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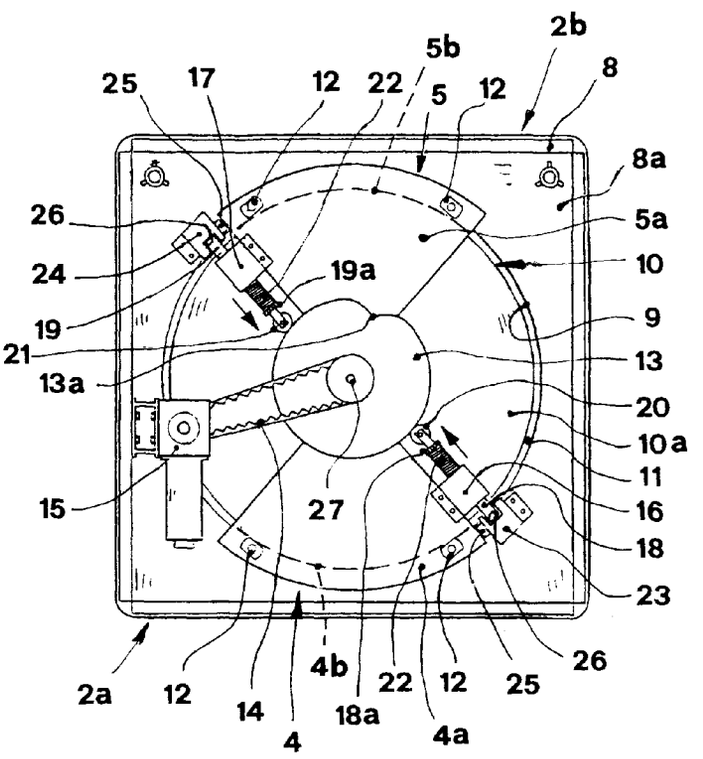
(54) Single-motor driving device for the doors of a robbery-proof box

(57) A driving device for a couple of doors (4,5) of an entrance and exit robbery-proof box (1) of a protected environment, each door (4, 5) being hingedly connected to the box so that it can move between a shutting position and an opening position. The device comprises motorised cam means (13) pivotally connected to the box, radially slidable engagement arms (18, 19), and stop means (23, 24) for doors (4, 5) in their respective shutting position, a first end of each arm (18, 19) being elastically in contact to a shaped profile of cam means (13) thereby the latter control the sliding of the arms, a second end of each arm being engageable with a respective locking seat (26) integral to box (1) when the correspondent door (4, 5) is in its shutting position.

Fig. 2



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Description

The present invention concerns the field of robbery-proof accesses, for example to banks or offices, controlled with interlocking doors, and in particular it relates to a driving device for the doors of a robbery-proof box.

It is commonly known in the field as robbery-proof box a steel load-bearing structure which is designed to be placed in correspondence to a doorway of a protected environment, such as a bank, defining a fixed passage for the working staff and/or the public. The box comprises two motorised doors, usually with a curved shutting panel made of toughened bullet proof glass, to cross in succession, the operating of which is controlled by a logical system that, in normal conditions, prevents their contemporaneous opening to regulate the entrance and exit of the people. A metal detecting device, working when a user in entrance is in the space between the doors, both of them being closed, is furthermore usually provided to avoid arms to be let in.

The control system has to be provided with accident prevention means, to stop the doors when they find an obstacle in their shutting movement, as it happens when a user is knocked over and trapped by one of them. Moreover, the contemporaneous opening of the doors must be permitted in case of emergency inside the protected environment, for example caused by a fire, to allow a fast outflow of the people.

Known robbery-proof boxes have the common feature of using a single motor for driving each door, the opening and closing of which is provided by way of crank gears having a more or less complex configuration.

This solution with two independent motors has the drawback of having a rather complex structure, each motor furthermore needing to have an over-dimensioned power to overcome the peak values of the movement friction of the doors. This friction is actually variable with the configuration of the operating crank gears, which changes during the movement, being in particular at a very high value during the start phase of the movement of the respective door.

Besides, these boxes have the further drawback that the accident prevention means is provided by additional devices of an active kind, to limit the thrust of the motor or to reverse its direction of rotation, which, in case of breakdowns or incorrect working, are not able to guarantee the required safety.

It is an object of the present invention to provide a driving device for the doors of a robbery-proof box, having a simpler structure and offering a smoother running as compared to known systems.

Another object of the invention is to provide a device of the above mentioned type, which is intrinsically equipped with a quite satisfactory degree of safety, so as not to need any additional device of the above cited kind.

These objects have been achieved with the driving device for the doors of a robbery-proof box according to the present invention, characterised in what stated in the enclosed claims.

Other features and advantages of the device according to the present invention will be apparent from the following description of one of its embodiments, which has to be intended only as an example and not a limitation, with reference to the attached drawings in which:

- figure 1 shows a schematic perspective view of a robbery-proof box equipped with the device according to the present invention;
- figure 2 is a schematic top plan view of the box of figure 1, in cross section so as to make the device according to the invention visible;
- figures 3, 4 and 5 are top plan views like the one of figure 2, with the device according to the invention shown in different working configurations.

With reference to figure 1, the driving device according to the invention is designed to equip a robbery-proof box 1 which is arranged in a known way in correspondence to a doorway of a protected environment, through which the entrance and exit of the working staff and/or of the public have to be regulated.

The box 1 comprises a steel support booth 2, defining a substantially cylindrical internal room 3 with passage openings formed in correspondence of two opposite sides 2a and 2b of the booth, in the following indicated respectively as inward and outward side. In this figure the device is not visible since it is hidden by a top cover panel 6 of booth 2.

Doors 4 and 5, each having a curved shutting panel, are hingedly connected to booth 2 as it will be described below. Operating push-buttons 7 are placed on sides 2a and 2b of the booth, to be pressed to command the opening of doors 4 and 5, in order to allow the passage in both directions across room 3.

With reference also to figures from 2 to 5, booth 2 comprises a fixed outer box-type frame 8, having a parallelepiped shape and closed at the top by a panel 8a, in the middle of which a circular opening 9 is formed. A hollow cylindrical body 10, closed at the top by a wall 10a, is housed within opening 9, to define room 3 andtwo accesses to the room itself with a respective opening formed on its lateral surface in correspondence of both sides 2a and 2b. Body 10 has an outside diameter which is slightly smaller than the one of opening 9, so as to define with the latter a slot 11.

Each of the two doors 4 and 5 comprises an horizontal support plate, indicated respectively with 4a and 5a, shaped as a circular sector having a width of about 90°, slidable by way of wheels, not shown, on wall 10a of body 10 and pivotally connected in correspondence of its own vertex to a vertical axis 27, coincident with the longitudinal axis of cylindrical body 10. A respective shutting panel, dashed in the figures and indicated with 4b and 5b, extends perpendicularly inside slot 11 from

each plate 4a and 5a and is connected thereto near its outer edge by way of pins 12.

Slot 11 guides the movement of the shutting panels so that each door can move independently between a shutting position, in which its panel is placed in correspondence to a respective of the opposite sides 2a and 2b, intercepting one of the accesses to room 3, and an opening position in which the door, swinging approximately by 90° with respect to axis 27, is placed so as to clear the access itself. In their opening position the two doors are arranged on opposite sides of booth 2, not to interfere one with each other during their movement. In particular in the figures it is indicated with 4 the door which in its shutting position faces the inward side 2a, and with 5 the one which, in its shutting position as well, is placed in correspondence to the outward side 2b.

The driving device according to the invention comprises a disk-shaped cam 13, coaxial to body 10 and pivotally mounted on the latter in a parallel way to wall 10a. A notch 13a, schematically sketched and whose function will be made clear later, is provided on the circumferential profile of cam 13, which is connected for its rotation, by way of a driving cog belt 14, to an electric motor 15 supported by frame 8.

Seats 16 and 17 are provided on respective plate 4a and 5a, each mounted with its axis parallel to a corresponding radial edge of the plate and near the edge itself. The seats slidingly support engagement arms 18 and 19, each bearing a respective wheel 20 and 21, pivotally connected to the arm end which is pointed towards cam 13, in the following referred to as first end, to roll around the lateral surface of the cam itself. A spring 22 is arranged around each engagement arm, compressed between the edge of the respective seat and an arm abutment, indicated with 18a and 19a, so as to keep the respective wheel in contact with the cam.

Two locking blocks 23 and 24 are fixed over panel 8a near opening 9, in diametrically opposed positions with respect to it, thereby plates 4a and 5a in their shutting position abut with a radial edge against stops 25 extending sideways from blocks 23, 24. In each block a locking seat 26 is also provided, with which the other end of a corresponding arm 18 and 19, in the following referred to as second end, is engageable when the door is in its shutting position.

Motor 15 is operated by a microprocessor control system, cooperating wirh a detection network, not shown, to detect the angular position of cam 13 as well as of the two doors.

The device according to the invention works in the following way. Supposing the box to be in the configuration shown in figure 3, both the doors are in their shutting position, with the second ends of arms 18 and 19 engaged with locking seats 26 of a respective block 23 and 24 and springs 22 keeping the first ends of the arms in contact with the lateral surface of cam 13. The notch 13a is in an intermediate position between the two wheels, facing outward side 2b. Internal room 3 is therefore closed, not allowing people to get into and out of the protected environment.

If the opening of room 3 is commanded from the outside to permit the access to the environment by pressing the button 7 of the respective side, the driving device has first of all to provide for the opening of door 5. To carry out this, the motor, by means of driving belt 14, causes the counter-clockwise angular displacement (according to the plan view of the figures) of cam 13, so notch 13a is brought in correspondence to wheel 21 of arm 19.

Spring 22 pushes wheel 21 into notch 13a, causing the axial sliding of arm 19 along seat 17 towards said cam and the disengagement of its second end from locking seat 26 of block 24. Now, an angular displacement of cam 13 in the opposite direction makes the plate 5a swing as well around axis 32, by means of the engagement of arm 19 with the notch, causing the shutting panel 5b to slide along slot 11. The movement comes to an end when the control system, having detected that the door is fully opened, i.e. after a rotation of the door by about 90°, stops motor 15.

The device is now in the configuration shown in figure 3. The user can enter room 3 and motor 15, operated by a suitable sensor, turns cam 13 in counter-clockwise direction, so that door 5 is driven once again to its shutting position. Plate 5a abuts against stop 25 of block 24 and, since the motor continues to work, cam 13 keeps turning, causing the disengagement of wheel 21 from the notch and making the second end of arm 19 get into the corresponding locking seat 26, to achieve the configuration shown in figure 4.

During all the phases described above door 4 has remained shut, locked in its position by the engagement of arm 18 with seat 26 of block 23, the turning of the cam having never brought notch 13a in front of wheel 20.

In the achieved configuration both doors are therefore shut, the user being inside room 3, and the metal detecting device can be operated, if provided. To allow the user to get out of room 3 and into the protected environment, the motor will turn cam 13 to bring notch 13a into engagement with wheel 20 of arm 18. At this point the repetition of an analogous sequence to that already described causes the opening and the following shutting of door 4.

The operating of cam 13 by motor 15 in case of a passage of a user in an opposite sense, i.e. from the inside to the outside of the protected environment, is not described in detail because it can be easily drawn from the foregoing. It will be appreciated how the control system, steadily detecting the angular position of cam 13, and of notch 13a as a consequence, will turn the cam in either direction, according to the side from which the opening command comes.

To make clear the advantages offered by the device according to the invention in terms of accident prevention safety, figure 5 shows a hypothetical stop of a door panel, in particular the panel 5b of door 5, about halfway

in its shutting movement, caused by the accidental interposition of a user's body or part of it. Plate 5a stopped at the point in which its swinging was prevented, while motor 15 continued to turn cam 13. As a consequence, arm 19 is disengaged from notch 13a and the door is free from the control of the driving device, thus being permitted its hand-driven opening without any effort.

The device therefore is characterised by a high degree of intrinsical safety and it does not need the use of any active sensor to reverse the direction of rotation of the motor. It will be furthermore appreciated that the disengagement force of arms 18 and 19 from cam 13, fixing the value of the thrust which if acted to the panels stops their movement, is adjustable by suitably setting springs 22, said value having to allow the cam to drive each door in normal operating conditions.

To face an emergency, for example in case of a fire inside the environment, the doors can be opened contemporaneously to permit a fast outflow of people, owing to the fact that they abut against limit stops, not shown, even in their opening position. In this way, once an alarm has been given and one of the doors has been opened, i.e. in a configuration as the one shown in figure 3, motor 15, instead of inverting its rotation, keeps on driving cam 13 in the same direction. Notch 13a is disengaged from the arm of the already opened door, blocked by one of said limit stops, and gets into engagement with the arm of the other door, continuing to turn so as to achieve its opening.

The device according to the invention therefore offers, with respect to known solutions with two independent motors, in addition to the clear advantages above described about safety, the very important one of having a very simple structure, both for having only one motor, and for not comprising any active safety device, with consequent considerably lower costs of construction and of maintenance. Besides, thanks to its very smooth running, it can be equipped with motor means having on the whole a power lower than that of known double-motored solutions.

Variations and/or modifications can be brought to the single-motor driving device for the doors of a robbery-proof box as described above, without departing from the scope of the appended claims.

Claims

1. A driving device for a couple of doors (4,5) of an entrance/exit robbery-proof box (1) of a protected environment, said box defining a passage room (3) communicating with said environment and with the outside through a respective access, each door being hingedly connected to said box to perform an angular displacement of about 90°, with respect to a central symmetry axis (27) of said box, between a shutting position, in which it is placed so as to intercept the respective access to said room, and an opening position, in which it clears the same access, and vice versa, said device comprising motor means (15) for driving said doors and being characterized in that it comprises cam means (13) operated by said motor means and pivotally connected to said box so that it can turn with respect to said axis, engagement arms (18, 19) connected to each of said doors (4, 5) and sliding along substantially radial direction with respect to the angular movement of said cam means, and stop means (23, 24) for said doors in their respective shutting position, a first end of each arm being elastically in contact to a shaped profile of said cam means thereby the latter control the sliding of said arms, a second end of each arm being engageable with a respective locking seat (26) integral to said box when the correspondent door is in its shutting position, said profile being such that it can operate each door alternatively in consequence of said sliding, in normal operating conditions the respective arm being axially displaced towards said cam means, in this position the arm being disengaged from said locking seat and integral to said cam means to lead said door from its shutting position to its opening position and vice versa, or towards said locking seat, in this position the arm being freely slidable along said profile and engaged with said seat to keep the respective door in its shutting position.

2. The device according to claim 1, wherein said cam means comprise a disk-shaped element, pivotally supported by said box over said doors, on the- lateral profile of said element a notch (13a) being formed to engage said first end of a respective of said arms.

3. The device according to the previous claims, wherein each door comprises an upper plate supporting a respective radial seat (16, 17) for said engagement arms, a respective shutting panel extending from said plate, said plate abutting with a radial edge against a respective of said stop means.

4. The device according to the previous claims, wherein the first ends of said engagement arms pivotally support a respective wheel (20, 21), rolling on said profile and engageable with said notch.

5. The device according to the previous claims, wherein said locking seats are formed in said stop means.

6. The device according to the previous claims, wherein elastic means are provided to keep the first end of each arm in contact to said cam means, acting in compression between said first end and said radial seat.

7. The device according to claim 6, wherein said elastic means comprise springs (22), each placed around a respective of said arms and extending axially between the corresponding radial seat and an abutment (18a, 19a) formed in each arm near said first end.

8. The device according to the previous claims, wherein respective stop means, integral to said box, are provided for said doors in their opening position too.

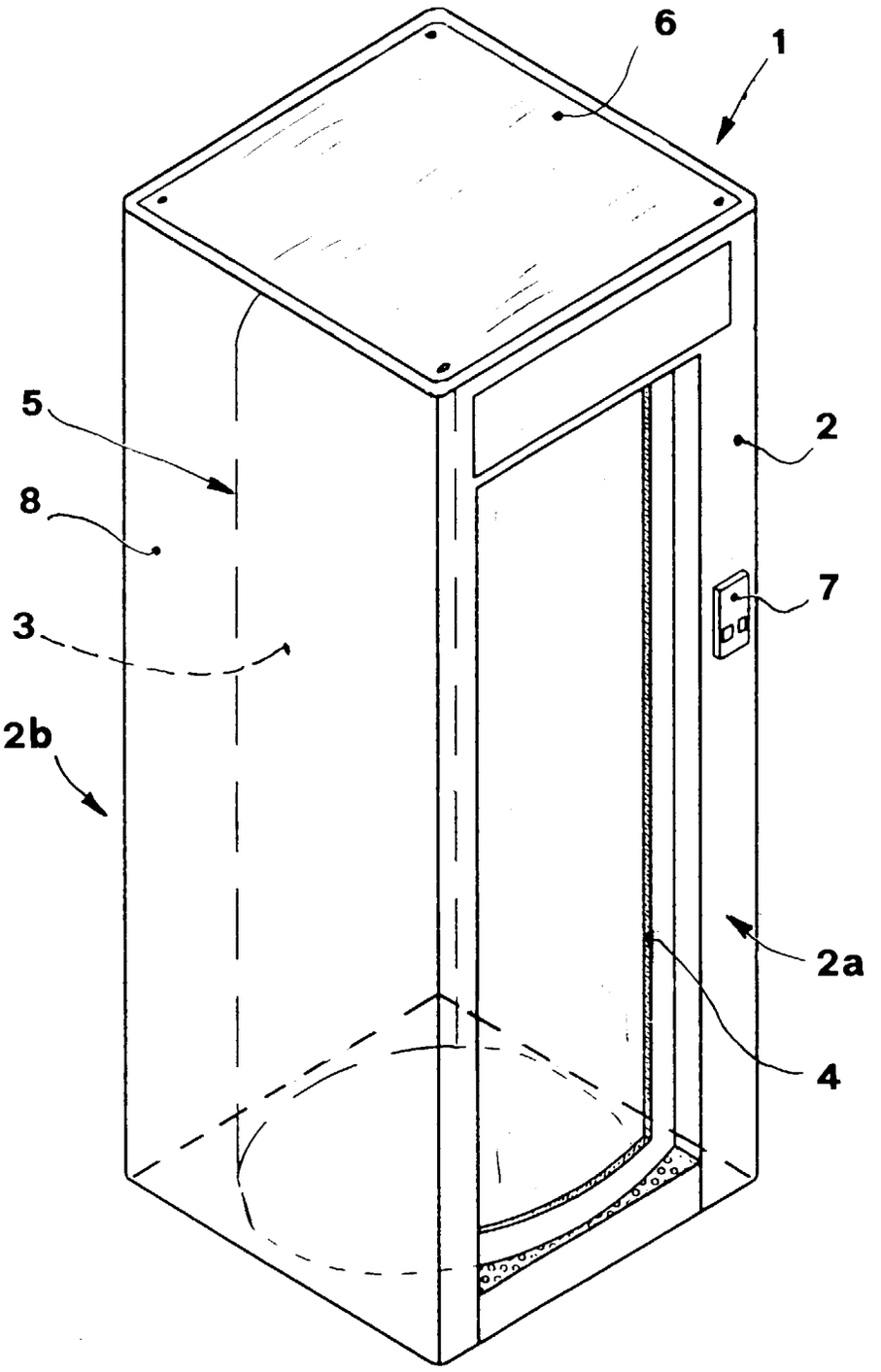

Fig. 1

Fig. 2

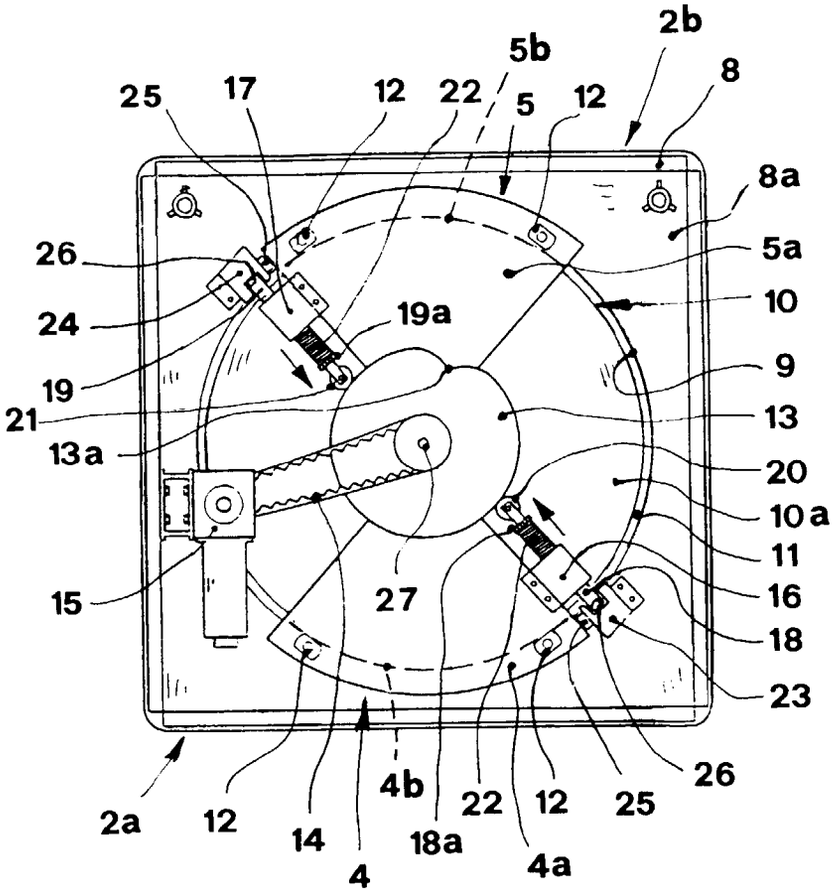
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Fig. 3

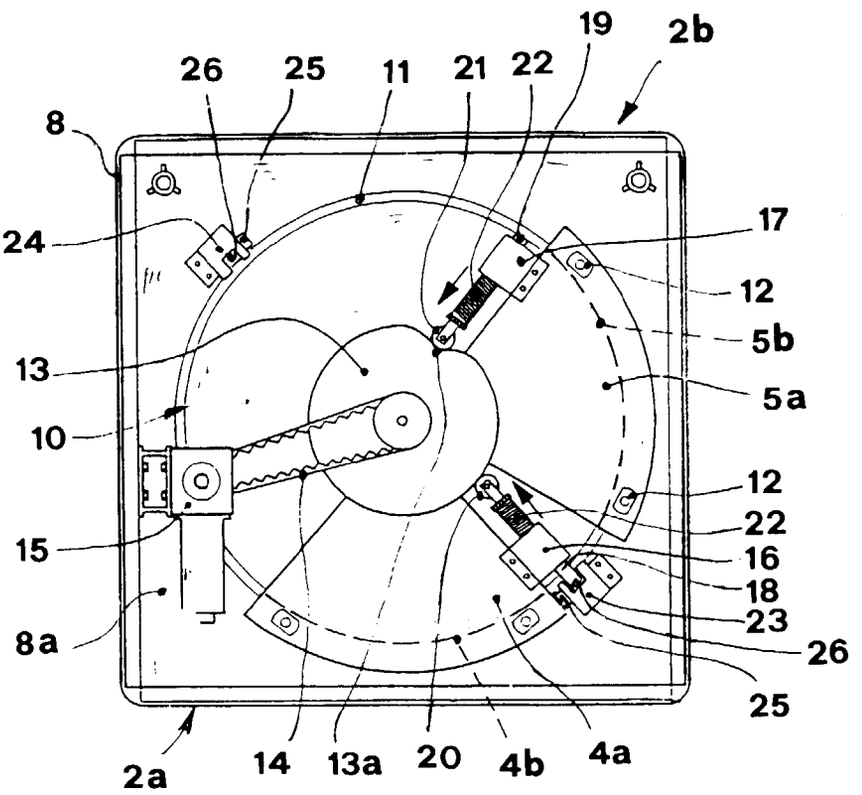
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Fig. 4

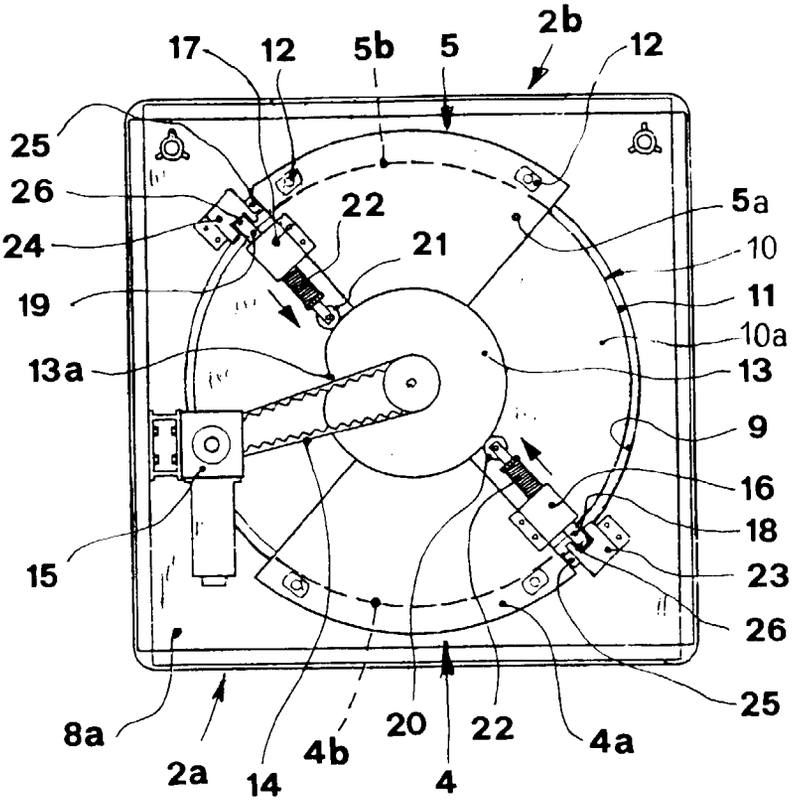
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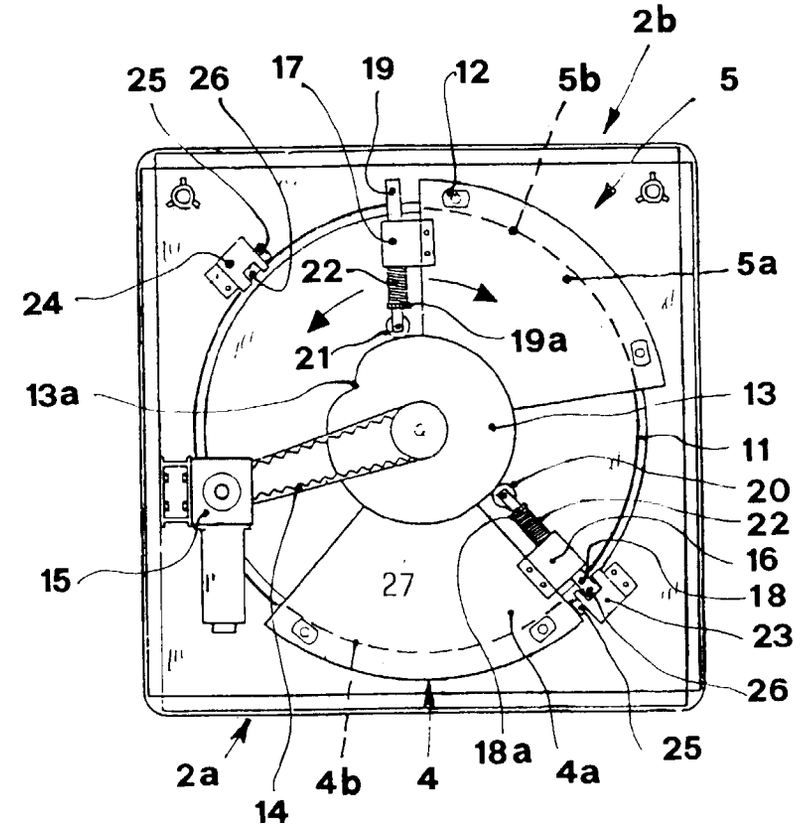
Fig. 5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