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(54) Self-locking device for blinds and closures

(57) Having as essential elements:

- A drive shaft (1) attached to the rolling drum (23) of the blind (21), linked by means of a first free wheel mechanism (2) to an actuating cylinder (4) having a releasing sector (5).
- A lobed wheel (17) having projections (18) between which corresponding extensions (19) of the slats (20) of the blind (21) are housed, and which is linked through a second free wheel mechanism (15) and certain gear elements to a locking sector (26).
- A fixed braking cylinder (7), housing inside of it a braking spring (9), the ends of which make up as many stops (10) defining two sector housings intended for receiving the releasing sector (5) and the locking sector (26), the latter acting upon the stops (10) in the direction of increasing the apparent diameter of the braking spring (9), and the releasing sector in the direction of reducing the apparent diameter of the braking spring (9).

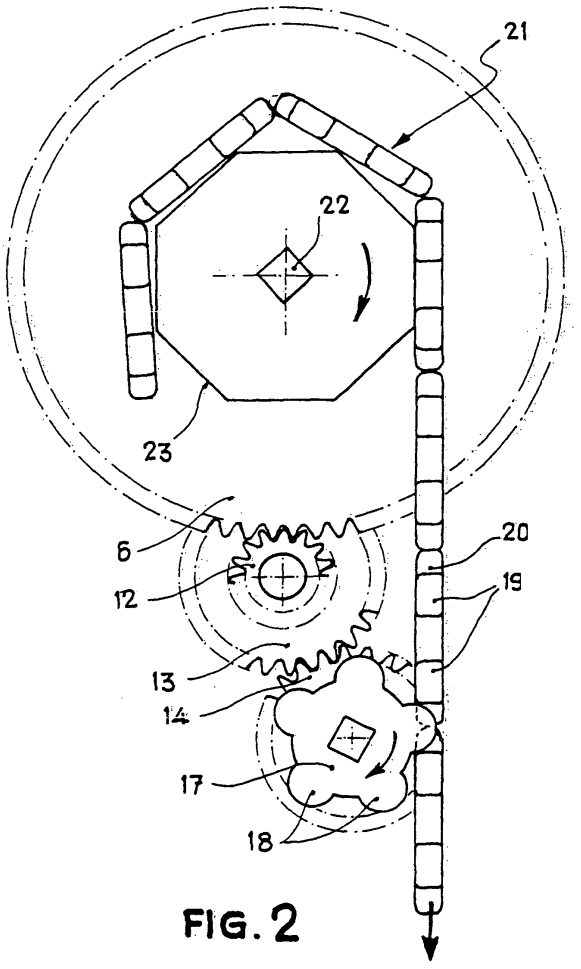

FIG. 2

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Description

[0001] The present invention refers to a system for locking with total safety blinds and closures intended for preventing passage through doors, windows or any other type of opening that buildings usually have on their facades.

[0002] Safety against intrusions inside buildings has become a prime need in our time. Different devices are normally used to achieve the desired safety, ranging from alarms to physical barriers, fixed or removable, in such a manner that they either detect that an intrusion has occurred or make it impossible or at least difficult.

[0003] On the other hand, devices based on rolling a slat blind about a rotating drum, which allows to totally cover doors, windows, shop windows, and other openings in building facades, have been known for a while. These devices are based on a mechanism of great simplicity whereby the blind is rolled about a rotating drum during the lifting manoeuvre, while the descent is performed by gravity due to the weight of the blind as it unrolls from the rotating drum as the latter allows it. This operating asymmetry of the device causes problems when intending to immobilize the blind in a safety position given that, although the operating mechanism is irreversible, it is always possible to lift the blind by hand from the outside. The solution of mounting locks on the inner side of the blind poses aesthetical problems, apart from requiring a manual and voluntary action for locking the same, with the corresponding risk of oversights.

[0004] It is an object of the present invention to provide a locking device for blinds and closures which actuates automatically without intervention by the user.

[0005] It is another object of the present invention to provide a locking device for blinds and closures which actuates independently from the operating mechanism such that it is not necessary for this operating mechanism to be mechanically irreversible.

[0006] In order to reach the objective set forth a system has been conceived involving the inclusion of a locking mechanism, independent of the operating mechanism, made up of a lobed wheel susceptible of retaining extensions conveniently arranged on the blind slat ends and which are that which circulate along the usual lateral vertical guides. The lobed wheel is in turn linked to a braking mechanism which, in fact, is that which really locks the blind when there is an attempt to manually lift it (hereinafter and within the context of this document, a "blind" shall be understood as any slat-based closing device).

[0007] The braking mechanism is made up of a spring, manufactured in steel wire preferably of a rectangular section, having several coils distributed axially about a same diameter, their ends being radially bent in order to make up a stop at each end. At rest, the spring diameter is greater than the inner circular housing of a fixed braking cylinder, whereby it must be introduced therein after rotating the spring stops in opposite directions and in the appropriate direction in order to reduce its diameter. The geometric line joining the bent ends which make up the stops divides the inner circle of the spring in two sector housings. A latching sector is introduced in one of them and a releasing sector in the other. Note that the basis of the mechanism is based on the braking spring increasing or decreasing its diameter depending on whether the stops are actuated on in one direction or the other. The tendency towards increasing or decreasing the spring diameter causes the latter to become locked or released with respect to the inner housing of the braking cylinder.

[0008] In a preferred embodiment, the drive linking the lobed wheel with the braking mechanism is made up of the aforementioned latching sector forming part of a drive crown gear meshing with an integral auxiliary pinion of an auxiliary crown gear in turn meshing with a drive pinion which transmits movement to a locking shaft attached to the lobed wheel.

[0009] The descending manoeuvre is carried out by gravity, and for this to be possible it is necessary that the blind slat extensions may drag the lobed wheel in their descent movement. The solution set forth involves providing a free wheel mechanism between the lobed wheel and the braking mechanism.

[0010] During the lifting manoeuvre it will have be possible to move the lobed wheel in a direction in which it should be locked by the braking spring. It has been necessary to introduce two novel concepts in the device to solve this problem.

[0011] The first one entails deactivating the braking mechanism during the manoeuvre, which is achieved by making the integral drive shaft of the blind rolling drum move an actuating cylinder having a releasing sector which is introduced between the braking spring stops and moves them in the direction of reducing the diameter thereof. Thus, during the lifting manoeuvre it is achieved that the lobed wheel is no longer braked but rather moves with a speed depending on that of the drive shaft and determined by a drive.

[0012] The second novel concept solves the problem set forth by the fact that the linear speed of the blind varies for a same speed of the rolling drum because the blind rolls about itself during the lifting manoeuvre and, consequently, progressively increases the apparent diameter defining the linear speed of the blind. The solution set forth entails sizing the different elements of the drive linking the drive shaft with the lobed wheel so that the latter tries to move with a speed clearly greater than that which would correspond to being linked with the blind slats through the extensions thereof. Thus the lobed wheel rotation is subject to a slide which is made possible by the free wheel mechanism which already had to be introduced to make the voluntary blind lifting manoeuvre possible.

[0013] Finally, and given that the drive shaft is linked with the releasing sector of the actuating cylinder braking spring, it will be necessary to introduce another free wheel mechanism between them to prevent the braking spring from becoming released during the descent ma-

noeuvre and the lobed wheel from trying to turn dragging the blind downwards at a speed constant and far greater than that allowed by the drive shaft movement.

[0014] There is consequently an obvious synergy between the different essential elements make up the device of the invention, which are no other than:

- An integral drive shaft of the blind rolling drum, linked by means of a first free wheel mechanism with an actuating cylinder having a releasing sector.
- A lobed wheel having projections between which corresponding extensions of the blind slats are housed, and which is linked through a second free wheel mechanism and different drive elements to a locking sector.
- A braking spring having several coils axially distributed about a same diameter and the radially-bent ends of which constitute as many stops defining two sector housings intended for receiving the releasing sector of the actuating cylinder and the locking sector of the drive crown gear.

[0015] The advantages of such a solution are basically the following:

The blind is locked at the end of a total or partial descent operation.

[0016] Blind locking occurs even though the operating device is not mechanically irreversible.

[0017] The blind is locked at any intermediate point in a lifting or descent operation, which allows passage of air and light.

[0018] Locking occurs automatically. The blind is always locked in any position it is left in. It is not necessary to perform any additional operation, whereby it is impossible to forget to lock the blind.

[0019] In order to complete the preceding description and with the purpose of aiding in a better understanding of the features of the invention, a detailed description of a preferred embodiment will be made based on a set of drawings attached to this specification and in which the following is has been depicted in a merely guiding and non-limiting character:

Figure 1 shows an elevational view of the device of the invention, with several sections so as to appreciate details of the braking mechanism and the anchoring of the rolling drum.

Figure 2 shows a side view.

Figure 3 shows a schematic section through line III-III of Figure 1.

Figure 4 shows a detail of the braking mechanism, similar to that depicted in Figure 1, with the drive shaft assembly in exploded view.

Figure 5 shows a perspective view of the braking spring.

Figure 6 shows a perspective view of the assembly formed by the drive shaft and the actuating cylinder, linked by the first free wheel mechanism.

Figure 7 shows a perspective view of the assembly formed by the lobed wheel and the drive pinion, linked by the second free wheel mechanism.

Figure 8 shows a perspective view of one of the free wheel mechanisms.

Figure 9 shows a perspective view of the assembly formed by the lobed wheel and the slotted disc, which forms part of the blind position locking mechanism.

Figure 10 shows a side view of the blind position locking mechanism.

[0020] In said figures the numeric references correspond to the following parts and elements.

1. Drive shaft
2. First free wheel mechanism
3. Outer bushing of the free wheel mechanisms
4. Actuating cylinder
5. Actuating cylinder releasing sector
6. Drive crown gear
7. Braking cylinder
8. Braking cylinder lugs
9. Braking spring
10. Braking spring stops
11. Casing
12. Auxiliary pinion
13. Auxiliary crown gear
14. Drive pinion
15. Second free wheel mechanism
16. Locking shaft
17. Lobed wheel
18. Projections
19. Extensions
20. Slats
21. Blind
22. Square-sectioned iron bar
23. Blind rolling drum
24. Slotted disc
25. Sensor
26. Locking sector

[0021] As can be seen in Figures 1, 2, and 4, the device of the invention consists of a drive shaft (1), operating in both rotation directions, that can rotate inside a first free wheel mechanism (2), the outer bushing (3) of which is pressure mounted in the inner diameter of an actuating cylinder (4) having a releasing sector (5) on one of its faces.

[0022] A drive crown gear (6) having a sector housing receiving with clearance the releasing sector (5) of the actuating cylinder (4) may freely rotate about the drive shaft (1), whereupon the drive crown gear (6) and the actuating cylinder (4) rotate integrally, except for the clearances existing between the releasing sector (5) and its housing in the drive crown gear (6). See Figure 4.

[0023] A braking disc (7), attached to the casing (11) of the device by two lugs (8), has a circular housing where a braking spring (9) is arranged. This braking spring,

made of rectangular-sectioned steel wire, has several coils which are axially distributed about a same diameter and its radially-bent ends make up as many stops (10). Its diameter at rest is greater than that of the circular housing of the braking disc (7), whereby it must be introduced therein after rotating the stops (10) in opposite directions and in the right direction in order to reduce its diameter. See Figures 1, and 3 to 5.

[0024] The drive crown gear (6) has a locking sector (26) on one of its front faces which is housed between the stops (10) of the braking spring (9) on the side opposite the releasing sector (5), as shown in Figures 1 and 3.

[0025] The drive crown gear (6) meshes on the outside with a integral auxiliary pinion (12) of an auxiliary crown gear (13), which in turn meshes with an integral drive pinion (14) of the outer bushing (3) of a second free wheel mechanism (15), inside of which an integral locking shaft (16) of a lobed wheel (17) rotatably plays (only in one direction but not in the other). The latter has on its periphery a plurality of projections (18) suitably spaced so that the extensions (19) of the slats (20) of a blind (21) may be housed between them when said extensions move in a notably linear manner along conventional guides, not depicted. See Figures 1 and 2.

[0026] For the purpose of aiding in the understanding of the device, Figures 6 and 7 show each a perspective view of the assembly of the first free wheel mechanism (2) and the second free wheel mechanism (15) on the drive shaft (1) and the locking shaft (16), respectively. Both figures show by means of arrows the relative movements allowed by the respective free wheel mechanisms.

[0027] Figure 8 shows a marketed free wheel mechanism used in the preferred embodiment, which has the appearance of a conventional needle bearing. A separator of asymmetric design, not visible, allows the needles to rotate with respect to the outer bushing (3) in one direction (that of the free wheel), but not in the opposite direction.

[0028] The operation of the self-locking device object of the invention is the following. During the descent manoeuvre the drive shaft (1) rotationally drags, by means of the square-sectioned iron bar (22), the rolling drum (23), which gradually releases the blind (21), allowing its descent by the action of gravity. In Figure 2 the direction of the arrows shows the rotation allowed by the free wheel mechanisms (2) (15), whereupon, as can be seen, the blind (21) can descend freely dragging the lobed wheel (17). The drive pinion (14), the auxiliary crown gear (13), the auxiliary pinion (12) and the drive crown gear (6), which make up the drive, remain still given that the locking sector (26) of the drive crown gear (6) is retained by the stops (10) of the braking spring (9), itself firmly applied against the braking cylinder (7) as seen in Figure 3.

[0029] During the lifting manoeuvre the first free wheel mechanism (2) remains locked, whereby the drive shaft (1) drags the actuating cylinder (4) in the anticlockwise direction, the releasing sector (5) of which drags the braking spring (9) in the direction of reducing its apparent diameter, which allows it to slide with respect to the braking cylinder (7). The drive crown gear (6) is thus mobilised, which transmits movement to the outer bushing (3) of the second free wheel mechanism (15) through the auxiliary pinion (12), the auxiliary crown gear (13), and the drive pinion (14). The lobed wheel (17) should therefore move upwards at the speed determined by the size the different elements of the drive.

[0030] However, the speed of the movement of the lobed wheel (17) is defined by the blind (21) itself upon rolling upon itself, in a value clearly lower than that determined by the size of the drive. That is, a relative slide occurs between the integral locking shaft (16) of the lobed wheel (17) and the drive pinion (14), precisely in the direction allowed by the second free wheel mechanism (15).

[0031] Regarding the self-locking of the device of the invention, note that if an attempt is made to force the blind by pushing it upwards, the lobed wheel (17) will try to rotate in the anticlockwise direction, blocking the second free wheel mechanism (15) and transmitting an effort through the locking shaft (16), drive pinion (14), auxiliary crown gear (13), auxiliary pinion (12), drive crown gear (6), locking sector (26), and stops (10) to the braking spring (9), applied firmly against the braking cylinder (7), itself immobilised with respect to the casing (11) by means of the lugs (8). See Figures 1, 2, and 3.

[0032] For the purpose of improving the safety of the self-locking device of the invention, an electronic blind position capture mechanism may be additionally arranged. Thus, if for any reason (breakage of a mechanical member) the intruder manages to move the blind (21), an alarm indicative that the self-locking device has been overcome will be triggered. This electronic blind position locking device involves arranging on the bolster opposite the one fitted with the locking device a lobed wheel (17), identical to the one described above, integrally attached to a slotted disc (24) facing a sensor (25) connected to an electronic alarm, which is not described in detail due to it being commonly known by a person skilled in the art. In a preferred embodiment, the sensor (25) is of the variable reluctance detection type, as it has been verified that optical sensors detecting the presence of dimensional discontinuities may eventually fail with time due to the dirt which accumulates thereon and interrupts the optical path. It is obvious that any other equivalent device of those existing in the market (multiturn potentiometer, ultrasonic sensor, etc.) would accomplish the objective set forth. Likewise, it may be possible to assemble the slotted disc (24) directly on the locking shaft (16) itself attached to the second free wheel mechanism (15), which would simplify the device of the invention by using a single bolster and a single lobed wheel (17).

[0033] Other modifications and alternatives to the preferred embodiment for the purpose of adapting the device to different stress conditions, costs, and manufacturing means shall be apparent to a person skilled in the art. A certain free wheel mechanism has thus be used which

is normally available in the market, but likewise any other with the required functionality could be used even though its shape does not correspond exactly to that shown in Figure 8. Likewise, the locking sector (26) and the releasing sector (5) have been depicted as bounded by circular surfaces, although this does not necessarily have to be the case. Finally, the drive does not necessarily have to comprise an auxiliary pinion (12) and an auxiliary crown gear (13), but may have a variable number of gears or equivalent devices according to certain constructive variables, most especially the distance between the drive shaft (1) and the locking shaft (16).

[0034] In order to aid in the understanding of the invention, only those essential elements thereof have been shown. The figures have also been devised to be as intuitive as possible, even at the slight expense of representational faithfulness. Thus, for example, the lobed wheel (17) has been positioned in Figure 2 so that the blind (21) is vertical. It is obvious that the distance in vertical projection between the lobed wheel (17) and the rolling drum (23) will be a function of the amount of blind that must be stored in the latter.

Claims

1. A self-locking device for blinds (21) and closures, **characterised in that** it comprises:

   - a drive shaft (1) operating in both rotation directions,
   - a rolling drum (23) of a blind (21), rotatably integral to the drive shaft (1),
   - a first free wheel mechanism (2) in which the drive shaft (1) plays, and the outer bushing (3) of which is integral to an actuating cylinder (4) having a releasing sector (5),
   - a second free wheel mechanism (15) in which a locking shaft (16) plays and the outer bushing (3) of which is integral to a drive pinion (14),
   - an integral lobed wheel (17) of the locking shaft (16), which has a series of projections (18) on its periphery, suitably spaced so that extensions (19) from the slats (20) of the blind (21) may be housed therebetween,
   - a drive crown gear (6) freely rotatable on the drive shaft (1), provided with a locking sector (26) on one of its faces and a housing intended for receiving the releasing sector (5) of the actuating cylinder (4) with a certain clearance,
   - a braking mechanism made up of a braking spring (9) formed by several coils of an resilient wire which are axially distributed about a same diameter, with its ends radially bent in order to make up stops (10), the braking spring (9) being firmly housed inside an integral braking cylinder (7) of the bushing (11) of the device such that by the line passing through both stops (10) of the braking spring (9) defining two opposing housings, one of which receives the locking sector (26) of the drive crown gear (6) and the other the releasing sector (5) of the actuating cylinder (4), the locking sector (26) actuating on the stops (10) in the direction of increasing the apparent diameter of the braking spring (9), and the releasing sector (5) of the actuating cylinder (4) in the direction of reducing the apparent diameter of the braking spring (9),
   - a drive linking the drive crown gear (6) with the drive pinion (14).

2. A self-locking device for blinds (21) and closures according to claim 1, **characterised in that** the drive comprises an auxiliary pinion (12) meshing with the drive crown gear (6) and is integral to an auxiliary crown gear (13) meshing with the drive pinion (14).

3. A self-locking device for blinds (21) and closures according to claim 1, **characterised in that** it incorporates an integral slotted disc (24) of a lobed wheel (17) having on its periphery projections (18), suitably spaced so that extensions (19) of the slats (20) of the blind (21) may be housed therebetween, and a sensor (25) facing the slotted disc (24), susceptible of detecting peripheral irregularities thereof.

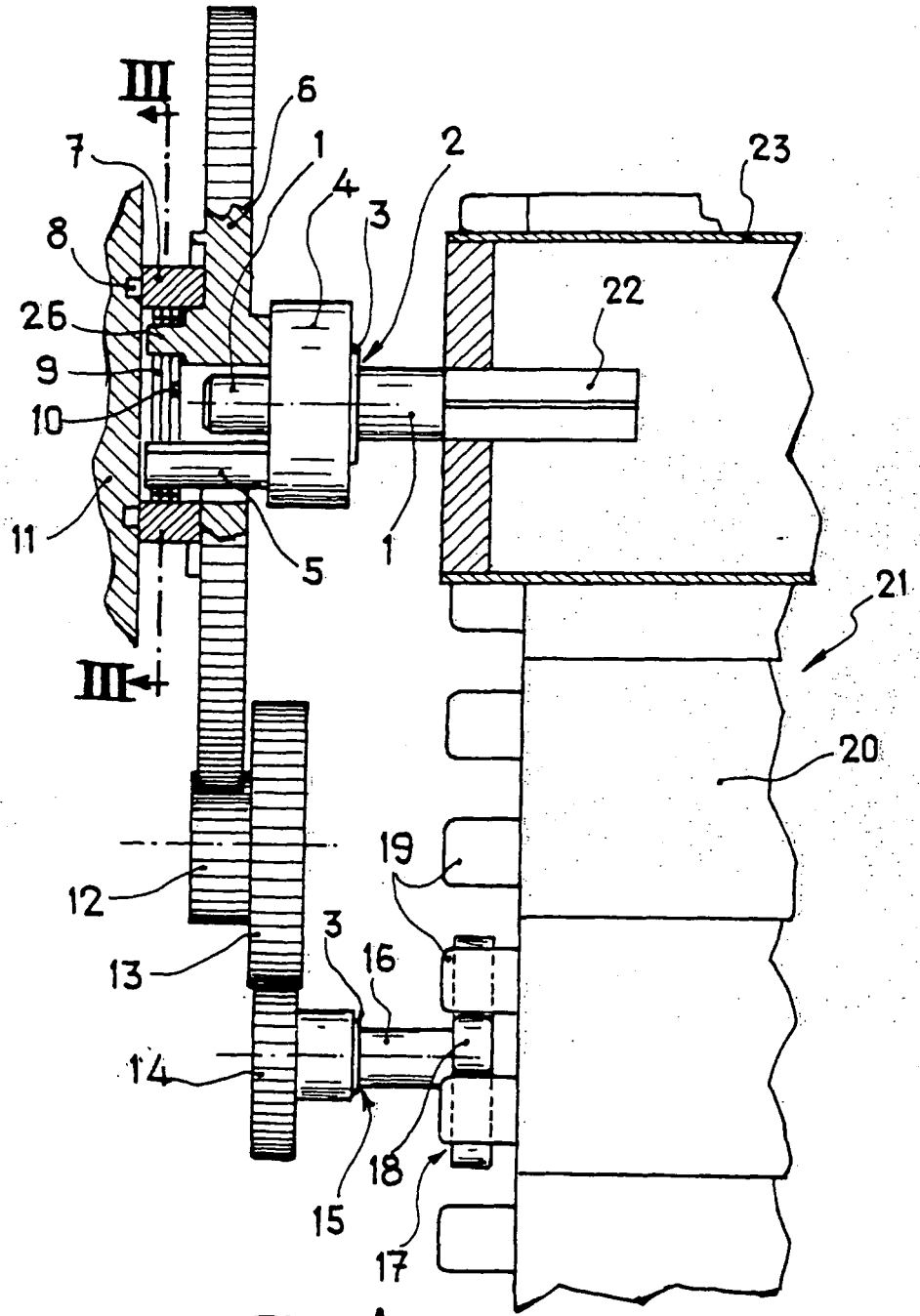

FIG. 1

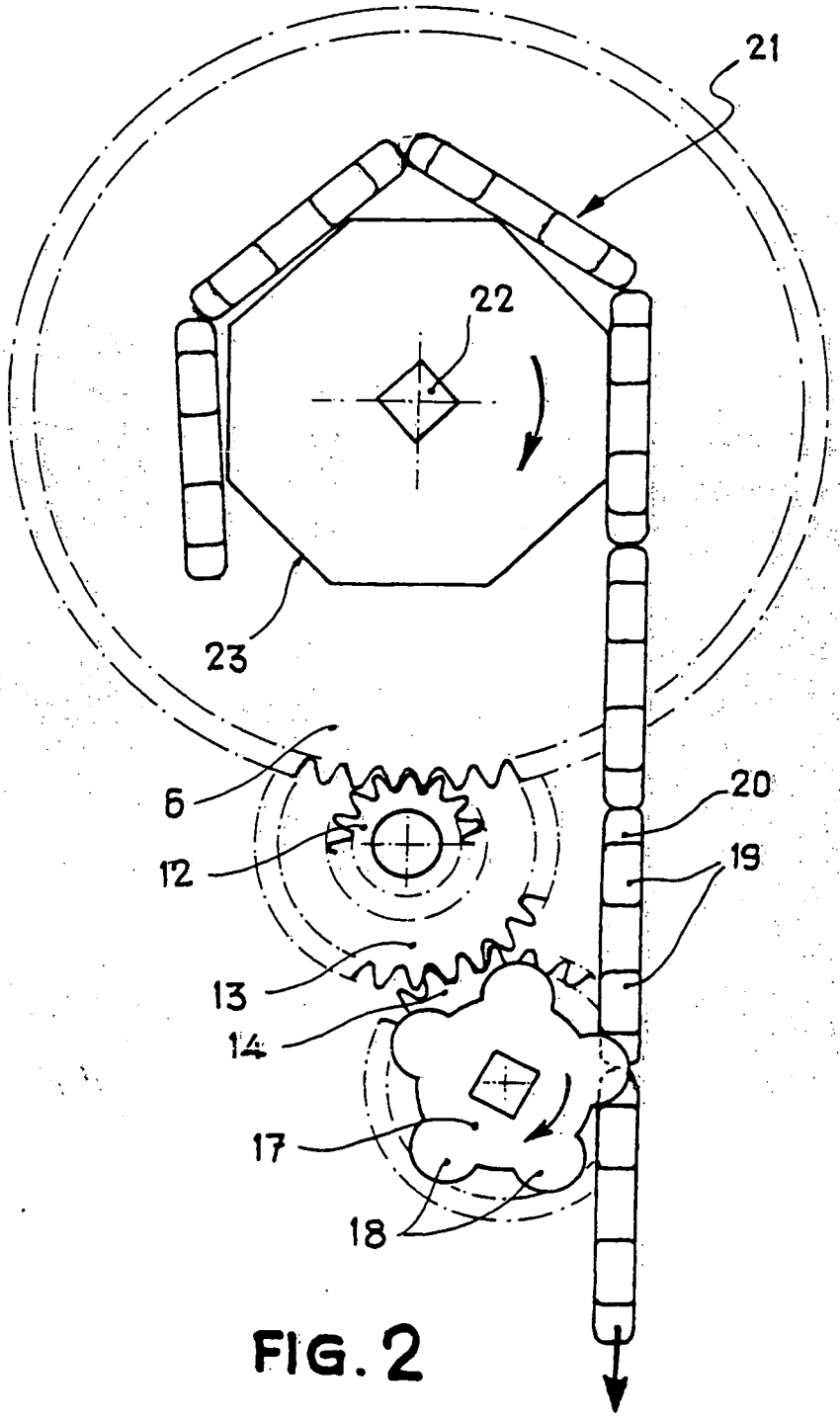

FIG. 2

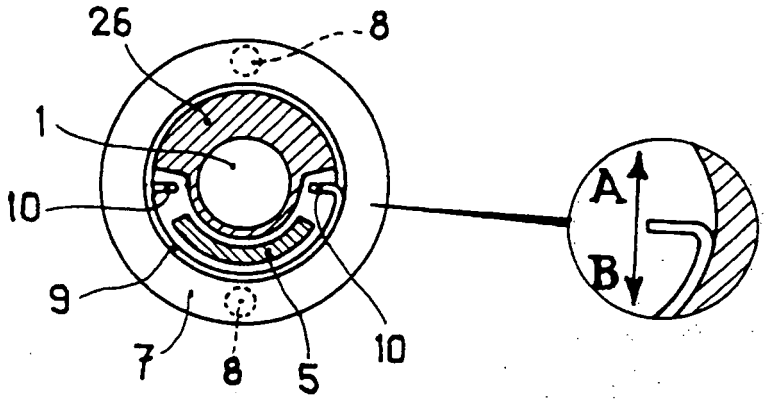

FIG. 3

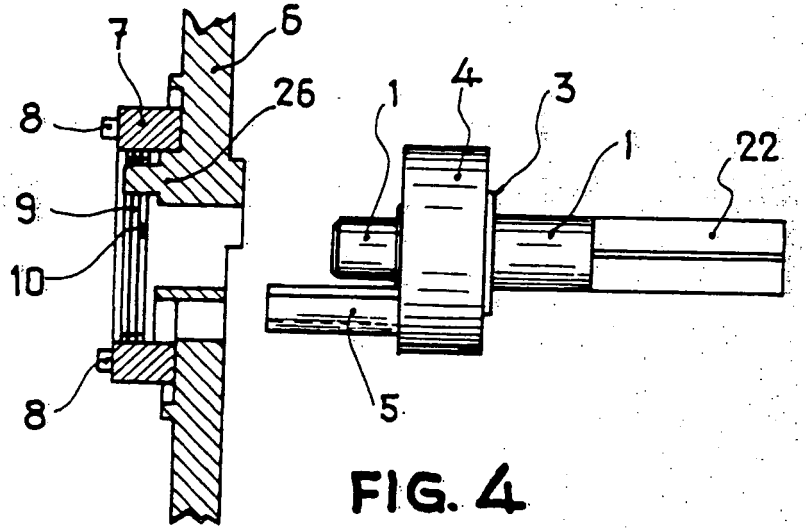

FIG. 4

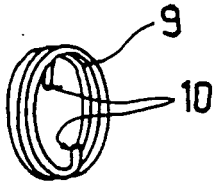

FIG. 5

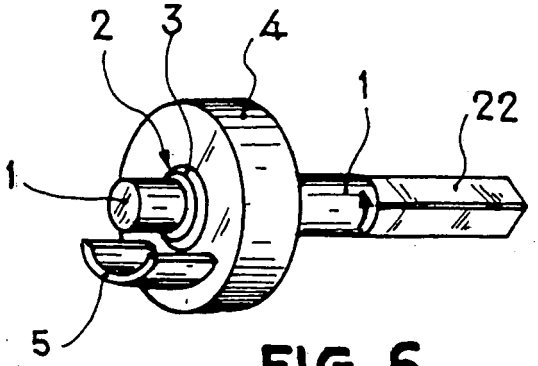

FIG. 6

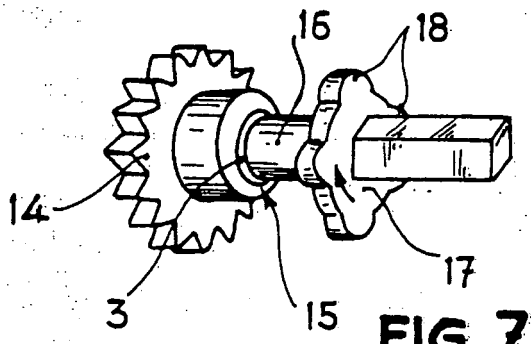

FIG. 7

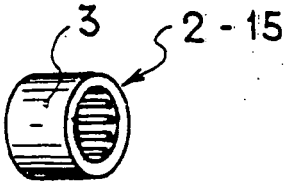

FIG. 8

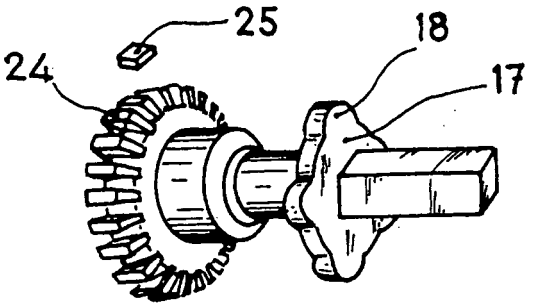

FIG. 9

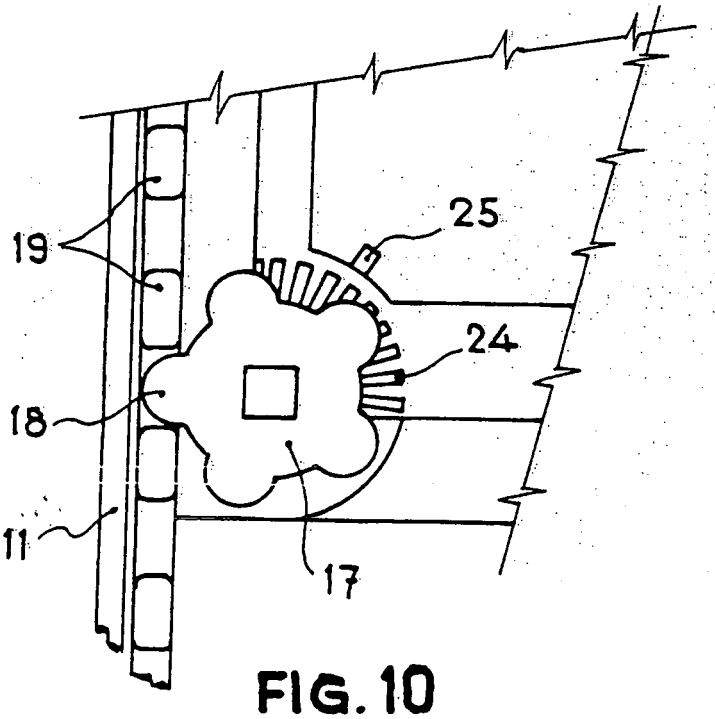

FIG. 10