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(54) Motor-reducing device for winding blinds and awnings and method of operation

(57) Consisting of an external tube (3) inside which an electric motor (14) is installed which acts through an electro-brake (13) and a planetary reducer (15) on a matrix ferrule (4) which is coupled to the inside of a polygonal drum (17) to which it transmits its movement, and in which the winding up/down of a blind or awning (18) takes place, its position being controlled by a linear potentiometer (16) joined to a prisoner nut (10) that can travel longitudinally in both directions with respect to a threaded rod (19) that is solidary with a toothed wheel (7) that is geared by the inside of a control ferrule (2) which received the movement from the polygonal drum (17) to the inside of which it is coupled. A printed circuit (11) memorises the extreme raising/lowering positions of the first operations carried out after having activated a restoration microswitch (5).

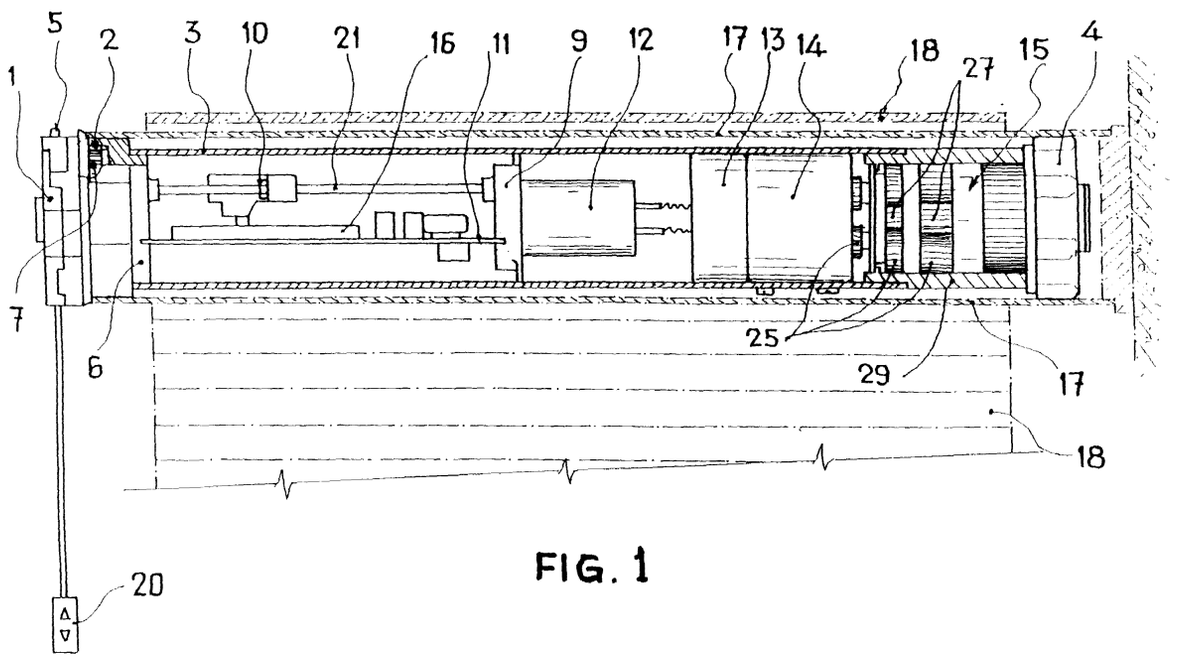

FIG. 1

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Description

[0001] This invention refers to an electronic system for the adjustment of stops and start-up of blind and awning automatic winding motor-reducers. The adjustment of the maximum stops for lowering and raising is carried out by means of an electronic plate controlled by a micro-processor with a single pressing action in each sense, from the final users control mechanism. The system is capable of adjusting the stops in such a way that cannot be cancelled from the control used by the final user.

[0002] There are adjustment systems that operate mechanically on the motor-reducer itself, which have serious disadvantages, such as the lack of space and the use of additional tools, which makes adjustment difficult.

[0003] German patent DE 4038923 describes a motorization for blind winders that uses a prisoner nut to activate two extreme position stops. The stops are also installed on prisoner nuts so that their position can be altered by turning the screws on which they are mounted. This system has two serious problems: on the one hand, the linear movement of the prisoner nut has to be transmitted to the opposite side of the motor-reducer device, which is performed by a flat metal strip that occupies space and restricts the size of the activation motor; and, on the other hand, the prisoner nut cannot move a great distance and because the micro-switches that are the extreme stops are relatively large, the assembly lacks prevision. It is also a totally mechanical device, subject to maladjustment and wear, and consequently to faults.

[0004] A considerable improvement on the previous system is the device described in US patent 5.709.349. In this case the transmission of the linear movement of the prisoner bolt and the micro-switches that are the extreme stops have been eliminated. Instead, the mechanical blocking of a prisoner nut is used to produce an overload for the motor, which is detected by an electronic circuit. The system is more reliable from a mechanical viewpoint, but it implies the use of a costly electronic circuit to detect the motor overload. Adjustment is made by turning the casing that contains the prisoner nut, which is not very convenient.

[0005] A further step in the development of mechanically controlled motor-reducers is the device described in document EP O 940 552. Here, the concept of interrupting the electric supply to the motor when the blind has reached its extreme positions has disappeared. Instead, it presents mechanical clutches that allow the motor to run in a vacuum, when the blind reaches the end of its path or meets with an obstacle on the way. This device has the least electric complication with the greatest mechanical complication. Although on paper it is very attractive, its reliability over time is to be doubted.

[0006] In view of the serious problems presented by mechanically controlled motor-reducer systems, there have been different attempts to use electronic controls of different kinds: document EP O 552 459 describes the use of virtual electronic stops by the use of an electronic control device in programming mode. The position of blind is determined by an impulse counter. The impulses are generated by a fixed Reed relay and numerous permanent magnets around the blind's winding drum. The control device has a programming mode and an operating mode and, consequently, the possibility of the final consumer acting on the motor-reducer is perfectly accessible, which is in no case convenient.

[0007] Along this line of electronic motor-reducer control, the device described in document US 5.540.264 is possibly one of the most sophisticated systems. Here the impulse counter is abandoned and replaced with a series of inductive end stops, the position of which on the side guides of the blind is adjustable, and which are activated by permanent magnets on the end of the blind. A linear inductive sensor, positioned along one of the side guides of the blind, produces an electro-driving force in proportion to its speed. Thus, there is total control over the movement of the blind, eliminating the impulse counter, in exchange for complex external wiring, which makes the system inappropriate for motorising existing installations.

[0008] Other motor-reducers in which the adjustment is carried our from the final user's control mechanism work in the following way:

- Press the control mechanism levers at the same time for more than 15 seconds (this operation automatically cancels previous adjustments).
- Release the levers.
- Press the raising lever and keep it pressed until the blind is in the desired position.
- Release the lever.
- Press both levers at the same time for more than one second. Release the lowering lever, keeping the raising lever pressed for more than one second. This operation memorises the upper stop limit.
- Press the lowering lever and keep it pressed until the blind is in the desired position.
- Release the lever.
- Press both levers at the same time for more than one second. Release the raising lever, keeping the lowering lever pressed for more than one second. This operations memorises the lower stop limit.

[0009] This system has a series of disadvantages, such as the fact that it is complicated, slow, and the stops can be cancelled by the final user's control mechanism. This can be very dangerous, because if a piece of furniture or any other object accidentally presses the control levers, the system would be out of control. This system also requires the use of an independent two-lever control device, which is more costly that opposite double-lever controls.

[0010] The motor-reducing device that is the object of

this invention solves the disadvantages previously described, providing total control over the movement of the blind, but with adjustment operations independent from the final user's control operations.

[0011] The motor-reducing device that is the object of this invention incorporates a linear potentiometer that is an electric, virtual representation of the blind's position. This potentiometer is activated by a prisoner nut that receives the movement from a polygonal control ferrule adjusted to the inside of the blind drum, which in turn receives the movement from a matrix ferrule activated by an electric motor and a planetary reducer. This allows the matrix ferrule and the control ferrule to be positioned on opposite ends of the motor-reducing device, since the drum of the blind is used as the element that solidarises both ferrules. In this way, practically all the interior volume of the drum of the blind is used, which allows us to use larger components, gaining manoeuvring power and adjustment precision.

[0012] On the same end where the control ferrule is positioned, there is a restoration micro-switch, easily accessible from outside the motor-reducing device, but which can not be manipulated by the final user during normal operations.

[0013] With the device that is the object of this invention, the adjustment operation is simplified as follows:

- We press and release the restoration micro-switch.
- We press and release the raising or lowering control lever, depending on which of the stops we wish to memorise.
- When we reach the desired stop position, we press either of the levers. The end position for raising or lowering is memorised.

[0014] Consequently, the memorisation of the two upper and lower stops is carried out automatically in the two operations that immediately follow pressing the restoration micro-switch.

[0015] The device that is the object of this invention ensures, by means of the micro-processor, protection against possible accident during domestic use:

- Detection of the motor-reducer failing to turn, which could be brought about by overloads or blockage.
- Detection of the motor overheating, by means of a heat relay.

[0016] The motor-reducing device that is the object of this invention ensures the availability of:

- A compact motor-reducing device, fully assembled, ready to install, that only requires being introduced inside the drum of the blind and connected to the electric supply.
- A motor-reducing device with extremely simple and easy-to-control adjustment operations.
- A motor-reducing device for which the adjustment operations can not be modified in an untimely manner by the final user.

[0017] To complete the previous description and with a view to providing a better understanding of the characteristics of the invention, following is a detailed description based on a set of drawings that are attached to this description, where the following has been represented (orientatively, without limitation):

Figure 1 shows a side section view of the device that is the object of the invention.
Figure 2 shows an upper section view of the device that is the object of the invention.
Figure 3 shows a III-III transversal section following the transmission of the movement from the control ferrule to the prisoner nut.
Figure 4 shows a IV-IV transversal section in which we see the transmission of the movement from the prisoner nut to the sliding potentiometer.
Figure 5 shows a V-V transversal section in which we see the recurring position of the planetary reducer and the coupling of the matrix ferrule to the inside of the drum of the blind.
Figure 6 shows the printed circuit electric diagram that contains the sliding potentiometer and the micro-processor.

[0018] In these figures, the numerical references correspond to:

1.- Motor-reducer support
2.- Control ferrule
3.- Exterior tube
4.- Matrix ferrule
5.- Restoration micro-switch
6.- External support of the printed circuit and threaded rod
7.- Gearing that activates the threaded rod
9.- Internal support of the printed circuit and threaded rod
10.- Prisoner nut
11.- Printed circuit
12.- Motor starter condenser
13.- Electro-brake
14.- Alternate current motor
15.- Planetary reducer
16.- Potentiometer
17.- Winding drum
18.- Blind
19.- Threaded rod
20.- Control button
21.- Support guides for the prisoner nut
22.- Stabilising circuit
23.- Support for prisoner nut
24.- Micro-processor
25.- Planetary gearing
27.- Central pinion

29.- Toothed crown
33.- ADC converter

[0019] As can be seen from figures 1 and 2, inside the drum (17) in which the blind is rolled, a tube (3) is introduced, inside which the entire motor-reducing device is positioned. This device consists of an electric motor (14) coupled to a planetary reducer (15) which transmits the movement to driving matrix (4) which is able to revolve around the fixed external tube (3), and is therefore liable to be coupled to the inside of the drum (17) in which the blind (18) is rolled. The control ferrule (2) has internal teeth that links to a gearing (17) which is solidary with a threaded rod (19) liable to cause the movement of a prisoner nut (10), which is lodged in a prisoner nut support (23) and slides along two guides (21), transmitting the movement to a linear potentiometer (16) which thus constitutes an electric representation of the physical position of the blind. A restoration micro-switch (5) is fixed to an external printed circuit and threaded rod support (6), and this end of the device is covered by the motor-reducer support (1), solidary with the external tube (3) which immobilised this assembly but allows the control ferrule (2) and the matrix ferrule (4) to turn freely.

[0020] Two printed circuit and threaded rod supports (6) (9) are used for the assembly of the above mentioned items, made up of two metal plates, one of which also acts as an earthing connection, joining the printed circuit (11) on which the linear potentiometer (16) is installed to the external tube (3). On the internal printed circuit and threaded rod support (9) the electric motor (14) starter condenser (12) is installed. The external printed circuit and threaded rod support (6) fastens the restoration micro-switch (5) to the motor-reducer, also preventing the threaded rod activating mechanism (7) from moving out of place.

[0021] As can be seen from figures 1 and 5, the conventional design planetary reducer (15) has three recurring stages, of a similar structure, to attain global reduction of 150:1. Each of the stages consists of three planetary gearings (25) moved by a central pinion (27), which in turn revolve on a toothed crown (29) attached to the external tube (3) which is the casing for the motor-reducing device assembly that is the object of the invention. This circular movement of the shafts of the planetary gearings (25) is transmitted to the following central pinion (27) which links to the planetary gearings for the following stage. The matrix ferrule (4) is solidary with the shafts on which the planetary gearings (25) for the third and final stage are mounted.

[0022] Both the electric motor (14) and the electro-brake (13) are conventional and any of those available on the market can be used, with the only condition that they adjust as well as possible to the diameter of the external tube (3).

[0023] The printed circuit (11) contains a source of supply, a stabilising circuit and a micro-processor detection and control circuit. See figure 6.

[0024] The source of supply is capable of generating sufficient voltage and current to support the entire electronic system. The different components used in the source of supply establish a current that will always circulate through the circuit. Both the resistances R1, R2, the condenser C1 and the diodes D1, D2, D3 and D4 are in charge of this function. Resistances R3 and R4 are for discharging the condenser C1 if there is no input current.

[0025] The stabilising circuit consists of condenser C2. Condenser C3 is made of polyester and rather than to stabilise the voltage it is used to avoid possible high frequency alterations. At this point of the circuit we will have a maximum stable voltage of 15 V. A conventional stabilising circuit (22) of the "7805" type stabilises the voltage at 5 V, and together with condenser C4, it avoids small signal alterations.

[0026] In the micro-processor detection and control circuit, from a stable voltage like we have now we will feed the ADC converter (analogic-digital converter) (33), the micro-processor and the linear potentiometer (16) which will give us the electric signal that is the reflection of the physical position of the blind. The ADC converter (33), taking into account the live value of the linear potentiometer (16), generates an output combination which the micro-processor (24) collects. Three levers are in charge of controlling the entire system. Marked as P1 and P3 in figure 6, these correspond to the control lever (20) and P2 corresponds to the restoration micro-switch (5). As can be seen on the drawing, there is a union between the input to lever P2 and the pin WR of the ADC converter (33). This is due to the fact that the microprocessor (24) will at times act as input and at others as output, providing a signal to activate the internal register of the ADC converter (33). Resistances R7 and R8 are microprocessor outlets (24) with activate transistors TI and T2. These in tun activate relays REL1 and REL2, respectively. Each relay is in charge of activating the motor in one sense or the other. In this system there is a small current absorption system. When one of the relays works, consumption is correct and therefore none of the components of the source of supply become heated. When no relay is functioning, the diodes of the source of supply could burn (not if they are of the right power rating). To avoid this, and for safety purposes, a system of T3 and T4 is installed, activated by resistances R6 and R15, which will work when no relay is functioning. They will thus drive the current through resistance R16, which will emulate the consumption of the relay.

[0027] One of the advantages of this system is the possibility of using, to manoeuvre the motor-reducing device, any of the dual control levers available on the market, since the electronic system is capable of absorbing an incorrect pressing or a double pressing. In a preferred embodiment, we have decided to use a SIMON ref. 31331-30 double control and its accessories, which is perfectly integrated in the style of electric

switches used in homes and offices.

[0028] In the sample embodiment we have used an ADC converter (33) of the AD 0803/4-1 type, from PHILIPS SEMICONDUTORS and a micro-processor (24) of the PIC 16FBX type marketed by MICROCHIP TECHNOLOGY INC.

[0029] The motor-reducing device that is the object of the invention works as follows:

[0030] When the raising lever of the control mechanism (20) is released after being pressed, this simultaneously activates the electro-brake (13) and the motor (14) and the motor (14) will transmit the movement to the planetary reducer (15) which will turn the matrix ferrule (4). In turn, the matrix ferrule (4) makes the drum (17) turn that rolls the blind or awning (18), which transmits the movement to the control ferrule (2). The control ferrule (2) has internal teeth that makes the threaded rod activator gearing (7) turn. This gearing and the threaded rod (19) are solidary. The prisoner nut (10) moves sideways in one direction or the other depending on the direction in which the motor (14) is turning, moving the linear potentiometer (16) mounted on the printed circuit (11) where the signal adapter components are. Thus the entire system moves until either of the two levers on the control mechanism (20) are pressed, when the upper extreme position will be memorised. If we later attempted to raise the blind further, the manoeuvre would not be possible, since the upper stop has been recorded.

[0031] When the lowering lever is released after being pressed, all the above will happen as described, but turning in the opposite direction, and therefore recording the lower stop. From that moment, the mechanism is adjusted and we can proceed to use it normally. We can also stop the motor-reducer at any point that we wish between both stops, proceeding as previously described, but in this case these intermediate positions are not memorised.

[0032] As for the industrial application of the device that is the object of this invention, the motor-reducer will be presented as a compact assembly fully mounted inside the external tube (3) liable to be fixed to a wall by its solidary support (1). See figure 1. From this compact assembly the only projections are the restoration micro-switch (5) and the matrix (4) and control ferrules (2), and this is connected by a cable to the control mechanism (20). The assembly is introduced into the drum (17) of the blind (18), for which the matrix ferrule (4) has a light surface with a view to reducing the resistance produced by friction when this operation is performed. After introducing all the external tube (3) of the motor-reducer into the drum (17), the operation is completed by coupling the control ferrule (2) to the inside of the drum (17). The motor-reducer support (1) is attached to the wall by a set of screws, as can be seen in figure 4, thus immobilising the assembly.

[0033] Although in figure 1 the matrix ferrule (4) has been represented as if it nearly reaches the right-hand side of the blind, it is evident that its position will depend on the width of the blind. As long as the control ferrule (2) is always at one end of the drum (17), the matrix ferrule (4) will penetrate more or less into the drum(17) depending on its length.

Claims

1. Motor-reducing device for winding blinds and awnings **characterised in that** it consist of an external tube (3) inside which an electric motor (14) is installed, which acts through an electro-brake (13) and a planetary reducer (15) on a matrix ferrule (4) positioned at one end and that can freely turn in relation to the external tube (3), and the matrix ferrule (4) is coupled to the inside of a polygonal drum (17) to which it transmits its movement, and in which a blind or awning (18) is wound up or down, with at the opposite end of the tube (3) a control ferrule (2) which, receiving the movement from the blind drum (17) to the inside of which it is coupled, transmits it to means of electric representation of the position of the blind positioned inside the external tube (3) and which, controlled by a printed circuit (11) allows it to memorise the extreme positions in the first raising/lowering operations carried out with the device after having activated a restoration micro-switch (5) positioned on the relevant end of the control ferrule (2) on the external tube (3).

2. Motor-reducing device for winding blinds and awnings, in accordance with claim 1, **characterised in that** the means of electric representation of the position of the blind consist of a linear potentiometer (16) mounted on the printed circuit (11) plaque, which receives the movement from a prisoner nut (10) that can move in both directions with respect to the threaded nut (19) that is solidary with a toothed wheel (7) which gears inside the control ferrule (2).

3. Method of operation for a motor-reducing device for winding blinds and awnings, **characterised in that** a printed circuit (11) memorises the extreme positions of the first raising/lowering operations carried out after having activated a restoration micro-switch (4), so that in subsequent raising/lowering operations the extreme raising/lowering positions that have been memorised can not be altered until the restoration micro-switch (5) is activated again.

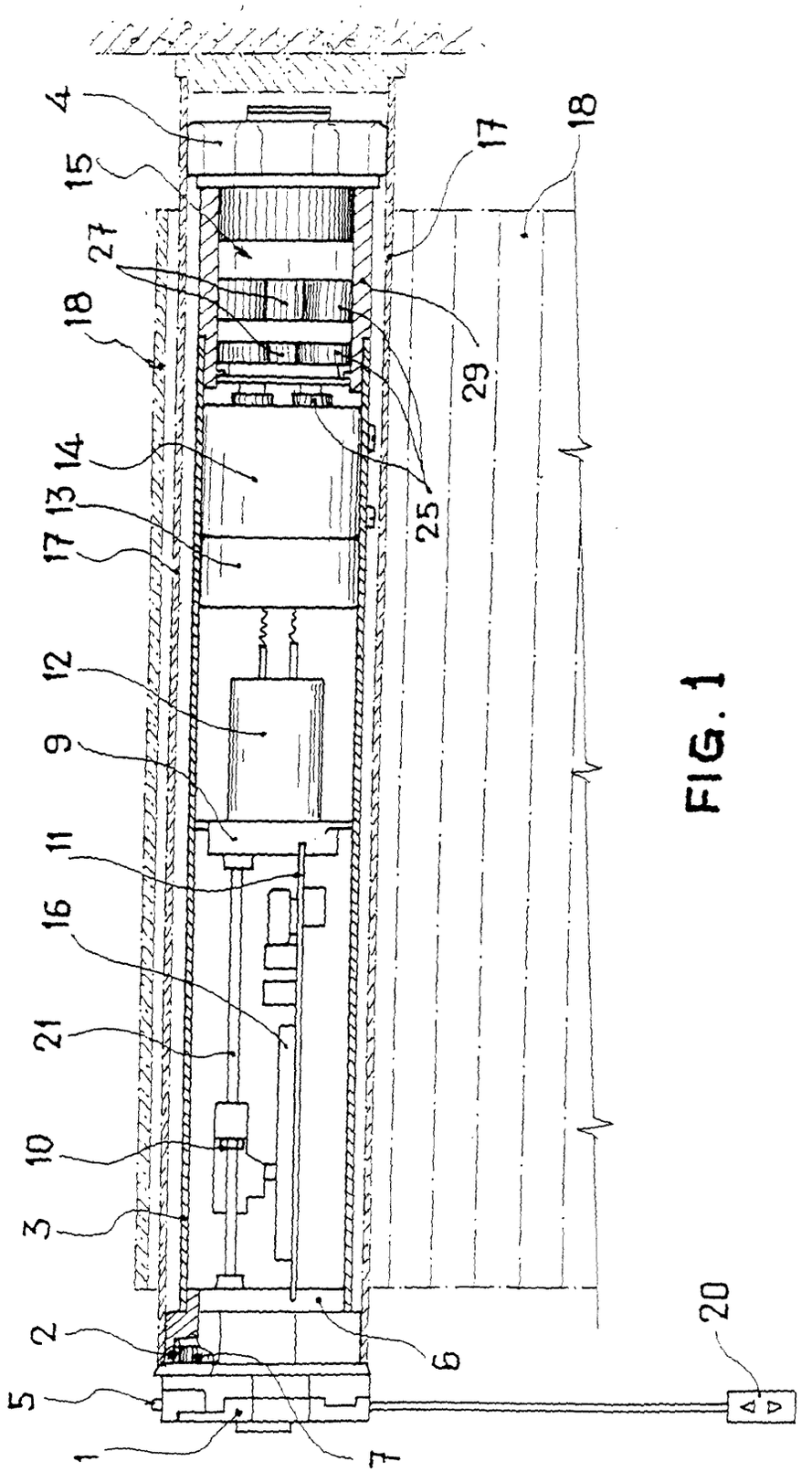

FIG. 1

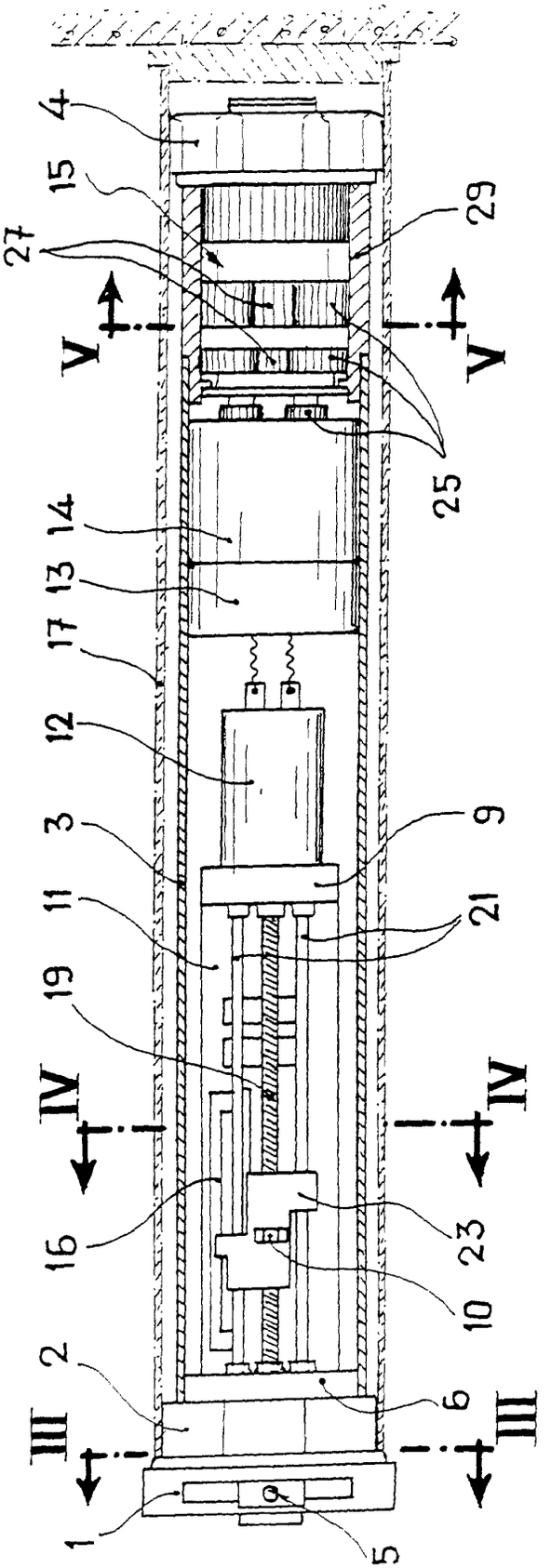

FIG. 2

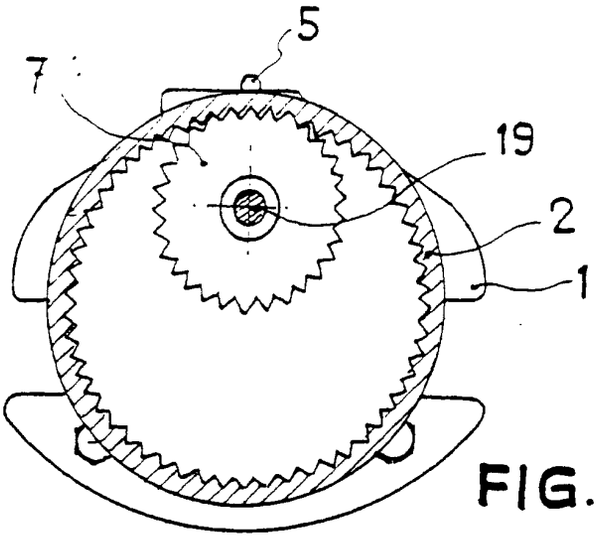

FIG. 3

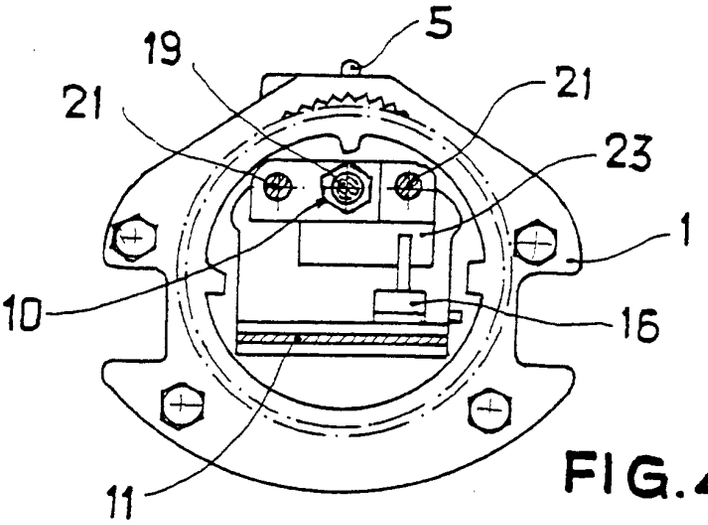

FIG. 4

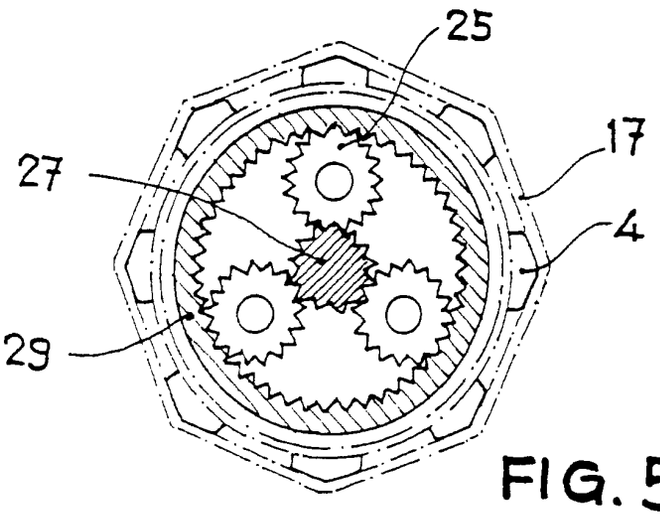

FIG. 5

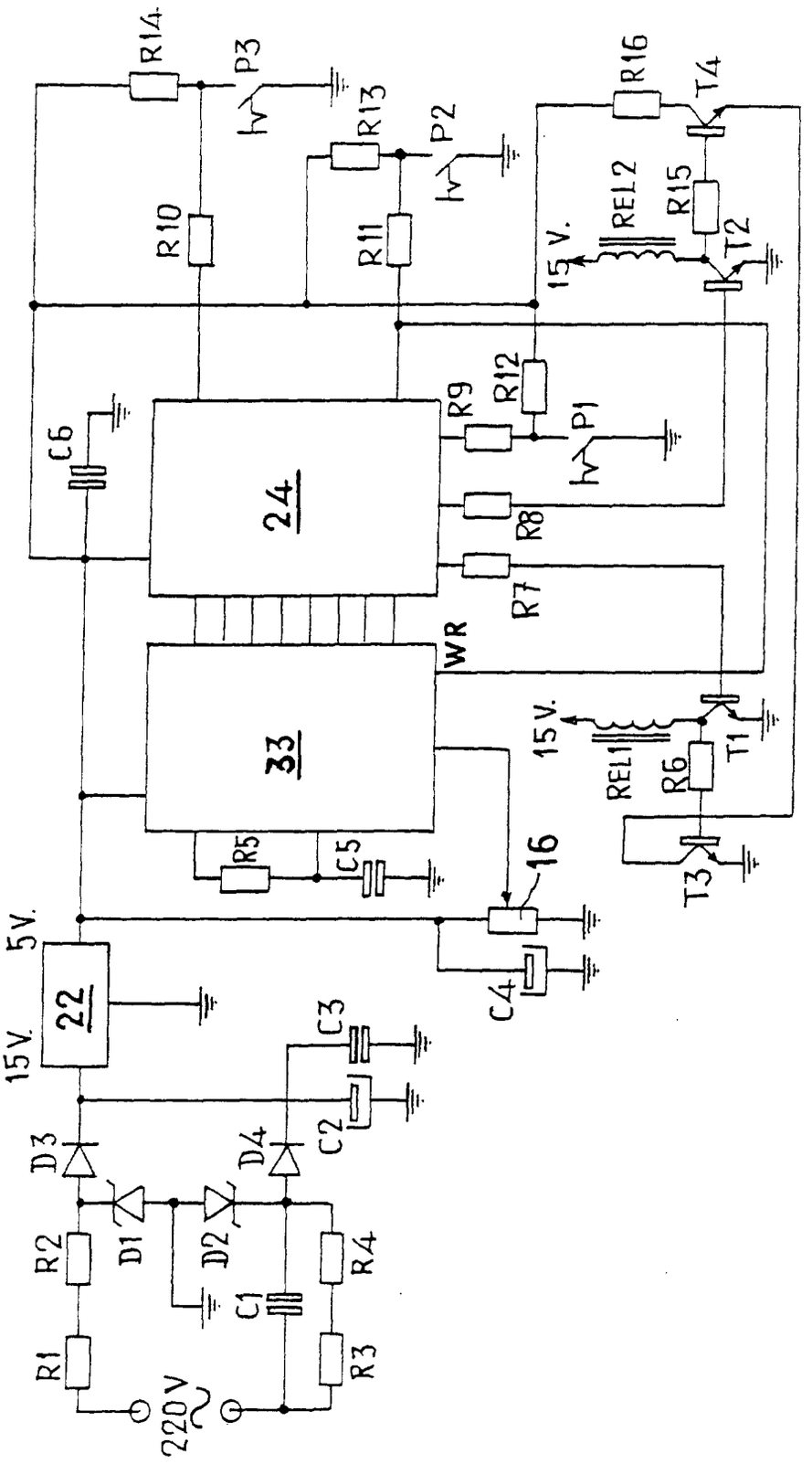
R14
P3
R13
P2
R16
T4
R10
R11
REL2
R15
T2
15 V.
R12
R9
P1
C6
24
R8
R7
WR
33
15 V.
REL1
R6
T1
R5
C5
16
T3
5V.
22
15V.
C3
C4
C2
D3
D4
D1
D2
R2
R4
C1
R1
R3
220V

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

E06B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
MUNICH	23 May 2001	Kofoed, P

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