door leaf of the door arrangement and to each their cable drum (22) too,
- **characterized in**
- **that** the drive shaft (19) is mounted axially slidable in the bearings (20), and
- **that** the two cables (23) are wound around their cable drums (22) in the same direction.

2. A sectional overhead door arrangement according to claim 1, **characterized in that** the drive shaft (19) is equipped with an outer screw thread (26) cooperating with an inner screw thread in a screw nut (27) which directly or indirectly is attached to an area at the doorway (2).

3. A sectional overhead door arrangement according to claim 1 or 2, where each cable drum (22) is formed with a helical groove (28) which has a shape fitting the associated cable (23), **characterized in that** the pitch of the helical groove (28) corresponds to the pitch of the screw threads (26,27).

4. A sectional overhead door arrangement according to claim 1, 2 or 3, **characterized in that** the outer screw thread (26) on the shaft (19) is either right-handed or left-handed.

5. A sectional overhead door arrangement according to any of the claims 1 - 4, **characterized in that** the axial distance which the shaft (19) is allowed to slide in the bearings (20) is the same or larger than the length of each drum (22).

6. A sectional overhead door arrangement according to any of the claims 1 - 5, where the sectional overhead door arrangement (1) comprises two guide rails (12) for guide rollers (7) on axles (11) mounted on each of the lateral edges of the door leaf (4), each of the guide rails (12) having at least an upwardly directed rail part (13), **characterized in that** the upwardly directed rail part (13) is mounted on the wall (3) around the doorway (2) or on jambs mounted on said wall (3).

7. A sectional overhead door arrangement according to any of the claims 1 - 6, **characterized in that** the cables (23) are extending along the lateral edges (8) of the door leaf (4) and that each cable (23) is extending between the guide rollers (7) and that side of the axles (11) of the guide rollers (7) facing the wall (3) around the doorway (2).

8. A sectional overhead door arrangement according to any of the claims 1 - 7, where the sectional overhead door arrangement (1) comprises at least one counterbalance torsion spring (36) which at one end is attached to the shaft (19), **characterized in that** the other end of said torsion spring (36) is attached to a spring-break protection (37) mounted upon one of the bearing plates (21).

9. A sectional overhead door arrangement according to claim 8, **characterized in that** the spring-break protection (37) comprises at least one pawl wheel (47) which is secured against rotation on the shaft (19) and is equipped with at least one pawl (49), and a pawl housing (38) upon which the torsion spring (36) is attached and which is pivotally mounted on said bearing plate (21) between a spring-break position, in which the least one pawl (49) of the pawl wheel (47) abuts a stop edge (43) on the housing (38) when the torsion spring (36) is in a non-tensioned condition and an operational position, in which the at least one pawl (49) cannot abut said stop edge (43) when the torsion spring (36) is in a tensioned condition.

10. A sectional overhead door arrangement according to claim 8 or 9, **characterized in that** the pawl wheel (47) is mounted axially displaceable on the shaft (19).

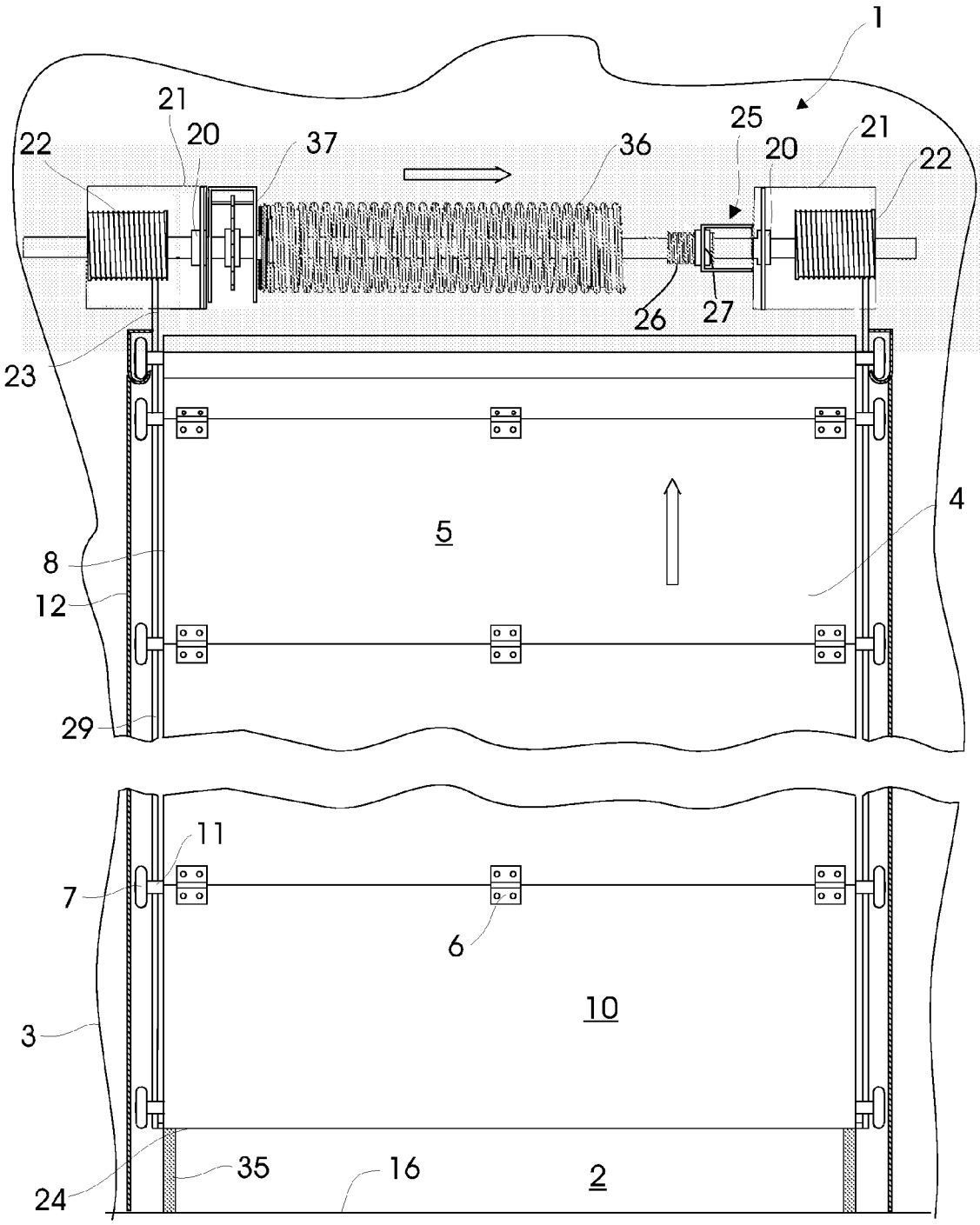

Fig. 1

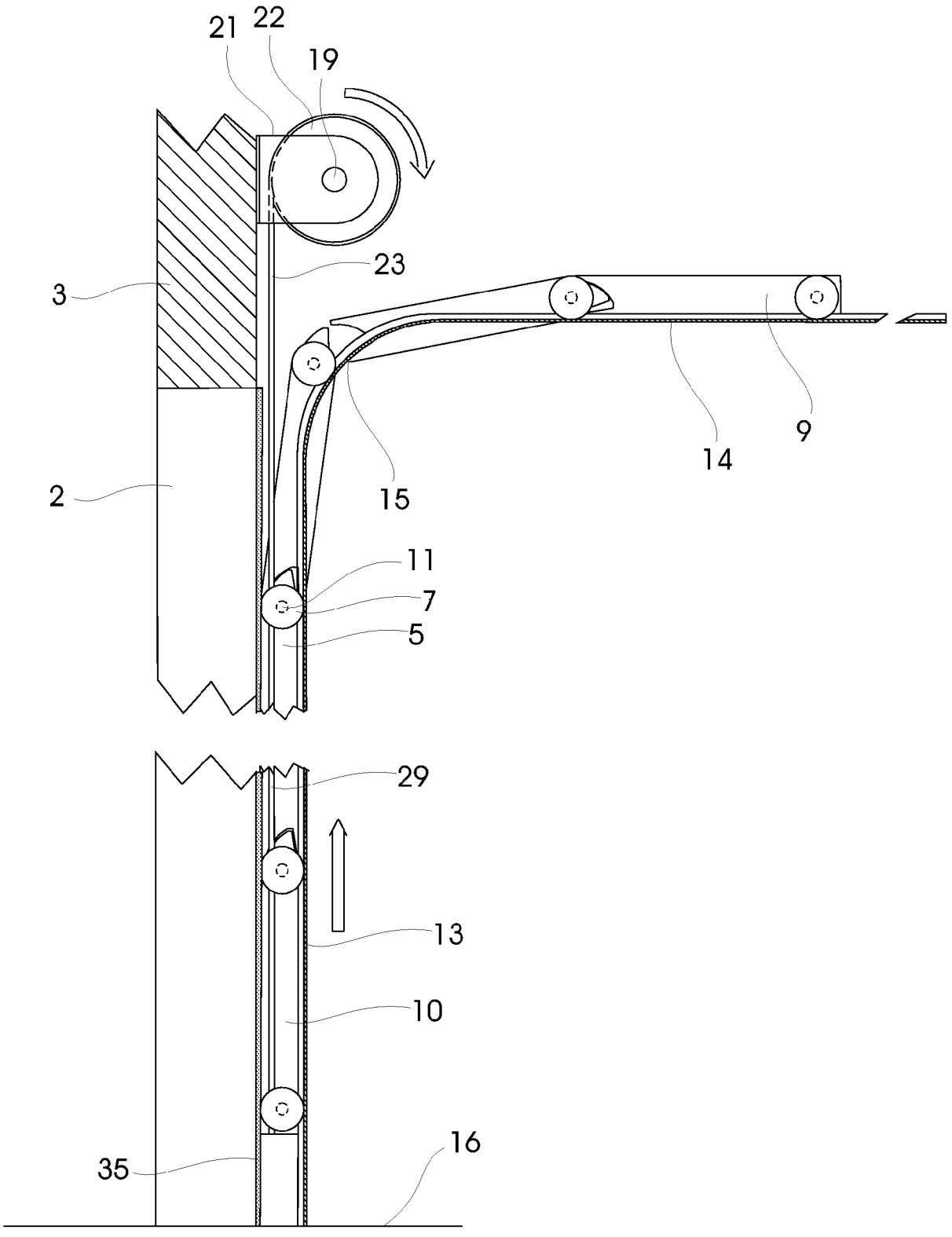

Fig. 2

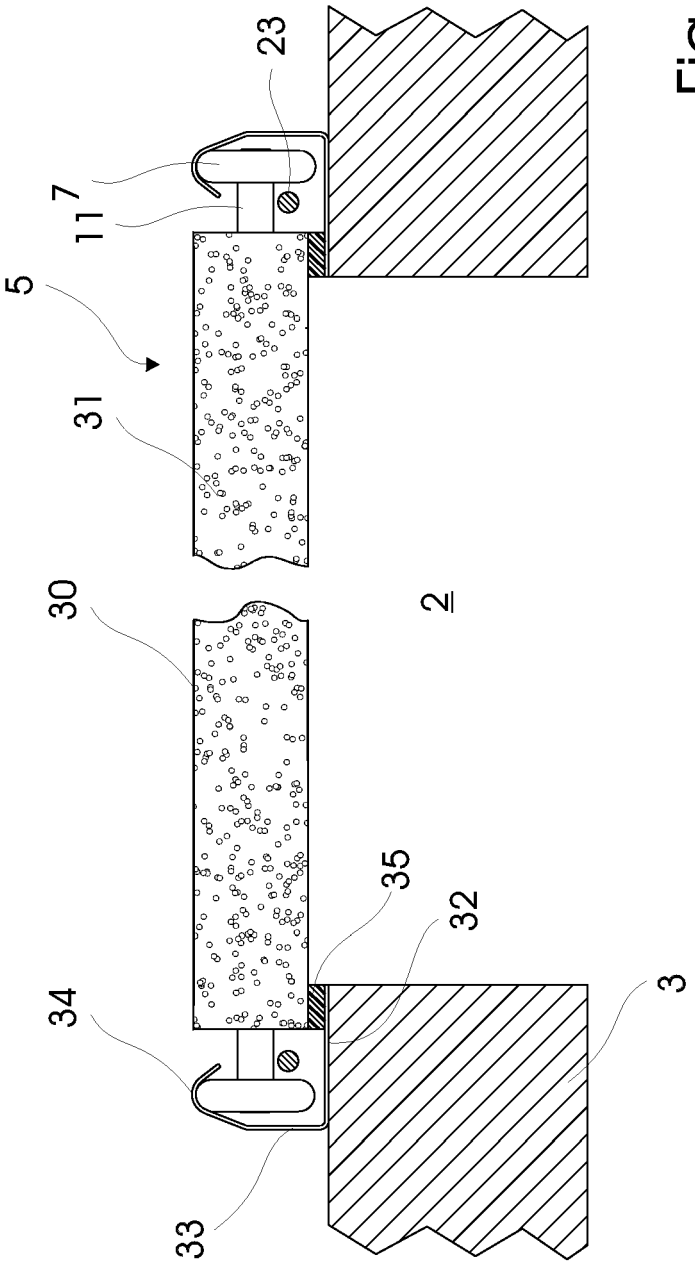

Fig. 3

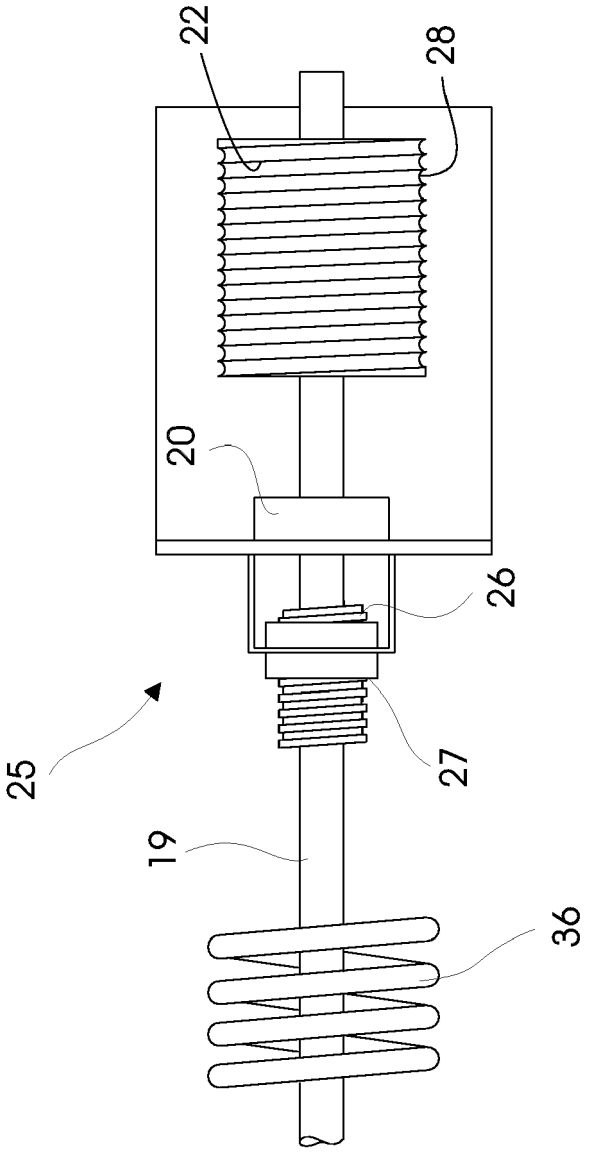

Fig. 4

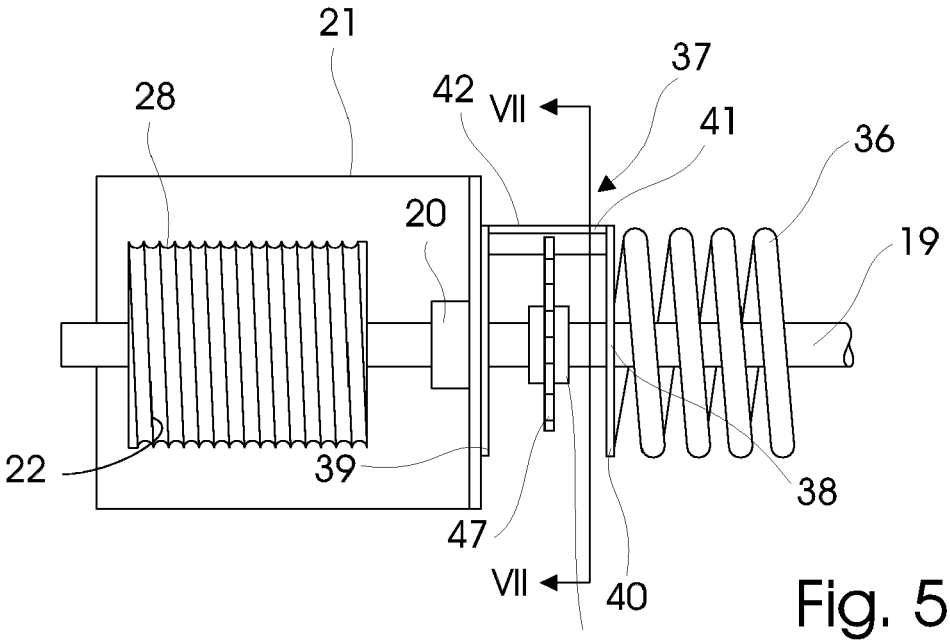
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Fig. 5

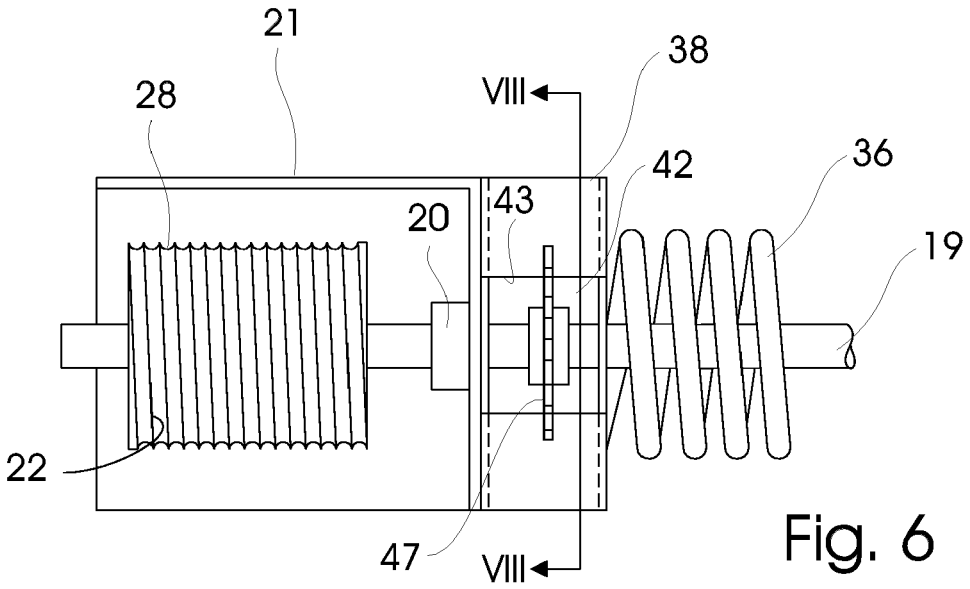
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Fig. 6

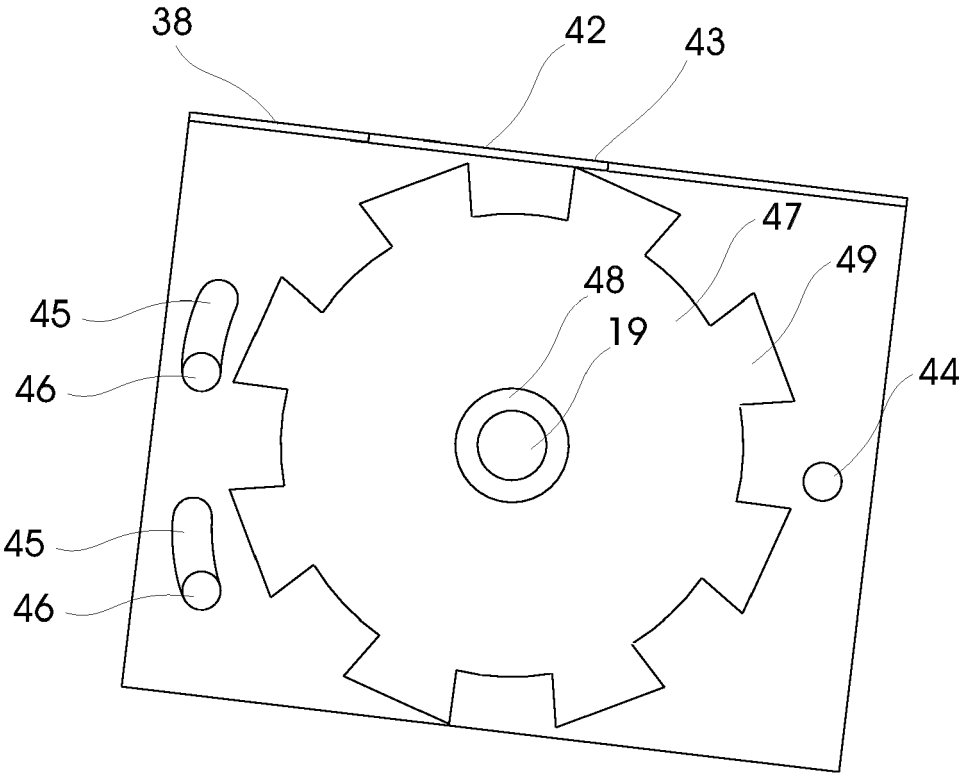

Fig. 7

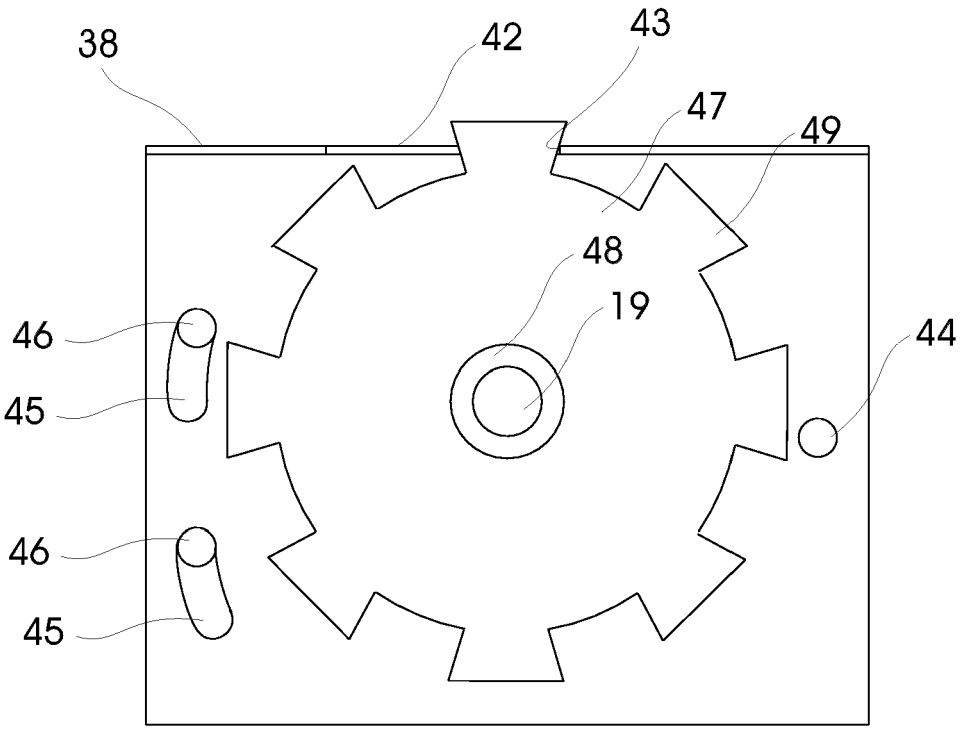

Fig. 8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 12 1884

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 1 031 698 A2 (MARANTEC ANTRIEB STEUERUNG [DE]) 30 August 2000 (2000-08-30) * abstract; figures 1,2 *	1,6-8	INV. E06B3/48 E05D13/00
A	NL 9 300 534 A (CRAWFORD HOLLAND B V) 17 October 1994 (1994-10-17) * abstract; figures 1-3 *	1,3,6	
A	WO 00/22270 A (WAYNE DALTON CORP [US]) 20 April 2000 (2000-04-20) * figures 1-3 *	1,3,8	
A	EP 1 148 198 A (OVERHEAD DOOR CORP [US]) 24 October 2001 (2001-10-24) * figure 1 *	1,8	
			TECHNICAL FIELDS SEARCHED (IPC) E06B E05D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	4 April 2007	Fernandez, Eva

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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