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(54) Motor driven curtain drawing apparatus.

(57) Disclosed is apparatus for sensing the end of travel of curtain drawn by a cord and associated electric motor. The apparatus consists of an assembly (100), including the motor, in which a sensing member (3;200) is mounted for rotation about a hollow boss (120) carried on a face (101) of the assembly, and through which the motor drive shaft (2) extends. A cord drive pulley (4) is carried at the end of the drive shaft (2) adjacent the sensing means (3;200); a beam member (20;210) is pivotally mounted (21;222) on the sensing means (3;200) above the drive pulley (4) and carries guide pulleys (22, 23) rotatably mounted at each end thereof such that they are spaced apart from the drive pulley (4). The curtain cord (31, 32) is passed between the guide pulleys (22, 23) and looped about the drive pulley (4). When the curtain reaches the end of its travel tension in the end of one cord run (31, 32) increases causing the beam (20; 210) to pivot and bring one of the guide pulleys (22, 23) adjacent the drive pulley (4) such that the cord run (31, 32) is pinched between the said guide (22, 23) pulley and the drive pulley (4) whereby the sensing (3; 200) means is caused to rotate about the hollow boss (120) against resilient means (10; 232, 233). A switch (8) in the motor drive circuit and positioned in the assembly is associated with means (5, 6, 7;) secured to the sensing member and is opened in response to a predetermined degree of rotation of the sensing member to stop the motor drive. The resilient means (10; 232, 233) acting against the sensing means (3; 200) control the degree of rotation of the sensing means, and further means (14, 15; 234) are provided to act on the resilient means and vary the force acting between the said means and the plate whereby the tension in a cord run (31, 32) required to cause rotational movement of the sensing means (3; 200) can also be varied.

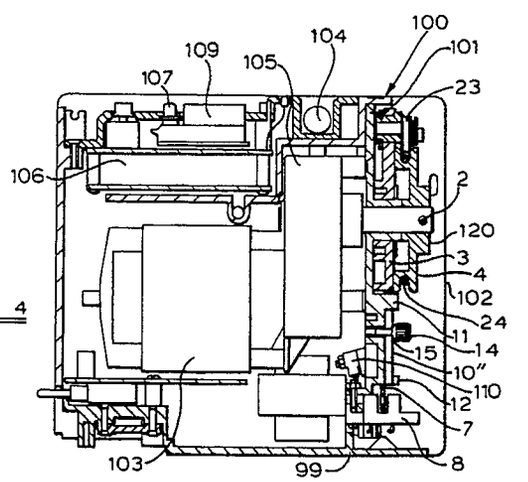

FIG 4

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The present invention relates to motor driven curtain drawing devices and in particular to means for sensing the end of travel of the curtain and disengaging the motor drive.

Electric motor driven curtain drawing devices are well known, however there exists a need for a convenient means to sense the end of travel of the curtain during opening or closing and for disengaging the motor drive automatically at the end of travel.

We have now developed a device for use with electrically driven motors that senses an increase in tension in a cord run and triggers a switch when the tension reaches a pre-determined level to break the electric circuit to the motor and thereby disengage the motor drive to the cord.

The cord may be a curtain cord used to open and close curtains across a window or it may be a cord used to transfer other articles between two positions.

The present invention provides an apparatus for sensing the end of travel of a cord run driven by an electric motor comprising:

a first plate member rotatably secured to a hollow boss extending outwardly from a second plate member forming a part of a motor drive assembly unit;

a cord drive pulley wheel secured to the end of a motor drive shaft extending through the said hollow boss carrying the said first plate member;

a beam member pivotally mounted on said first plate member, having its pivotal axis parallel to the motor drive shaft and carrying two rotatable guide pulleys one on each side of the said pivot and spaced apart from the said drive pulley;

resilient means acting between said first plate and said second plate to control the rotation of said first plate;

and switch means for controlling the electrical circuit to the motor drive in response to a predetermined degree of rotational movement of the said first plate member;

said cord being looped about the drive pulley, an end of each cord run passing between the drive pulley and a respective guide pulley, whereby on energisation of the motor, tension in one cord run urges the beam member to pivot to bring one guide pulley adjacent the drive pulley to pinch the other cord run therebetween and impart a rotational force to the said first plate.

In an embodiment the said first plate includes two arm portions extending substantially parallel to a line through the motor drive shaft and said beam pivot axes and away from said drive shaft the resilient means acting against each said arm portion and means secured to the said second plate to resist rotational movement of said first plate, the said arm portions being linked by a transverse member which acts to actuate the said switch means in response to swinging movement of the arm members caused by rotational movement of the said first plate.

In another embodiment the first plate includes a single arm portion extending substantially vertically downwardly away from the said beam member and said resilient means acts against said arm to resist rotation of the said plate.

The present invention will now be described with reference to the accompanying drawings, the drawings relating to an electrical motor drive assembly unit and cord tension sensing device for use in drawing curtains across a window between open and closed positions.

In the drawings:

Figure 1 is a face view of the assembly unit diagramatically illustrating one embodiment of a sensing device of the present invention with the motor drive in the "off" condition,

Figure 2 is a face view of the assembly unit when the motor drive is in the "on" condition,

Figure 3 is a face view of the assembly unit illustrating the position of the sensing device components at the end of travel of a cord run, and

Figure 4 is a cross sectional view of the motor drive assembly unit along the lines A-A of Figure 1.

Figure 5 is an exploded view of a second embodiment.

Figure 6 is a cross-sectional view along the lines B-B of Figure 4.

Referring to Figures 1-4 of the drawings, assembly face plate 101 forms the front face of a drive unit assembly 100. The tension sensing device of the invention is generally indicated at 1 and comprises a sensing plate 3 rotationally mounted on hollow boss 120 extending from plate 101. Arms 5 and 6 extend downwardly from the lower portion of plate 3 and are joined at their lower end portions by a transverse arm member 7 free to swing across and actuate switch 8 on rotational movement of plate 3, switch 8 forming part of the electrical circuit to motor drive 103. A U-shaped spring member 10 having outwardly extending arms 10^{1} and 10^{11} is located between arms 5 and 6, the ends of arms 10^{1} and 10^{11} being adjacent the said arms and positioned to make contact therewith on rotational movement of plate 3. The upper closed end of spring 10 is looped around boss 11 secured to face plate 101 and the end portions of arms 10^{1} and 10^{11} locating in elements 12 and 13 also secured to face plate 101. A spring tension adjusting member 14 having sloping shoulders 15 screw threadedly engages face plate 101 whereby inward movement of the screw tensions spring 10.

Switch 8 is activated by arm 7 to stop the motor drive at the end of the curtain travel. The motor is started, and may be stopped also, by a remote switch such as a standard infra red control unit, there being an infra red opto switch in the motor control circuit. On pulse from the remote control switch or infra red unit either starting or stopping the motor depending upon its mode at the time.

An elongate beam member 20 is mounted on pivot member 21 secured to plate 3 at the upper end thereof, and carries rotatable pulley members 22 and 23 at either end thereof.

Motor drive shaft 2 extends through boss 120 and has cord drive pulley 4 secured to the end thereof, such that pulley 4 lies in substantially the same plane as pulleys 22 and 23.

An O-ring or grooved rubber tyre 24 is positioned in the track of pulley 4 to make gripping contact therewith. Curtain track cord 30 having runs 31 and 32 passes round pulley 4 over O-ring 24 and inside pulleys 22 and 23 with which it makes contact.

The drive unit assembly, shown in section in Figure 4 comprises a case 99 having a face plate 101 and a cover 102. Cover 102 covers the face plate 101 and cord tension sensing device 1. An electric motor 103 is mounted behind face 101 and drives pulley shaft 2 via a gear reduction unit 105. A timer assembly 106 includes timer set buttons 107 and a digital display 109 that can he operated by an emergency 1.5 volt battery 104.

Microswitch 110 is included in the motor circuit and is activated by an abutment (not shown) secured to the inside of cover 102. The positioning of the abutment and the microswitch 110 is arranged such that the switch is activated to open the circuit and stop motor 103 when the case is opened or when subjected to a downward pressure from the top, for example by an object trapped on the downward moving cord run.

It may also be arranged that this microswitch 110 is activated to open and close momentarily by a button linkage from the case exterior. This can advantageously provide a manual control method when the electronics are designed to respond to an interrupt signal in the mains power supply.

The assembly is adapted for fixing to a wall or a structural unit adjacent the window curtains that it is to operate.

In use, with the curtain stationary, and the motor in the "off" condition, the tension sensing device 1 components will be in the positions illustrated in Figure 1, that is plate 3 will be substantially vertical with arms 5 and 6 equispaced on either side of the plate's longitudinal axis.

When the motor is switched on, for example by remote control, to cause cord run 32 to draw the curtains across the window, rotation of pulley 4 applies tension to cord 32, cord 32 then urges pulley 23 upwards and causes arm 20 to swing about pivot 21 so that pulley 22 moves towards drive pulley 4 pinching cord 30 between the two pulleys and thereby enhancing the grip between O-ring 24 of pulley 2 and cord 30 allowing cord run 31, being paid out, to be completely untensioned.

The tension in spring 10 acting against arm 6 is adjusted such that rotational movement of plate 3 about boss 102 is substantially prevented during the curtain drawing operation and the position of the components of the sensing device is as illustrated in Figure 2.

When the curtain reaches the end of travel, however, there is a sharp increase in the tension in cord run 32 such that the force now applied against pulley 23 is sufficient to overcome the tension in spring 10 allowing plate 3 to pivot anticlockwise about boss 120 to the position illustrated in Figure 3. As plate 3 rotates arm 7 is moved across switch 8 to an extent that is sufficient to activate the switch and to stop motor 103 thereby automatically halting further curtain movement. Tension having been removed from cord 32 the components of the tension sensing device 1 resume the position shown in Figure 1.

Motor 103 may also be activated by means of timer 107 to allow the curtains to be open or closed at predetermined times.

Reactivation of the motor by a remote switch, infra red remote control unit, or by other means such as the timer, results in the motor 103 operating in reverse, pulley 4 then rotates in the reverse direction and tension is then applied to cord 31 with the result that, at the end of travel, plate 3 is caused to rotate in a clockwise direction swinging arm 5 and plate 7 to the left thereby again actuating switch 8 to stop the motor.

A second embodiment is described with reference to Figures 5 and 6. In this embodiment face plate 101 of the drive unit assembly 100 includes a hollow boss 120 on which a sensor plate 200 is mounted for limited rotation thereabout. Sensor plate 200 has a face portion 201 partially surrounded by arcuate wall 202 within which is located pulley 4 (not shown) secured to the drive shaft of the motor (not shown). Portion 205 of plate 200 extends upwardly from face 201 and arm 203 extends downwardly in a diametrically opposite direction. Arm 203 is generally wedge shaped and hag an end 204 locates in slot 231 of bridge 230 secured to the bottom of face plate 101, slot 231 being sufficiently wide to allow limited rotation of sensor 200 about boss 120.

A hollow beam member 210, shown cross section in Figure 6, comprises a front face to 211, a rear face 212 and a top portion 213. Chambers

241, 214' formed within the beam and located at each end thereof contain rotatable pulley means 22 and 23 carried on axles 22', 23'journalled in faces 211 and 212. Beam member 210 is mounted on a square section stud 222 projecting from portion 205 of sensor 200 and partially carried thereon. Hollow portion 217 located centrally of beam member 210 slidingly engages on stud 222. A spring 220 bears against the top of stud 222 under the influence of screw 221 engaged in a correspondingly screw threaded hole 218 formed in the top 213 of member 210.

The curtain cord (not shown) passes through openings 215, 216 in member 210, inside pulleys 22 and 23 and around pulley 4. The "gripping" pressure between the cord and the pulley members can be varied by varying the pressure on spring 220 by appropriate adjustment of screw 221.

As mentioned above, end 204 of arm 203 projects into slot 231 of bridge 230. A screw threaded hole 235 is formed in bridge 230 at right angles to slot 231 and contains a spring (233) loaded ball bearing 232 retained in place by screw means 234. Bearing 232 engages in a vertically extending detente 236 formed in end 204 of arm 203 and acting to restrain sensor plate 200 against rotation during movement of the curtains.

Peg means (not shown) project rearwardly of sensor 200 normal to face 201 and extend through arcuate slot 240 formed in face plate 101 to operate a slide switch located at the rear thereof and which forms part of the electrical circuit to the motor drive, movement of the switch from a normally central position to either side acting to break the circuit to the motor.

In use, with the curtain stationary, sensor 200 will normally be positioned with arm 203 essentially vertical and with the spring loaded ball bearing 232 located in detente 236; beam 210 will be substantially horizontal. When the motor is started the action of the cord on guide pulleys 22, 23 and drive pulley 4 will be as described with reference to the embodiment of Figures 1-4.

The pressure exerted by ball 232 on detente 236 will act to restrain rotation of sensor 200 during normal curtain movement. When the curtain reaches the end of its travel, however, the sharp increase in tension in the cord is sufficient to overcome the force applied by the spring loaded bearing 236 with the result that the sensor will rotate rapidly about boss 120 causing pegs operating the slide switch to move the switch to an off position thereby breaking the electrical circuit to the motor and preventing further movement to the curtain.

In the event that the sensor arm 200 does not immediately return to its starting position once the motor has been turned off, the increase in tension in the cord when the curtain is next moved in the opposite direction will cause the sensor plate 200 to rotate in the opposite direction to the earlier movement until bearing 232 again locates in detente 236. Further rotation of the sensor 200 will not take place until a sharp increase in tension on the cord again occurs, for example at the end of curtain travel.

As with the previous embodiment the external control of the motor may be by any convenient method e.g. by remote control, timer controls or standard 2 way switch.

Claims

1. Apparatus for sensing the end of travel of a cord run (31, 32) driven by an electric motor comprising:

a first plate (3; 200) member rotatably secured to a hollow boss (120) extending outwardly from a second plate member (101) forming a part of a motor drive assembly unit (100);

a cord drive pulley wheel (4) secured to the end of a motor drive shaft (2) extending through the said hollow boss (120) carrying the said first plate member (3;200);

a beam member (20, 210) pivotally mounted (21;222) on said first plate member (3;200), having its pivotal axis parallel to the motor drive shaft (2) and carrying two rotatable guide pulleys (22, 23) one on each side of the said pivot and spaced apart from the said drive pulley;

resilient means (10; 232, 233) acting between said first plate (3; 200) and said second plate (101) to control the rotation of said first plate;

and switch means (8) for controlling the electrical circuit to the motor drive in response to a predetermined degree of rotational movement of the said first plate member (3, 200);

said cord (31, 32) being looped about the drive pulley (4), an end of each cord run (31, 32) passing between the drive pulley (14) and a respective guide pulley (22, 23), whereby on energisation of the motor, tension in one cord run (31, 32) urges the beam member (3; 210) to pivot to bring one guide pulley (22, 23) adjacent the drive pulley (4) to pinch the other cord run (31, 32) therebetween and impart a rotational force to the said first plate (3, 200).

2. Apparatus according to claim 1 wherein further means (14, 15; 234) is provided to vary the force acting between the resilient means (10, 233, 234) and the said first plate (3, 200) whereby the tension in a cord run (31, 32)

required to cause rotational movement of the plate can be varied.

3. Apparatus according to claim 1 or 2 wherein the said first plate (3) includes two arm portions (5, 6) extending substantially parallel to a line through the motor drive shaft (2) and said beam pivot axis (21) and away from said drive shaft, the resilient means (10, 10', 10") acting against each said arm portion (5, 6) and means (11) secured to the said second plate (101) to resist rotational movement of said first plate (3), the said arm portions (5, 6) being linked by a transverse member (7) which acts to actuate the said switch means (8) in response to swinging movement of the arm members (5,6) caused by rotational movement of the said first plate (3).

4. Apparatus according to claim 3 wherein the resilient means is a U-shaped leaf spring (10) having parallel arms (10', 10") the free end portions of which are outwardly extending to engage said first plate arm portions (5,6).

5. Apparatus according to claim 3 wherein the tension in the spring is controlled by means (14, 15) located between said parallel arm portions (5, 6) and acting thereagainst to urge said arms apart.

6. Apparatus according to claim 5 wherein said tension control means comprises a second means (14) threadedly engaging said second plate member (101) and having sloping shoulders (15) bearing against said spring (10) parallel arm portions (10', 10") whereby the tension in the spring is increased or decreased by clockwise or anticlockwise movement of said screw (14).

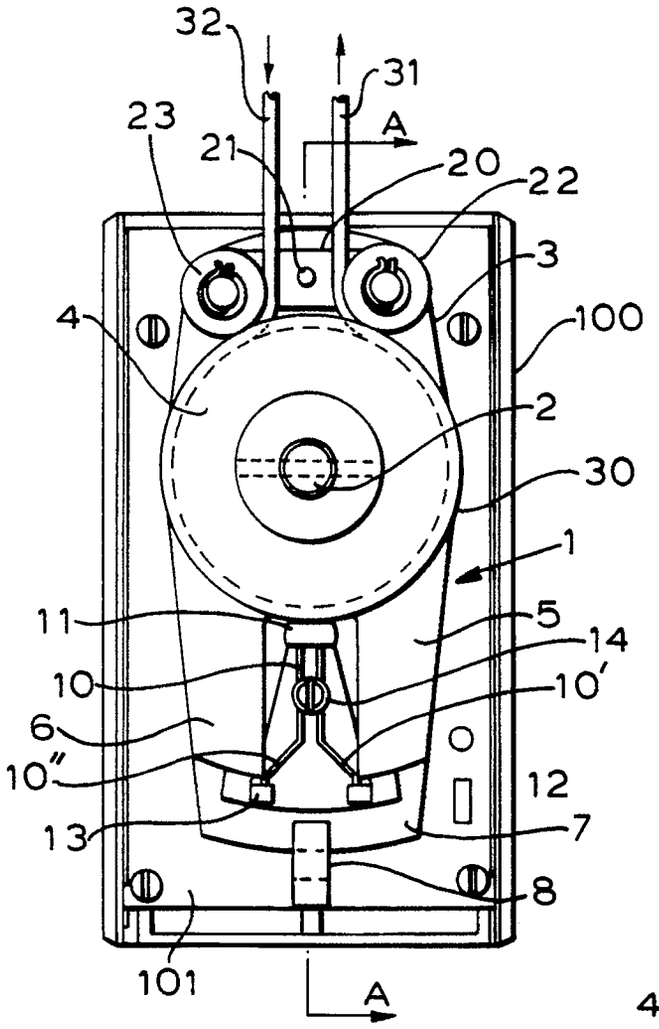
7. Apparatus according to claim 2 wherein the said first plate includes a single arm portion (203) extending substantially vertically downwardly away from said beam and said resilient means (232, 233) acts against said arm (203) to restrain rotation thereof.

8. Apparatus according to claim 7 wherein the resilient means comprises a ball bearing (232) engaging in a detente (236) formed in said downwardly extending arm portion (203) and urged thereagainst by spring means (233) having an end portion acting against adjustable means (234) provided in means (230) secured to said second plate.

9. Apparatus according to any one of the preceeding claims wherein an O-ring (24) or grooved rubber tyre is located on the drive pulley (4) to enhance the grip between the pulley and the cord.

10. A device according to claim 8 including electric timer means (106, 107) for controlling the motor drive circuit.

11. Apparatus according to any one of the preceeding claims wherein adjustable means (220, 221) are provided acting between said beam (210) and said beam pivot (222) to vary the distance between the guide pulleys (22, 23) and the drive pulley (4).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8
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A

FIG 1

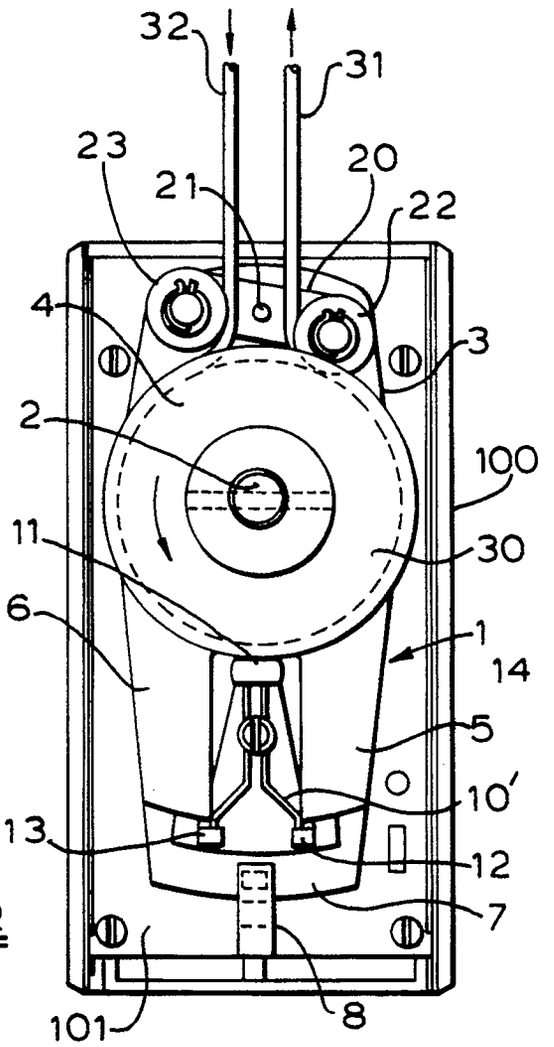
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FIG 2

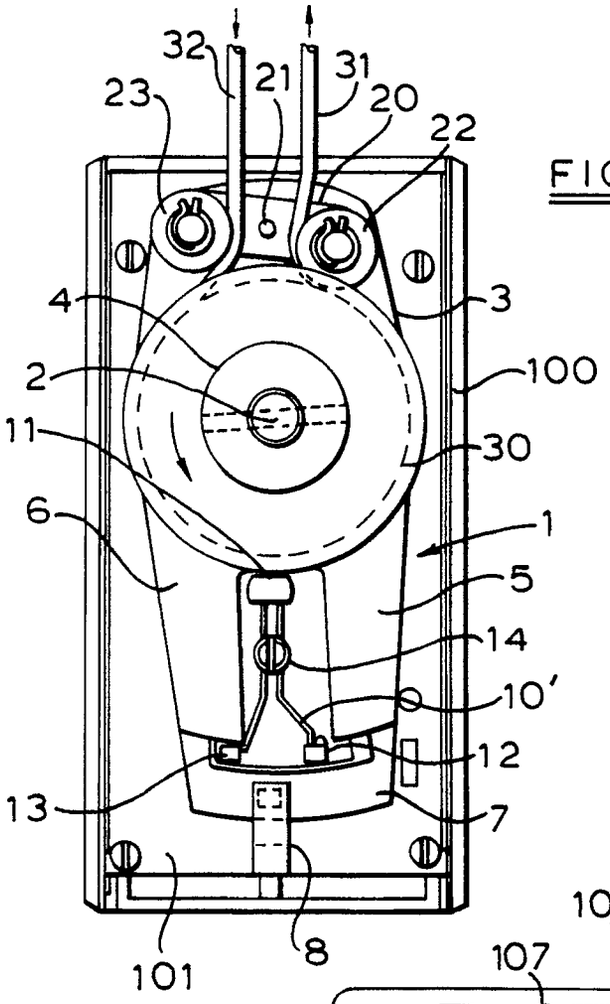
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FIG 3

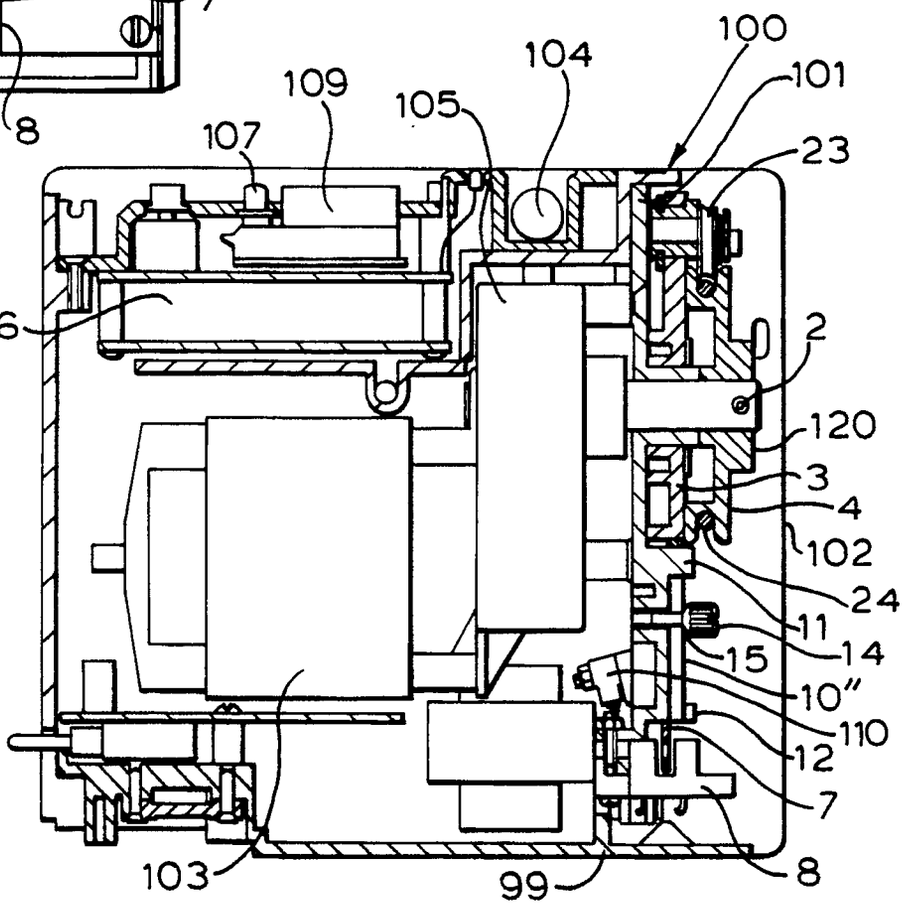
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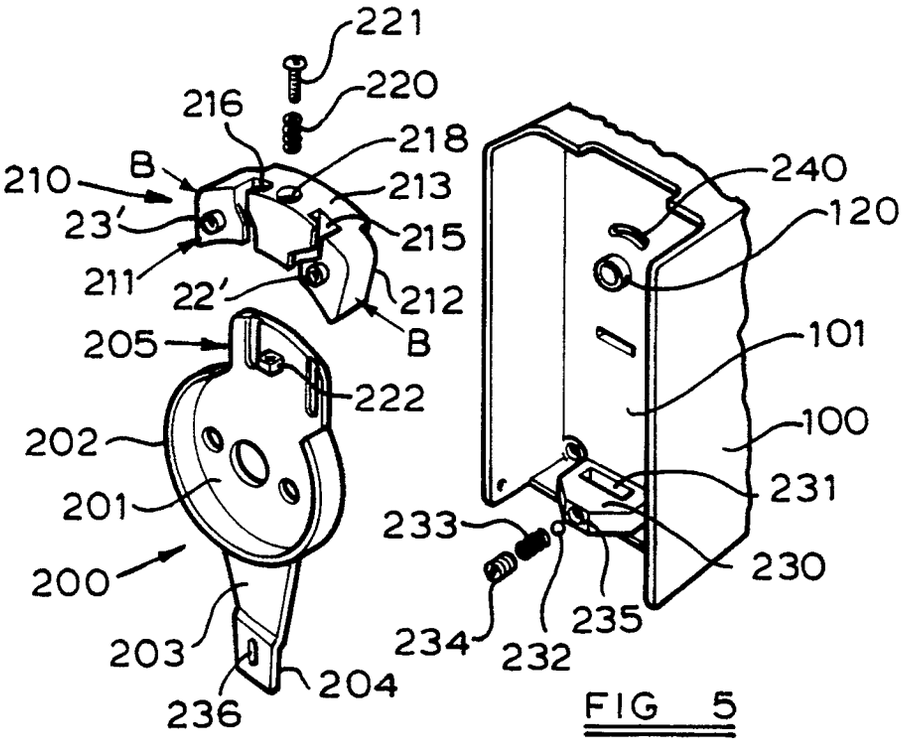
FIG 4


221
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204
236
240
120
101
100
231
233
230
234
232
235

FIG 5

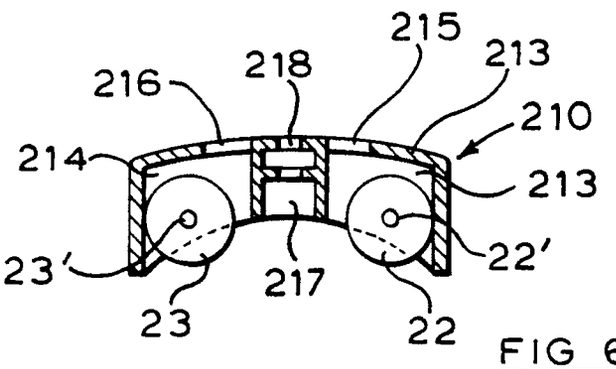
215
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FIG 6