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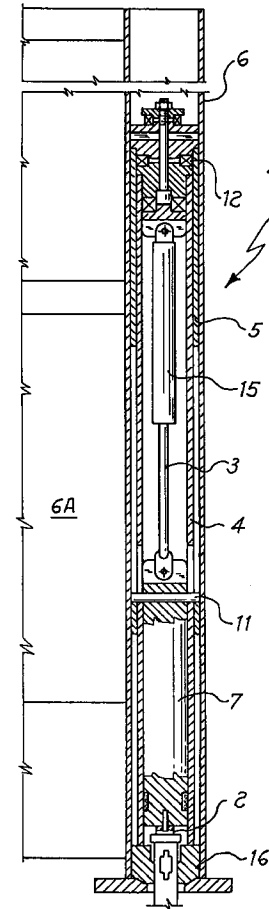
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(54) **Device to rotate an element about an axis**

(57) A device (1) to rotate an element about an axis, comprises a piston (7) reciprocable along the axis of rotation, within a first sleeve (4), at least one curved slot (14) cut into the first internal sleeve (4) and a pin (11) fitted to the piston (7), and engaging the curved slot (1); a second rotatable sleeve (5), comprising at least one vertical slot (9), and in which the pin (11) engages, and means of transmitting the rotation to a third sleeve (6), coaxial and external to the first two sleeves (4,5), and to the rotatable element.



**Fig. 1**

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## Description

The present invention relates to a device to rotate an element about an axis. In particular, the device according to the present invention could be applied to open and close gates, automatic doors, safety doors for access to presses, gates of transport systems for the disabled, etc.

Devices are known at present to effect the opening and closing of gates by means of rotation, which generally comprise a telescopic arm, disposed externally and angled with respect to the plane of the gate shutter. The said arm is provided with means (e.g. a hydraulic piston) of opening and closing the shutter of the gate.

However, systems of this type for opening and closing gates have several drawbacks. In the first place, since the arm is set externally to the shutter of the gate, it is not protected and is an element of encumbrance, so that it is difficult to use in applications such as gates for presses or platforms for disabled persons. Moreover, the systems known to the art often do not have a safety mechanism or system to prevent the gate being pushed open.

The presence of the moving external arm may also be source of danger to the users, and for children in particular.

The aim of the present invention is to solve the aforementioned problems by a device to effect the rotation of an element about an axis, which occupies minimum space, operates in a safe way, is protected from the outside and cannot be pushed open.

Such aim is achieved by the present invention which relates to a device to rotate a rotatable element about an axis, characterized by comprising a piston movable along the axis of rotation, at least one sleeve coaxial to said piston, means of imposing a relative rotation between said piston and said sleeve (i.e. of rotating the piston with respect to the sleeve or viceversa) and means of transmitting said rotation to said rotatable element.

According to a preferential aspect of the present invention, the device is provided with a first fixed sleeve and a second rotatable sleeve, coaxial and external to the first sleeve, and means of transmitting the rotation of the piston to said second sleeve.

The means of rotating the piston comprises preferably a pair of curved slots cut into the first sleeve, and a pin fitted to and projecting from the piston to engage said slots.

According to another preferential aspect of the present invention, the means of transmitting the rotation from the piston to the external sleeve comprises at least one vertical slot cut into the external sleeve, said slot being engaged by said pin.

According to a further preferred aspect of the present invention, the curved slot comprises an first section parallel to said axis of rotation and a second helicoidal section.

The device according to the present invention offers firstly the advantage that the means that causes the rotation of the element about an axis - and therefore the movement of opening and closing of the shutter of the gate - are housed within a fixed location. Since the location of such means of movement is in association with the axis of rotation of the shutter of the gate, minimum encumbrance is caused. Moreover, thanks to such a system, the possibility of a user accidentally coming into contact with said means of movement is eliminated. Finally, the device according to the present invention is able to prevent the operation of the rotatable element by pushing.

Further advantages and characteristics of the invention will become more evident from the following illustrative but not limiting description, with reference to the attached schematic drawings in which:

- figure 1 is a side view, in section, of a device to effect the rotation of an element about an axis according to a preferred embodiment of the invention,
- figure 2 is a side view, in section, of a detail of the embodiment of figure 1; and
- figure 3 shows the planar development of the curved slots of the first sleeve and of the straight slots of the second sleeve, of the embodiment of figure 1.

The following description refers to a gate as the element rotatable about an axis without, however, limiting the application of the device according to the present invention to that use alone.

In the embodiment of the present invention shown in figures 1-3, the piston 7 operates with a translational-rotary movement which can be divided into two components:

an first translational component along a substantially vertical axis and a second rotational component about said vertical axis. The rotation of the piston 7 is transmitted, by appropriate means described below, to the element 6A to be rotated. In this way the element 6A is made to rotate about the said vertical axis, thus causing the gate to open.

The device 1 to effect the rotation of a element about an axis shown in figure 1 comprises a piston 7 which moves vertically along the axis of rotation, inside a first sleeve 4 and can be rotated inside the said sleeve. There is a second sleeve 5 external to the sleeve 4 and coaxial with said sleeve 4 and with the piston 7. The internal sleeve 4 is fixed and fast to the base 16 of the device 1, while the second sleeve 5 is rotatable. The piston 7 is of a hydraulic type and is provided with a rod 3 and a gas buffer 15 to return it to the bottom dead center. In the embodiment shown in figure 1 there is a third sleeve 6, external to the sleeves 4 and 5,

whose function is that of supporting the rotatable element 6A. The third sleeve 6 is therefore fast to the rotatable element 6A and is rotatable with the second sleeve 5. In the lower part of the device 1 there is an electric contact 2, whose function will be illustrated below. The device 1 is in alignment with the axis of rotation of the shutter of the gate on which it acts.

Figure 2 shows some details of the device 1. In particular, there is a substantially horizontal pin 11 fitted to the piston 7 which engages both the internal sleeve 4 and the second sleeve 5. There are a pair of curved slots 10 cut into the internal fixed sleeve 4.

These slots 10 are helicoidal in profile, and symmetrical to each other, so that they are both engaged by opposite ends of the pin 11. Preferably each of the curved slots 10, one of which is shown in planar development in figure 3, comprises a first vertical section 13 parallel to the axis of rotation and a second curved section 14. There is a further pair of straight, vertical slots 9 on the second sleeve 5 which are also symmetrical, one of which is shown in planar development in figure 3. Vertical slots in the present description means slots that are parallel to the axis of rotation. The pin 11 is provided with portions projecting from the piston, which engage the two slots 10 and the two slots 9.

Pin 11 is thus constituting both the means of causing a rotation of the piston and the means of transmitting this rotation to the second sleeve and to the element 6A.

The opening of the element 6A occurs in the following way:

the hydraulic piston 7 is forced upwards by the oil entering the cylinder. The piston 7 in rising drags the pin 11 to which it is fast and said pin 11 runs in the pair of slots 10 cut into the internal sleeve 4. After having travelled the first straight section 13 of the slots 10, the pin 11 meets the curved section 14 of the slots 10 and is forced to rotate on a vertical axis.

Since the pin 11 is fast with the piston 7, said piston 7 is also forced to rotate. The pin 11 engages with the straight, vertical slots 9 on the second sleeve 5, which is rotatable around the axis of rotation of the piston, thanks also to the presence of the bearings 12. The pin 11 can run only vertically in the straight slots 9, and therefore forces the second sleeve 5 to rotate. The third sleeve 6 and the element 6A that comprises, for instance, the shutter of the gate, are locked to the said second sleeve 5. The rotation of the element therefore causes the gate to open.

The presence of the first straight section 13 on the curved slots 10 prevents the gate from being pushed open, since in such section 13 the pin 11 is restricted to running vertically. If the element 6A is given a purely manual push, without the aforementioned means associated with piston 7 being involved, the horizontal component of the said push is counterbalanced by the

opposite reaction of the wall of the vertical section 13. Moreover, the vertical component of such a manual push, is, if present at all, negligible and is not sufficient to force the pin 11 to climb up the straight section 13.

The closing of the gate is effected (once the oil pressure is removed) by the piston 7 returning to its starting position under the influence of the gas buffer 15 or of similar spring means. The return of the piston 7 forces the pin 11 to retrace its path described above along the curved slots 10. Therefore the piston 7 rotates in the opposite direction, causing rotation of the second sleeve 5, of the third sleeve 6 and of the element 6A in the direction of closing the gate.

At the base of the device 1 there is an electric contact 2. Such contact 2, referred to as a "consent contact" has a safety function, in that it communicates the consent to the carrying out of a following operation to other devices or potentially dangerous machinery, for instance a press or a system of transport for disabled persons. The electric contact 2 closes the corresponding electric circuits only when the piston 7 has reached its own bottom dead center in its downward movement, that is when closure of the gate has been verified.

The device 1 according to the present invention could be applied to gates of different sizes and weight, since it is possible to regulate the strength of the rotation force imposed on the shutter by adjusting the oil pressure.

### Claims

1. Device (1) to rotate an element (6A) about an axis, characterized by comprising a piston (7) movable along said axis of rotation, at least one sleeve (4) coaxial to said piston (7), means of imposing a relative rotation between said piston (7) and said sleeve (4) and means of transmitting said rotation to said element (6A).
2. Device (1) according to Claim 1, comprising a rotatable piston (7), a first fixed sleeve (4), a second rotatable sleeve (5), coaxial and external to said first sleeve (4), and a means of transmitting the rotation of the said piston (7) to the said second sleeve (5).
3. Device (1) according to Claim 2, wherein said means of imposing the rotation on the piston (7) comprise at least one curved slot (10), cut into the internal sleeve (4), and a pin (11) fitted to said piston (7) and projecting from the same piston (7) to engage the said curved slots (10).
4. Device (1) according to Claim 3, wherein the said means of transmitting the said rotation from the piston (7) to the second sleeve (5) comprise at least one vertical slot (9) cut into the said external sleeve (5), the said slot (9) being engaged by the said pin

(11).

- 5. Device (1) according to the Claims 3 or 4, wherein the said curved slot (10) comprises an first section (13) parallel to said axis of rotation and a second helicoidal section (14). 5
- 6. Device (1) according to any of the preceding Claims, further comprising a third sleeve (6), external to the said first and second sleeves (4, 5) and coaxial with them, said third sleeve (6) being fast with the element (6A) to be rotated and rotatable with said second sleeve (5). 10
- 7. Device (1) according to any of the preceding Claims, wherein said piston (7) is a hydraulic piston. 15
- 8. Device (1) according to any of the preceding Claims, wherein that said piston (7) comprises means of returning the said piston (7) to the bottom dead center. 20
- 9. Device (1) according to any of the preceding Claims, further comprising a safety contact (2) at the bottom dead center. 25

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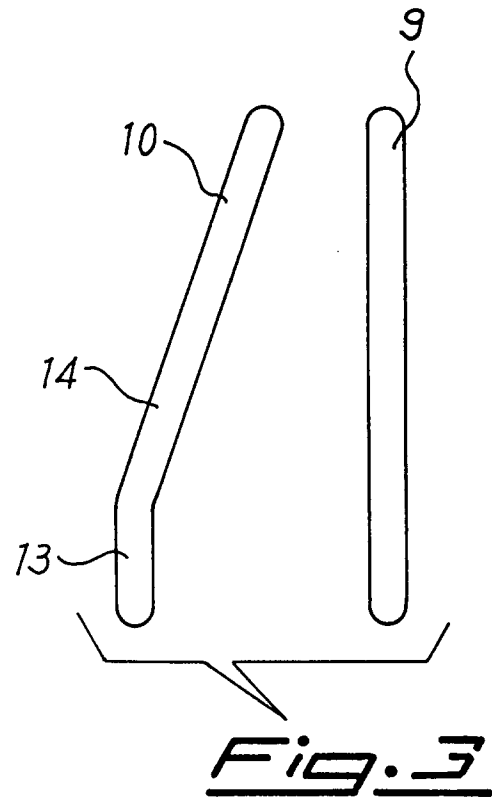
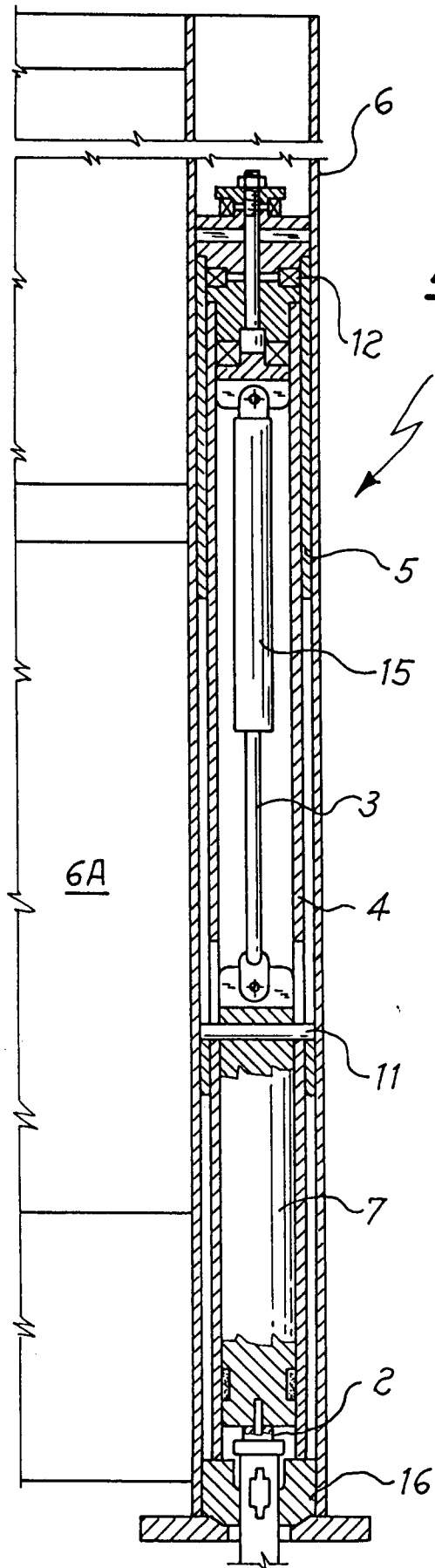
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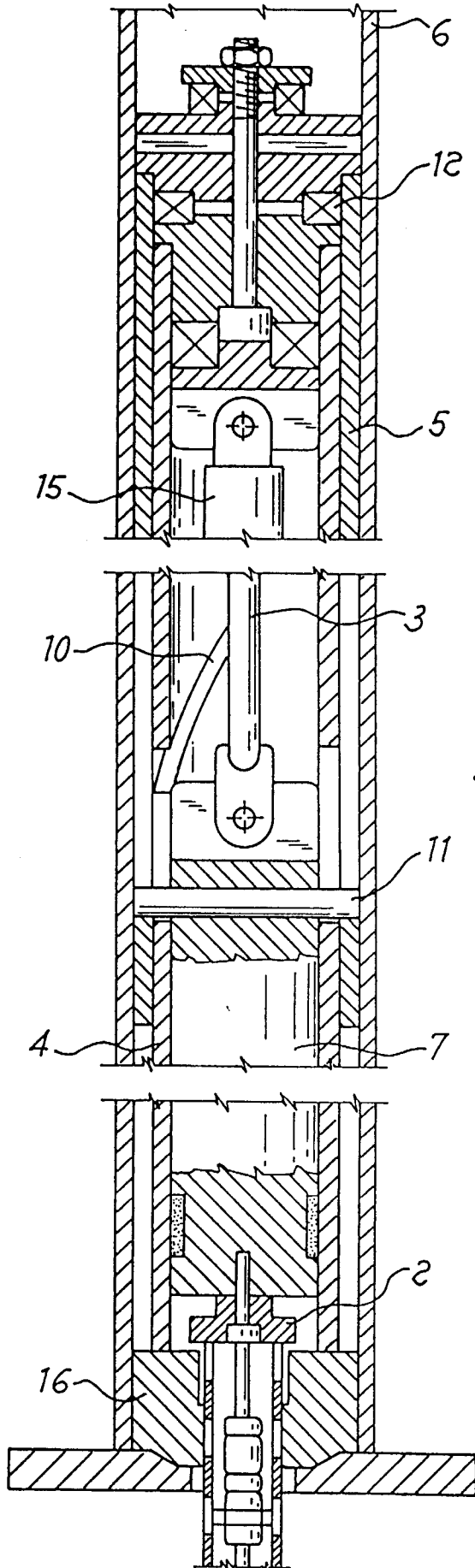
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*Fig. 2*



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EUROPEAN SEARCH REPORT

Application Number  
EP 96 11 8867

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X Y	EP 0 279 236 A (GEBRÜDER BODE & CO.) * column 4, line 41 - column 5, line 52; figures 3,3A * ---	1,7,8 2-6,9	E05F1/00 E05F15/04
X Y	DE 25 38 529 A (HOLZER) * page 2, paragraph 5 - page 4, paragraph 4; figures 3-5 * ---	1,7,8 2-6	
Y	DE 33 20 738 A (CHIRON-WERKE) * page 13, paragraph 2; figure 3 * -----	9	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			E05F F16P
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		9 January 1997	Guillaume, G
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