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(54) Transmission mechanism for a motor-driven blind

(57) A transmission mechanism includes at least one cord roll-up unit driven by a driving unit to lift/lower or tilt the slats of the motor-driven Venetian blind. Each cord roll-up unit including an amplitude modulation wheel rotated by the driving unit to lift/lower the slats of the Venetian blind, a frequency modulation wheel capable of synchronous rotation with the amplitude modulation wheel to tilt the slats of the Venetian blind, and a clutch adapted for controlling linkage between the amplitude modulation wheel and the frequency modulation wheel.

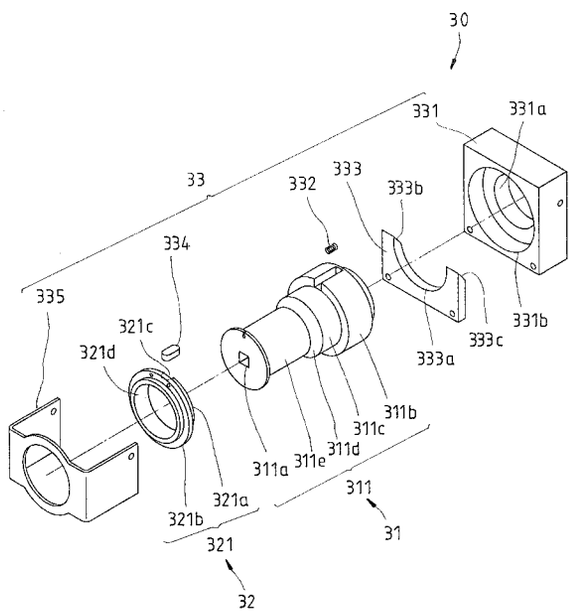

FIG.2

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Description

BACKGROUND OF THE INVENTION

1. Field of the Invention:

[0001] The present invention relates to Venetian blinds and, more specifically, to a transmission mechanism for a motor-driven blind.

2. Description of the Related Art:

[0002] A regular Venetian blind comprises a headrail, a bottom rail, a plurality of slats arranged in parallel between the headrail and the bottom rail, an amplitude modulation control mechanism for controlling lifting and positioning of the bottom rail to change the extending area of the blind, a frequency modulation control mechanism for controlling the tilting angle of the slats to regulate the light. The amplitude modulation control mechanism comprises an endless lift cord suspended from the headrail at one lateral side for pulling by hand to lift/lower the bottom rail. The frequency modulation control mechanism comprises a frequency modulation member disposed at one lateral side of the blind for permitting rotation by the user to regulate the tilting angle of the slats. When adjusting the elevation of the bottom rail, the user must approach the blind and pull the lift cord by hand with much effort. Further, because the lift cord is not kept out of reach of children, children may pull the lift cord for fun. In case the lift cord is hung on a child's head, a fetal accident may occur.

[0003] US Patent No. 5103888 discloses a motor-driven blind, which keeps the lift cord from sight. According to this design, a motor is mounted in the headrail or bottom rail, and controlled by a remote controller to roll up or let off the lift cord. The motor is used to control lifting of the lift cord only. When adjusting the tilting angle of the slats, the user must approach the blind and touch-control a tilting control unit. This operation manner is still not convenient.

[0004] There are blinds provided with an additional motor drive in the headrail or bottom rail for controlling tilting of the slats. However, the use of this motor drive occupies much installation in the headrail or bottom rail.

SUMMARY OF THE INVENTION

[0005] The present invention has been accomplished to provide a transmission mechanism for a motor-driven blind, which eliminates the aforesaid drawbacks. It is the main object of the present invention to provide a transmission mechanism for a motor-driven blind, which controls lifting/lowering of the slats and bottom rail of the Venetian blind as well as tilting of the slats.

[0006] It is another object of the present invention to provide a transmission mechanism for a motor-driven blind, which is compact, and requires less installation space.

[0007] It is still another object of the present invention to provide a transmission mechanism for a motor-driven blind, which is inexpensive to manufacture.

[0008] To achieve these objects of the present invention, the transmission mechanism is mounted in a motor-driven Venetian blind and adapted to be driven by a driving unit for controlling lifting/lowering of slats of said Venetian blind and tilting of said slats. The transmission mechanism comprises at least one cord roll-up unit having an amplitude modulation set, a frequency modulation set and a clutch. The amplitude modulation set has an amplitude modulation wheel coupled to said driving unit, and an amplitude modulation lift cord coupled to said amplitude modulation wheel and said slats and adapted to lift/lower said slats of said Venetian blind while the amplitude modulation wheel is driven by the driving unit to rotate. The frequency modulation set has a frequency modulation wheel being capable of synchronous rotation with said amplitude modulation wheel through said clutch, and a lift cord coupled to said frequency modulation wheel and said slats and adapted to tilt said slats of said Venetian blind through the rotation of the frequency modulation wheel driven by the amplitude modulation wheel. The clutch is capable of releasing the synchronous rotation between the frequency modulation wheel and the amplitude modulation wheel while the clutch is performed to a predetermined position.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009]

FIG. 1 is an applied view of a first embodiment of the present invention, showing the transmission mechanism installed in a Venetian blind.

FIG. 2 is an exploded view of the cord roll-up unit for the transmission mechanism according to the first embodiment of the present invention.

FIG. 3 is an elevational assembly view of the cord roll-up unit shown in FIG. 2.

FIG. 4 is a sectional view of the cord roll-up unit shown in FIG. 3.

FIG. 5 and FIG. 6 are schematic drawings showing the cord rolling action of the cord roll-up unit according to the first embodiment of the present invention.

FIGS. 7～10 are side views showing the action of the amplitude modulation set, the frequency modulation set, and the clutch according to the first embodiment of the present invention.

FIGS. 11～13 are sectional views showing the action of the amplitude modulation set, the frequency modulation set, and the clutch according to the first embodiment of the present invention.

FIG. 14 is a perspective view in an enlarged scale of the sensor shown in FIG. 1.

FIGS. 15～17 are schematic drawings showing the

action of the sensor according to the first embodiment of the present invention.

FIG. 18 is an applied view of a second embodiment of the present invention, showing the transmission mechanism installed in a Venetian blind.

FIG. 19 is an exploded view of the cord roll-up unit for the transmission mechanism according to the second embodiment of the present invention.

FIG. 20 is an elevational assembly view of the cord roll-up unit shown in FIG. 19.

FIG. 21 is a sectional view of the cord roll-up unit shown in FIG. 20.

FIG. 22 illustrates the lift cord rolling action of the cord roll-up unit according to the second embodiment of the present invention.

FIG. 23 is an applied view of a third embodiment of the present invention, showing the transmission mechanism installed in a Venetian blind.

FIG. 24 is an exploded view of the cord roll-up unit for the transmission mechanism according to the third embodiment of the present invention.

FIG. 25 is an elevational assembly view of the cord roll-up unit shown in FIG. 24.

FIG. 26 is a sectional view of the cord roll-up unit shown in FIG. 25.

FIGS. 27～29 are sectional views showing the action of the cord roll-up unit according to the third embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0010] Referring to FIGS. From 1 through 9, a first preferred embodiment of the present invention provides a transmission mechanism **100** mountable to a Venetian blind **10** including a driving unit **20**. The Venetian blind **10,** as shown in FIG. 1, comprises a headrail **11** and a slat set **12.** The headrail **11** is mountable to the top side of the window, comprising an inside holding chamber **111,** and two through holes **112** bilaterally disposed at a bottom side in communication with the holding chamber **111**. The slat set **12** is comprised of a plurality of slats **121** and a bottom rail **123.** Each slat **121** has two-wire holes **122** corresponding to the through holes **112** of the headrail **11.** Because the Venetian blind **10** is of the known art, no further detailed structural description is necessary.

[0011] As shown in FIG. 1, the driving unit **20** comprises a reversible motor **21,** a transmission shaft **22,** a signal transmitter **23,** a signal receiver **24,** and a battery **25.** The motor **21** is mounted inside the holding chamber **111** of the headrail **11.** The transmission shaft **22** is a rod member of non-circular cross section, having one end coupled to the motor **21** for rotation by the motor **21.** The signal transmitter **23** can be a remote controller or wired controller for providing control signal to the signal receiver **24.** According to the present preferred embodiment, the signal transmitter **23** is a wireless remote controller. The signal receiver **24** is electrically connected to the motor **21,** and adapted to control the operation of the motor **21** subject to the nature of the control signal received from the signal transmitter **23.** The battery **25** can be a storage battery, dry battery, planar battery, cylindrical battery, or mercury battery mounted inside the holding chamber **111** and electrically connected to the motor **21** to provide the motor **21** with the necessary working power.

[0012] Referring to FIGS. 1～4 again, the transmission mechanism **100** comprises two cord roll-up units **30**. The cord roll-up units **30** are respectively mounted inside the holding chamber **111** of the headrail **11** corresponding to the through holes **112,** each comprised of an amplitude modulation set **31**, a frequency modulation set **32,** and a clutch **33.**

[0013] Referring to FIGS. 2～4, the amplitude modulation set **31** comprises an amplitude modulation wheel **311,** and an amplitude modulation lift cord **312.** The amplitude modulation wheel **311** is a stepped cylindrical wheel, comprising a head **311b** at one end, a tail **311e** at an opposite end, a body **311c** axially connected between the head **311b** and the tail **311e,** a cone **311d** axially connected between the body **311c** and the tail **311e** and disposed corresponding to one through hole **112** of the headrail **11,** a center through hole **311a** of non-circular cross section axially extended through the tail **311e,** the cone **311d**, the body **311c** and the head **311b** and coupled to the transmission shaft **22** for enabling the amplitude modulation wheel **311** to be rotated with the transmission shaft **22,** and a groove **311f** longitudinally extended in the periphery of the head **311b** toward the body **311c.** As illustrated in FIG. 3, the amplitude modulation lift cord **312** has one end fixedly connected to a fixed point **311g** of the amplitude modulation wheel **311,** and the other end inserted through one through hole **112** of the headrail **11** and one wire hole **122** of each slat **12** and then fixedly connected to the bottom rail **123.**

[0014] The frequency modulation set **32** is comprised of a frequency modulation wheel **321,** and a frequency modulation lift cord **322.** The frequency modulation wheel **321** comprises an axially extended circular hole **321d,** a body **321a**, and a head **321b.** The body **321a** is provided with a notch **321c**. The outer diameter of the head **321b** is greater than the outer diameter of the body **321a.** By means of the circular hole **321d**, the frequency modulation wheel **321** is sleeved onto the body **311c** of the amplitude modulation wheel **311,** keeping the body **321a** aimed at the head **311b** of the amplitude modulation wheel **311.** The frequency modulation lift cord **322** has one end fixedly connected to the frequency modulation wheel **321**, and the other end inserted through one through hole **112** of the headrail **11** and fixedly connected to each slat **12** and the bottom rail **123.**

[0015] The clutch **33** is comprised of a support **331,** a spring **332,** a stop block **333**, a link **334,** and a limiter **335**. The support **331** is fixedly mounted inside the hold-

ing chamber **111** of the headrail **11,** having a stepped center through hole formed of a through hole **331a** and a recessed hole **331b.** The inner diameter of the through hole **331a** is smaller than the recessed hole **331b** and the outer diameter of the amplitude modulation wheel **311** of the amplitude modulation set **31.** The inner diameter of the recessed hole **311b** is approximately equal to or slightly greater than the outer diameter of the head **311b** of the amplitude modulation wheel **311,** such that the head **311b** of the amplitude modulation wheel **311** can be inserted into the recessed hole **311b** to confine the position of the amplitude modulation wheel **311.** The spring **332** is mounted in the groove **311f** of the amplitude modulation wheel **311**, having one end stopped at one end of the groove **311f.** The stop block **333** is fixedly fastened to the support **331** outside the recessed hole **331b,** having a semicircular notch **333a,** and two beveled faces **333b, 333c** disposed at two sides of the semicircular notch **333a** and respectively downwardly sloping from the top toward the recessed hole **331b.** The link **334** is an oblong key member, having one end inserted into the groove **311f** of the amplitude modulation wheel **311** and stopped against the spring **332** and the other end inserted into the notch **321c** of the frequency modulation wheel **321.** Therefore, the link **334** couples the frequency modulation wheel **321** to the amplitude modulation wheel **311**. The limiter **335** is fixedly fastened to the support **331,** stopping the frequency modulation wheel **321** from falling out of the amplitude modulation wheel **311.**

[0016] The operation of the present invention is outlined hereinafter with reference to FIGS. from 5 through 13. When the user operated the signal transmitter **23** of the driving unit **20** to transmit a control signal of lifting the Venetian blind, the signal receiver **24** immediately receives the control signal. Upon receipt of the control signal, the signal receiver **24** drives the motor **21** to rotate the transmission shaft **22.** Because the center through hole **311a** of the amplitude modulation wheel **311** is a non-circular hole that fits the transmission shaft **22**, rotating the transmission shaft **22** causes the amplitude modulation wheel **311** to be synchronously rotated to roll up the amplitude modulation lift cord **312**. During rotary motion, the amplitude modulation wheel **311** moves axially in the support **331,** keeping the amplitude modulation lift cord **312** to be smoothly wound round the periphery of the amplitude modulation wheel **311** from the conical surface of the cone **311d** toward the tail **311e** (see FIGS. 5 and 6). When the amplitude modulation wheel b rolling up the amplitude modulation lift cord **312**, the bottom rail **123** is lifted, thereby causing the slats **121** to be received and moved with the bottom rail **123** upwards toward the headrail **11** to the desired elevation.

[0017] Because the link **334** of the clutch **33** links the frequency modulation wheel **321** and the amplitude modulation wheel **311** at this time, the frequency modulation wheel **321** is rotated with the amplitude modulation wheel **311** (see FIGS. 7 and 11). During rotary motion of the frequency modulation wheel **321**, the frequency modulation lift cord **322** is moved, causing the slats **121** to be tilted. When the frequency modulation wheel **321** turned to a predetermined position (the position where the link **334** touches the beveled face **333b** of the stop block **333** (see FIGS. 8and 12), the link **334** moves along the beveled face **333b** toward the recessed hole **331b** (see FIG. 9) to compress the spring **332,** thereby causing the link **334** to be forced out of the notch **321c** of the frequency modulation wheel **321** (see FIG. 10) to disconnect the frequency modulation wheel **321** from the amplitude modulation wheel **311.** Therefore, when the frequency modulation wheel **321** rotated to this angle, it is disengaged from the amplitude modulation wheel **311.** At this time, the transmission shaft **22** continuously rotates the amplitude modulation wheel **311** to roll up the amplitude modulation lift cord **312** and to receive the slats **121** without changing the tilting angle of the slats **121**.

[0018] When releasing the slats **121,** operates the signal transmitter **23** to transmit a control signal of releasing the slats to the signal receiver **24.** Upon receipt of the signal, the signal receiver **24** immediately drives the motor **21** to rotate in the reversed direction, thereby causing the transmission shaft **22** and the amplitude modulation wheel **311** to be rotated in the same direction. Reverse rotation of the amplitude modulation wheel **311** lets off the amplitude modulation lift cord **312,** and therefore the bottom rail **123** and the slats **121** are lowered to extend out the Venetian blind **10.** At the initial stage during rotary motion of the amplitude modulation wheel **311,** the beveled face **333b** of the stop block **333** keeps the frequency modulation wheel **321** out of the amplitude modulation wheel **311.** However, when the link **334** reversed with the amplitude modulation wheel **311** to the beveled face **333b** again, the spring power of the spring **332** forces the link **334** into the notch **321c,** thereby causing the frequency modulation wheel **321** and the amplitude modulation wheel **311** to be linked again. At this time, the frequency modulation wheel **321** is rotated with the amplitude modulation wheel **311** to tilt the bottom rail **123** and the slats **121**. When the link **334** moved to the other beveled face **333c,** the beveled face **333c** forces the link **334** away from the frequency modulation wheel **321** to disconnect the amplitude modulation wheel **311** from the frequency modulation wheel **321.** At this time, the transmission shaft **22** continuously rotates the amplitude modulation wheel **311** to let off the amplitude modulation lift cord **312** and to release the slats **121** without changing the tilting angle of the slats **121.**

[0019] With respect to the tilting of the slats **121,** the operation is described hereinafter. At first, the user operates the signal transmitter **23** to transmit a slat tilting control signal to the signal receiver **24.** Upon receipt of the control signal, the signal receiver **24** immediately drives the motor **21** to rotate the transmission shaft **22** and the amplitude modulation wheel **311,** and to further forces the link **334** into engagement with the amplitude

modulation wheel **311** and the frequency modulation wheel **321**, permitting synchronous rotation of the frequency modulation wheel **321** with the amplitude modulation wheel **311** to let off the frequency modulation lift cord **322** and to further control the tilting angle of the slats **121**. In actual practice, it is not necessary to tilt the slats **121** at a wide angle, therefore the angle of rotation of the frequency modulation wheel **311** can be limited to a limited range. According to the present preferred embodiment, the frequency modulation wheel **321** is rotatable with the amplitude modulation wheel **311** within about 180°. The stop block **333** limits the angle of rotation of the frequency modulation wheel **311.** When the slats **121** tilted to the desired angle, the motor **21** is stopped. (during the aforesaid slat angle tilting control operation, the amount of upward or downward movement of the bottom rail **11** due to rotation of the amplitude modulation wheel **311** is insignificant, without affecting the reliability of the operation).

[0020] Referring to FIG. 1 and FIGS. from 14 through 17, the transmission mechanism **100** further comprises a sensor **40** installed in the middle of the transmission shaft **22.** When the slats **121** moved to the upper limit or lower limit position, the sensor 40 is induced to stop the motor **21.** According to the present preferred embodiment, the sensor **40** comprises a mounting plate **41,** a locating block **42,** a wheel **43**, and two limit switches **44, 45.** The mounting plate **41** is fixedly fastened to the peripheral wall of the holding chamber **111** of the headrail **11.** The locating block **42** is fixedly mounted inside the holding chamber **111** of the headrail **11.** having a center screw hole **421.** The wheel **43** is coupled to the transmission shaft **22** for synchronous rotation, having an outer thread **431** threaded into the center screw hole **421** of the locating block **42.** Rotation of the transmission shaft **22** causes synchronous rotation of the wheel **43** with the transmission shaft **22** and axial movement of the wheel **43** in the locating block **42.** The limit switches **44, 45** are respectively mounted on the mounting plate **41** at two sides relative to the wheel **43** (at the ends of path for axial movement of the wheel **42** of the sensor **40** corresponding to the upper limit position and lower limit position of the slats **121** of the Venetian blind **10**), and electrically connected to the motor **21.** When the slats **121** moved to the upper or lower limit position, the wheel **43** touches one limit switch **44** or **45**, thereby causing the limit switch **44** or **45** to cut off power supply from the motor **21.**

[0021] The structure and function of the present invention are well understood from the aforesaid detailed description. The advantages of the present invention are outlined hereinafter.

1. Slat lifting and tilting dual-control function:

   The clutch is controlled to couple the amplitude modulation wheel, which controls lifting of the slats, and the frequency modulation wheel, which controls tilting of the slats, enabling the amplitude modulation wheel and the frequency modulation wheel to be driven by the same driving source to lift or tilt the slats.

2. Single drive source and compact size:

   Because a clutch is used to couple the amplitude modulation wheel and the frequency modulation wheel, one single driving source is sufficient to drive the amplitude modulation wheel and the frequency modulation wheel. Therefore, the transmission mechanism of the present invention is compact and inexpensive, and requires less installation space.

3. Durable mechanical design:

   Because the transmission mechanism is provided with a sensor, the motor is immediately stopped when the slats moved to the upper or lower limit position, preventing damage to the parts of the mechanism.

[0022] FIGS. 18～22 show a transmission mechanism **200** used in a Venetian blind **10** having a driving unit **20** and a sensor **40** according to a second embodiment of the present invention. The transmission mechanism **200** comprises two cord roll-up units **50.** Each cord roll-up unit **50** is comprised of an amplitude modulation set **51,** a frequency modulation set **52,** and a clutch **53.** This embodiment is substantially similar to the aforesaid first embodiment of the present invention with the exception of the cord roll-up units **50**. The main features of this second embodiment are outlined hereinafter with reference to FIGS. from 19 through 22.

[0023] The amplitude modulation wheel **511** of the amplitude modulation set **51** comprises an outer thread **511a** extended around the periphery, and a longitudinal groove **511b** extended in the periphery and cut through the outer thread **511a**. The frequency modulation wheel **521** of the frequency modulation set **52** comprises a body 5**21a** having a peripheral notch **521b.**

[0024] The clutch **53** is comprised of a support **531,** a spring **532,** a pressure ring **533,** a stop block **534**, a link **535,** and a limiter **536.** The support **531** is fixedly mounted inside the holding chamber **111** of the headrail **11,** having a stepped center through hole formed of a through hole **531a** and a recessed hole **531b.** The through hole **531a** has a threaded section **531c** threaded onto the outer thread **511a** of the amplitude modulation wheel **511** of the amplitude modulation set **51.** The spring **532** is sleeved onto the amplitude modulation wheel **511** and supported in between the through hole **531a** and the recessed hole **531b**. The pressure ring **533** is sleeved onto the amplitude modulation wheel **511** and stopped at the spring **532** against the support **531.** The stop block **534** is fixedly fastened to the support **531**

outside the recessed hole **531b** and stopped at the pressure ring **533** against the spring **532,** having a semicircular notch **534a** and two beveled faces **534b, 534c** disposed at two sides of the semicircular notch **534a** and respectively downwardly sloping from the top toward the recessed hole **531b.** The link **535** is an angled key member, having one end inserted into the longitudinal groove **511b** of the amplitude modulation wheel **511** and stopped against the pressure ring **533** and the spring **532** and the other end inserted into the peripheral notch **521b** of the frequency modulation wheel **521**. Therefore, the link **535** couples the frequency modulation wheel **521** to the amplitude modulation wheel **511**. The limiter **536** is fixedly fastened to the support **531,** stopping the frequency modulation wheel **521** from falling out of the amplitude modulation wheel **511**.

[0025] According to the aforesaid second embodiment of the present invention, the link **535** couples the frequency modulation wheel **521** to the amplitude modulation wheel **511** for synchronous rotation. Further, by means of the relative action between the link **535** and the beveled faces **534b, 534c,** the amplitude modulation wheel **511** is disconnected from the frequency modulation wheel **521.** Therefore, one single driving source is sufficient to achieve amplitude modulation control and frequency modulation control. Further, because the amplitude modulation wheel **511** is coupled to the support **531** by a screw joint, the amplitude modulation wheel **511** is moved axially when rotated, keeping the amplitude modulation lift cord **512** smoothly wound round the periphery of the amplitude modulation wheel **511** (see FIG. 22).

[0026] FIGS. 23～29 show a transmission mechanism **300** used in a Venetian blind **10** having a driving unit **20** and a sensor **40** according to a third embodiment of the present invention. The transmission mechanism **300** comprises two cord roll-up units **60.** Each cord roll-up unit **60** is comprised of an amplitude modulation set **61,** a frequency modulation set **62**, and a clutch **63**. Similarly, the amplitude modulation set **61** is comprised of an amplitude modulation wheel **611** and an amplitude modulation lift cord **612.** The main features of this third embodiment are outlined hereinafter with reference to FIGS. from 24 through 26.

[0027] The amplitude modulation wheel **611** of the amplitude modulation set **61** is formed of a cylindrical wheel body **613,** a bobbin **614**, and a stop key **615**. The wheel body **613** comprises a coupling portion **613b,** a bearing portion **613d** axially connected to the coupling portion **613b** in a line, a collar **613c** extended around the periphery of the connection area between the coupling portion **613b** and the bearing portion **613d,** a center through hole **613a** of non-circular cross-section axially extended through the front and rear ends thereof and coupled to the transmission shaft **22** of the driving unit **20** for enabling the wheel body **613** to be synchronously rotated with the transmission shaft **22,** and a recessed hole **613e** disposed in the periphery of the bearing portion **613d** adjacent the collar **613c**. The stop key **615** is mounted in the recessed hole **613e** and partially protruding over the outside wall of the bearing portion **613d.** The bobbin **614** comprises a first inner hole **614a** and a second inner hole **614b** respectively axially extended from the two distal ends thereof toward each other, a protruded block **614c** suspended in the second inner hole **614b,** and a conical face **614d** extended around the periphery at one end. The diameter of the first inner hole **614a** is approximately equal to the outer diameter of the bearing portion **613d** of the wheel body **613.** The diameter of the second inner hole **614b** is greater than the outer diameter of the bearing portion **613d** of the wheel body **613.** The bearing portion **613d** of the wheel body **613** is inserted through the second inner hole **614b** into the first inner hole **614a.** When the amplitude modulation wheel **6111** assembled, the periphery of the bearing portion **613d** is equally spaced from the peripheral wall of the second inner hole **614b** of the bobbin **614,** and the protruded block **614c** is suspended in the second inner hole **614b** around and without touching the periphery of the bearing portion **613d.** When rotating the cylindrical wheel body **613** relative to the bobbin **614** in one direction, the stop key **615** will be forced into contact with the protruded block **614c.** Continuously rotation of the cylindrical wheel body **613** after contact between the stop key **615** and the protruded block **614c** causes synchronous rotation of the bobbin **614** with the cylindrical wheel body **613.** The amplitude modulation lift cord **612** has one end fixedly fastened to the bobbin **614.** When rotating the bobbin **614** to roll up the amplitude modulation lift cord **612,** the conical face **614d** guides the winding of the amplitude modulation lift cord **612** round the periphery of the bobbin **614** smoothly.

[0028] The frequency modulation set **62** is comprised of a frequency modulation wheel **621** and a frequency modulation lift cord **622**. The frequency modulation wheel **621** has a center through hole **621b** coupled to the coupling portion **613b** of the cylindrical wheel body **613** of the amplitude modulation wheel **611**, and a protrusion **621a** protruded from one side thereof.

[0029] The clutch **63** is comprised of a support **631,** a spring **632,** and a limiter **633**. The support **631** is fixedly mounted inside the holding chamber **111** of the headrail **11,** having a stepped center through hole formed of a through hole **631a** and a recessed hole **631b** and two shoulders **631c, 631d** bilaterally disposed in one sidewall thereof outside the recessed hole **631b** and adapted to act with the protrusion **621a** of the frequency modulation wheel **621** alternatively. The spring **632** is mounted in the recessed hole **631b** of the support **631,** having one end stopped at the connection area between the recessed hole **631b** and the through hole **631a** and the other end stopped at the frequency modulation wheel **621**. The limiter **633** is fixedly fastened to the support **631,** stopping the frequency modulation wheel **621** from falling out of the amplitude modulation wheel **611.**

[0030] According to the aforesaid third embodiment

of the present invention, the spring power of the spring **632** forces the frequency modulation wheel **621** into friction-engagement with the collar **613c** of the cylindrical wheel body **613** of the amplitude modulation wheel **611** for synchronous rotation. When the protrusion **621a** of the frequency modulation wheel **621** stopped at one shoulder **631c** or **631d** of the support **631,** the resisting force between the protrusion **621a** and the corresponding shoulder **631c** or **631d** surpasses the friction resistance between the frequency modulation wheel **621** and the collar **613c** of the cylindrical wheel body **613** of the amplitude modulation wheel **611.** At this time, the frequency modulation wheel **621** is stopped at the corresponding shoulder **631c** or **631d,** and the amplitude modulation wheel **611** is continuously rotated. Therefore, one single driving source is sufficient to achieve amplitude modulation control and frequency modulation control.

[0031] Referring to FIGS. 27~29, at the initial stage of the rotary motion of the cylindrical wheel body **613** with the transmission shaft **22,** the protruded block **614c** of the bobbin **614** does not touch the stop key **615** (see FIG. 27). At this time, the cylindrical wheel body **613** runs idle without moving the bobbin **614.** When the stop key **615** moved with the cylindrical wheel body **613** into contact with the protruded block **614c** of the bobbin **614** during rotary motion of the cylindrical wheel body **613** (see FIG. 28 or FIG. 29), the bobbin **614** is rotated with the cylindrical wheel body **613** to roll up the amplitude modulation lift cord **612.** Therefore, when controlling the tilting angle of the slats, the bobbin **614** does no work, i.e., the elevation of the bottom rail is maintained unchanged when adjusting the angle of the slats.

Claims

1. A transmission mechanism mounted in a motor-driven Venetian blind and adapted to be driven by a driving unit for controlling lifting/lowering of slats of said Venetian blind and tilting of said slats, the transmission mechanism comprising:

at least one cord roll-up unit having an amplitude modulation set, a frequency modulation set and a clutch;

wherein the amplitude modulation set has an amplitude modulation wheel coupled to said driving unit, and an amplitude modulation lift cord coupled to said amplitude modulation wheel and said slats and adapted to lift/lower said slats of said Venetian blind while the amplitude modulation wheel is driven by the driving unit to rotate;

wherein the frequency modulation set has a frequency modulation wheel being capable of synchronous rotation with said amplitude modulation wheel through said clutch, and a lift cord coupled to said frequency modulation wheel and said slats and adapted to tilt said slats of said Venetian blind through the rotation of the frequency modulation wheel driven by the amplitude modulation wheel;

wherein the clutch is capable of releasing the synchronous rotation between the frequency modulation wheel and the amplitude modulation wheel while the clutch is performed to a predetermined position.

2. The transmission mechanism as claimed in claim 1 further comprising a sensor adapted to turn off said driving unit when said slats of said Venetian blind lifted to an upper limit position or lowered to a lower limit position.

3. The transmission mechanism as claimed in claim 2, wherein said sensor comprises a mounting plate fixedly mounted in said Venetian blind, a locating block fixedly supported on said mounting plate, two limit switches bilaterally mounted on said mounting plate and electrically connected to said driving unit, a wheel threaded into said locating block and coupled to said driving unit for rotation and axial movement between said limit switches upon operation of said driving unit to trigger one of said limit switches to cut off power supply from said driving unit when said slats of said Venetian blind moved to the lower/upper limit position.

4. The transmission mechanism as claimed in claim 1, wherein said amplitude modulation wheel is a stepped cylindrical member, having a center through hole of non-circular cross-section extended through two distal ends thereof and coupled to said driving unit for enabling said amplitude modulation wheel to be rotated by said driving unit.

5. The transmission mechanism as claimed in claim 1, wherein said amplitude modulation wheel comprises a tail adapted for rolling up said amplitude modulation lift cord, and a cone disposed at one end of said tail and adapted for guiding said amplitude modulation lift cord onto said tail.

6. The transmission mechanism as claimed in claim 1, wherein said clutch comprises a support having a recessed hole, which receives one end of said amplitude modulation wheel to stop said amplitude modulation wheel from axial displacement.

7. The transmission mechanism as claimed in claim 6 wherein said frequency modulation wheel comprises a circular center through hole sleeved onto said amplitude modulation wheel; said clutch further comprises a limiter fixedly fastened to said support to stop said frequency modulation wheel from falling out of said amplitude modulation wheel.

8. The transmission mechanism as claimed in claim 6, wherein said amplitude modulation wheel comprises a longitudinal groove disposed in the periphery thereof inside said recessed hole of said support; said frequency modulation wheel comprises a peripheral notch; said clutch further comprises a spring mounted in the longitudinal groove of said amplitude modulation wheel and stopped at one end of said longitudinal groove, and a link supported on one end of said spring in said longitudinal groove of said amplitude modulation wheel and partially engaged into the peripheral notch of said frequency modulation wheel to link said frequency modulation wheel to said amplitude modulation wheel.

9. The transmission mechanism as claimed in claim 8, wherein said clutch further comprises a stop block fixedly fastened to one side of said support outside said recessed hole, said stop block comprising a semicircular notch and two beveled faces disposed at two sides of said semicircular notch and respectively downwardly sloping toward said recessed hole of said support and adapted for guiding said link out of said peripheral notch of said frequency modulation wheel into said longitudinal groove of said amplitude modulation wheel to disengage said frequency modulation wheel from said amplitude modulation wheel.

10. The transmission mechanism as claimed in claim 9, wherein the position is where said link touches one of said beveled faces.

11. The transmission mechanism as claimed in claim 1, wherein said amplitude modulation wheel comprises an outer thread extended around the periphery thereof; said clutch comprises a support, said support having a center through hole and an inner thread extended around said center through hole and threaded onto the outer thread of said amplitude modulation wheel to guide axial movement of said amplitude modulation wheel upon rotary motion of said amplitude modulation wheel for enabling said amplitude modulation lift cord to be wound round said amplitude modulation wheel in good order.

12. The transmission mechanism as claimed in claim 11, wherein said amplitude modulation wheel further comprises a longitudinal groove; said frequency modulation wheel comprises a circular center through hole sleeved onto said amplitude modulation wheel, and a peripheral notch; said clutch comprises a link mounted in the longitudinal groove of said amplitude modulation wheel and moved along the longitudinal groove of said amplitude modulation wheel in and out of the periphery notch of said frequency modulation wheel to control linking between said frequency modulation wheel and said amplitude modulation wheel.

13. The transmission mechanism as claimed in claim 12, wherein said support comprises a recessed hole disposed in one side thereof in communication with the center through hole of said support; said clutch further comprises a spring mounted around said amplitude modulation wheel and supported in said recessed hole of said support, and a pressure ring mounted around said amplitude modulation wheel and stopped between said spring and said link to force said link into engagement with the peripheral notch of said frequency modulation wheel by means of the effect of the spring power of said spring.

14. The transmission mechanism as claimed in claim 11, wherein said clutch further comprises a stop block fixedly fastened to said support, said stop block comprising two beveled faces bilaterally sloping downwards toward the center through hole of said support and adapted for guiding said link out of the peripheral notch of said frequency modulation wheel to disengage said frequency modulation wheel from said amplitude modulation wheel when said frequency modulation wheel rotated to the position where said link touches one of said beveled faces of said stop block.

15. The transmission mechanism as claimed in claim 1, wherein said frequency modulation wheel comprises a cylindrical wheel body coupled to said driving unit for rotation upon operation of said driving unit, said cylindrical wheel body having a peripheral notch, a stop key mounted in the peripheral notch of said cylindrical wheel body and partially protruded over the periphery of said cylindrical wheel body, and a bobbin sleeved onto said cylindrical wheel body, said bobbin comprising a first inner hole coupled to said cylindrical wheel body, a second inner hole axially connected to one end of said first inner hole, said second inner hole having a diameter greater than said first inner hole, and a protruded block suspended in said second inner hole corresponding to said stop key for enabling said bobbin to be rotated with said cylindrical wheel body when said stop key rotated with said cylindrical wheel body to touch said protruded block.

16. The transmission mechanism as claimed in claim 15, wherein said cylindrical wheel body comprises a center through hole of non-circular cross-section axially extended through two distal ends thereof and coupled to said driving unit for enabling said cylindrical wheel body to be rotated by said driving unit.

17. The transmission mechanism as claimed in claim 15, wherein said second inner hole of said bobbin is spaced from the periphery of said cylindrical wheel body at a distance so that said protruded block of said bobbin can be moved with rotary motion of said bobbin relative to said cylindrical wheel body within a limited angle.

18. The transmission mechanism as claimed in claim 15, wherein said bobbin comprises a cone extended around the periphery at one end thereof and adapted for guiding said amplitude modulation lift cord onto said bobbin in proper order during rotation of said bobbin with said cylindrical wheel body.

19. The transmission mechanism as claimed in claim 15, wherein said cylindrical wheel body comprises a cylindrical bearing portion disposed at one end thereof and inserted through said second inner hole of said bobbin into said first inner hole of said bobbin, said cylindrical bearing portion having an outer diameter approximately equal to said first inner hole of said bobbin.

20. The transmission mechanism as claimed in claim 19, wherein said frequency modulation wheel comprises a center through hole; said cylindrical body further comprises a coupling portion axially extended from one end of said bearing portion and inserted through the circular center through hole of said frequency modulation wheel, and a collar extended around the periphery thereof between said bearing portion and said coupling portion and adapted for friction-engagement with said frequency modulation wheel.

21. The transmission mechanism as claimed in claim 20, wherein said clutch comprises:

a support, said support comprising a recessed hole and a circular center through hole axially connected in a line through two opposite sides thereof, the recessed hole of said support having a diameter greater than the circular center through hole of said support; and
a spring mounted in the recessed hole of said support and supported between said support and said frequency modulation wheel to force said frequency modulation wheel against the collar of said cylindrical wheel body of said amplitude modulation wheel.

22. The transmission mechanism as claimed in claim21, wherein said clutch further comprises a limiter fixedly fastened to said support to stop said frequency modulation wheel from falling out of said amplitude modulation wheel.

23. The transmission mechanism as claimed in claim 21, wherein said frequency modulation wheel comprises a protrusion protruded from one side thereof; said support comprises two shoulders disposed in one side thereof at two sides of the recessed hole of said support and adapted to act with the protrusion of said frequency modulation wheel to limit the angle of rotation of said frequency modulation wheel relative to said amplitude modulation wheel.

24. The transmission mechanism as claimed in claim 23, wherein the reactive force produced upon contact between the protrusion of said frequency modulation wheel and one shoulder of said support is greater than the friction resistance between said frequency modulation wheel and the collar of said amplitude modulation wheel.

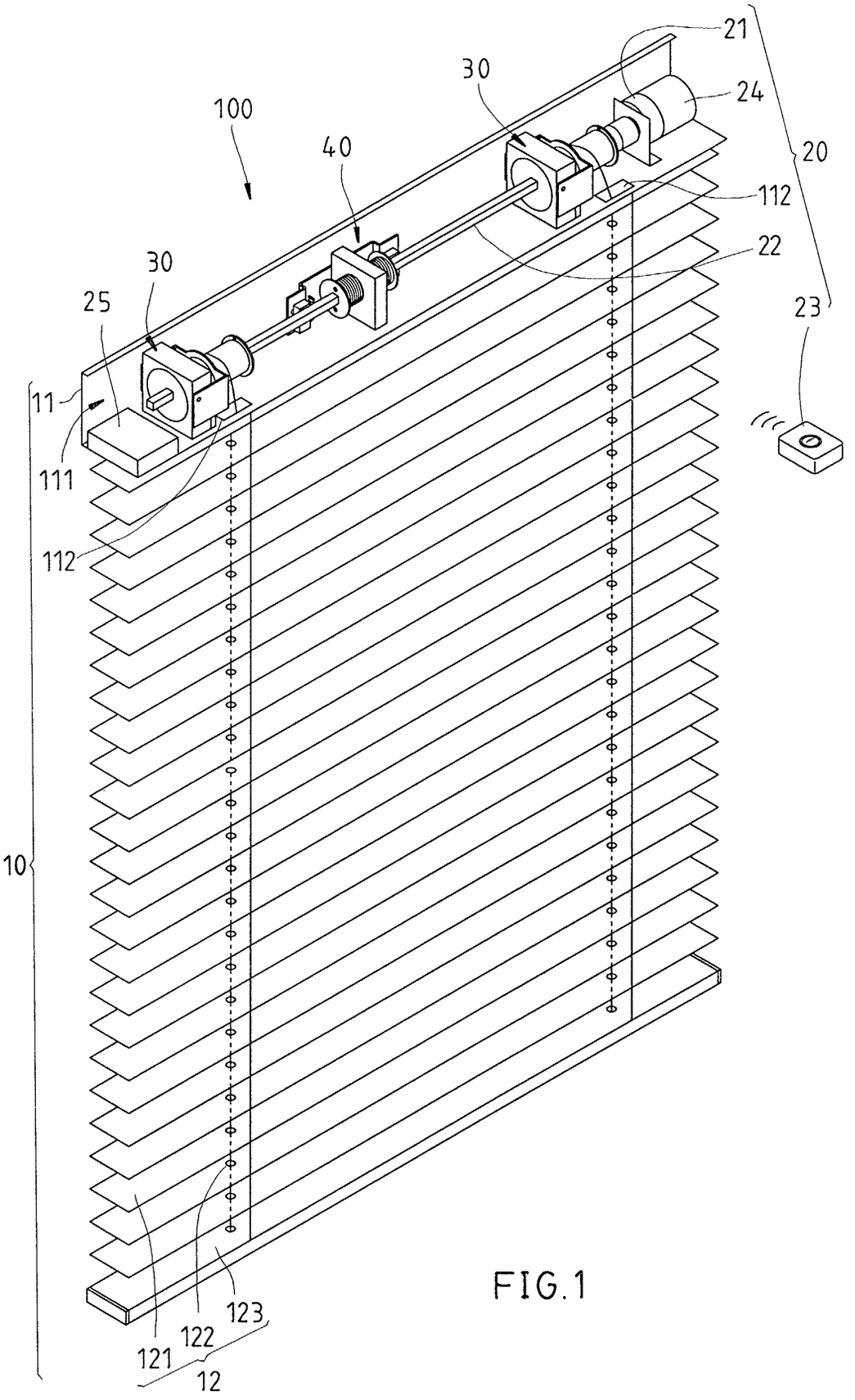

FIG.1

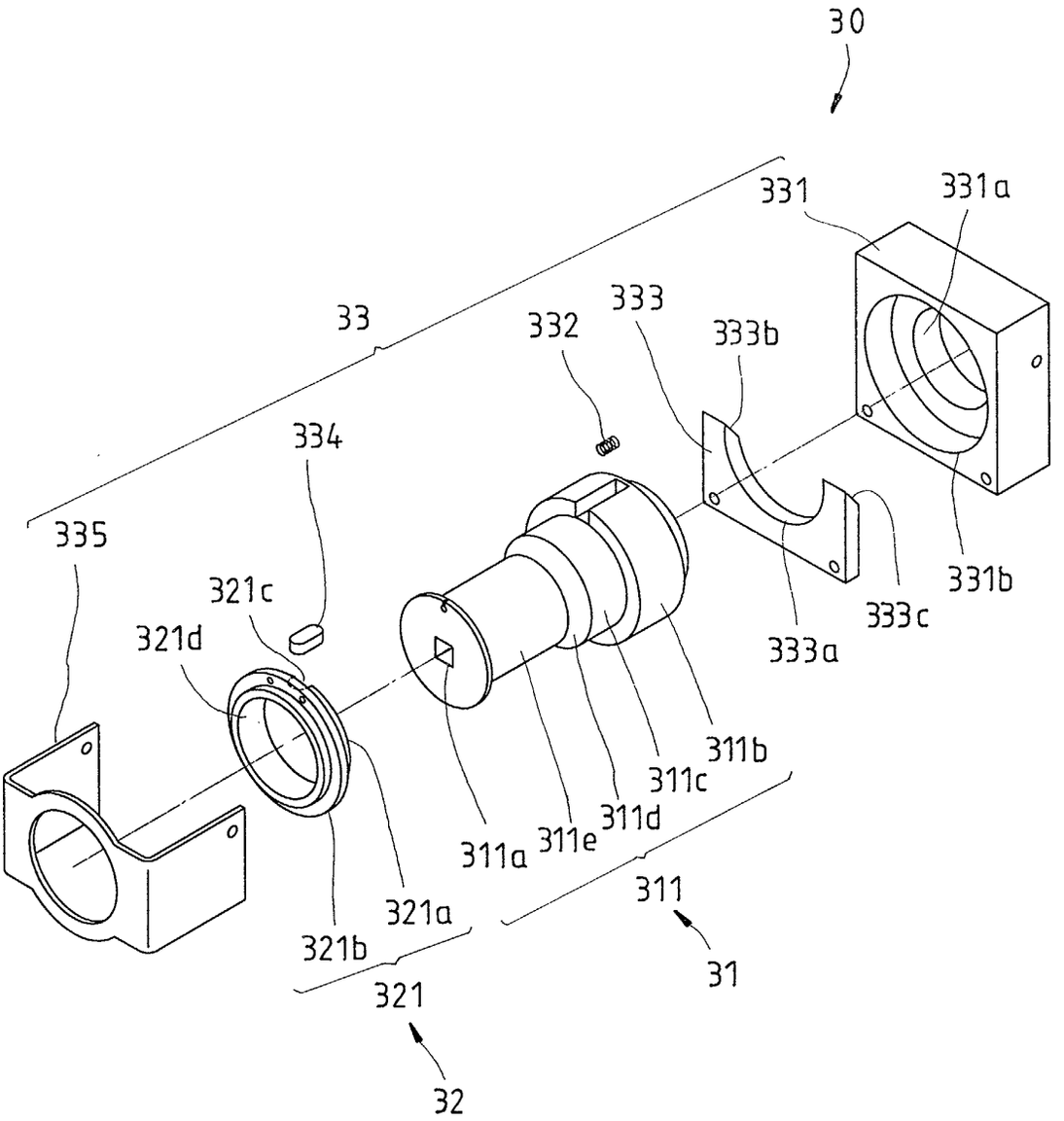
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FIG. 2

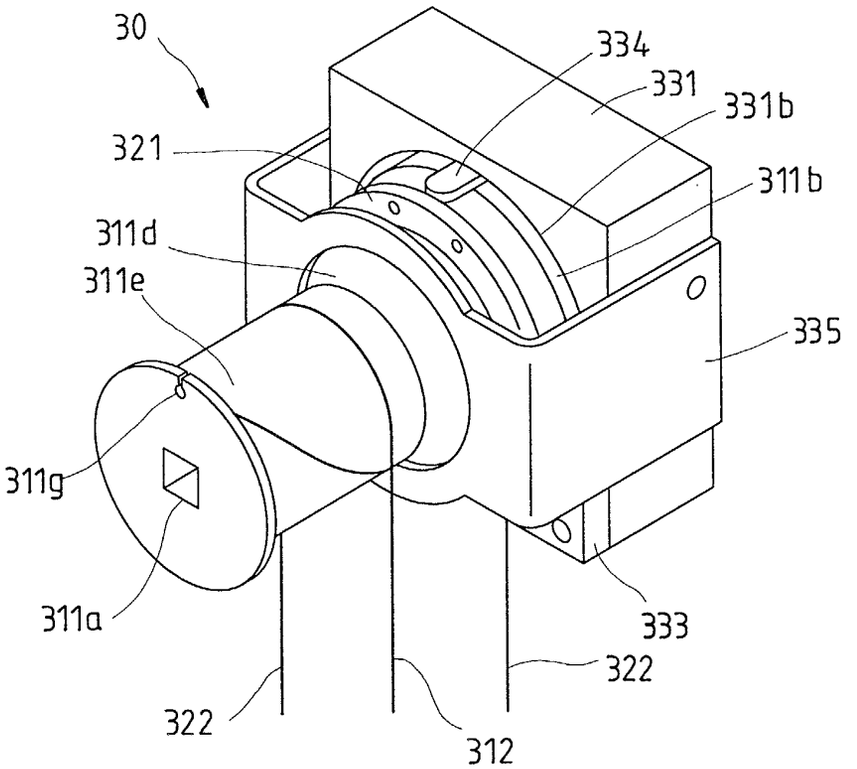
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FIG. 3

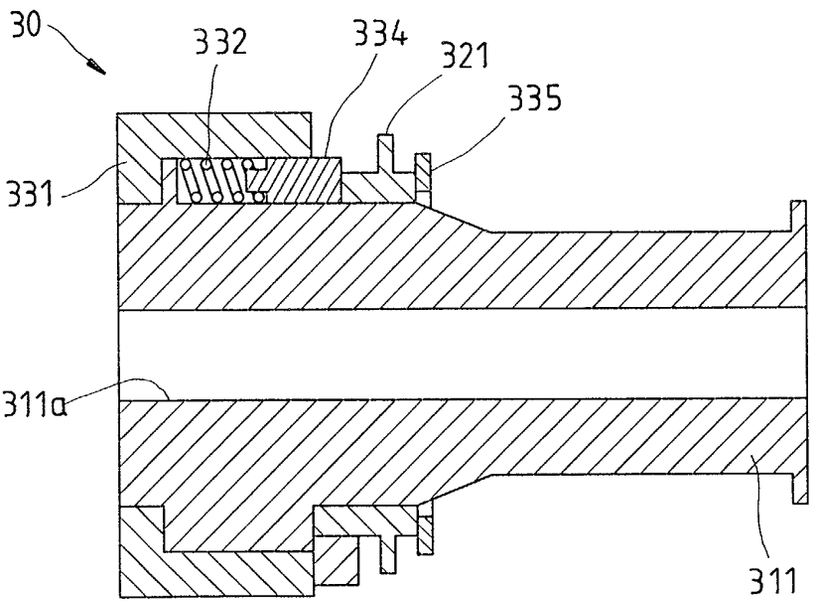
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FIG. 4

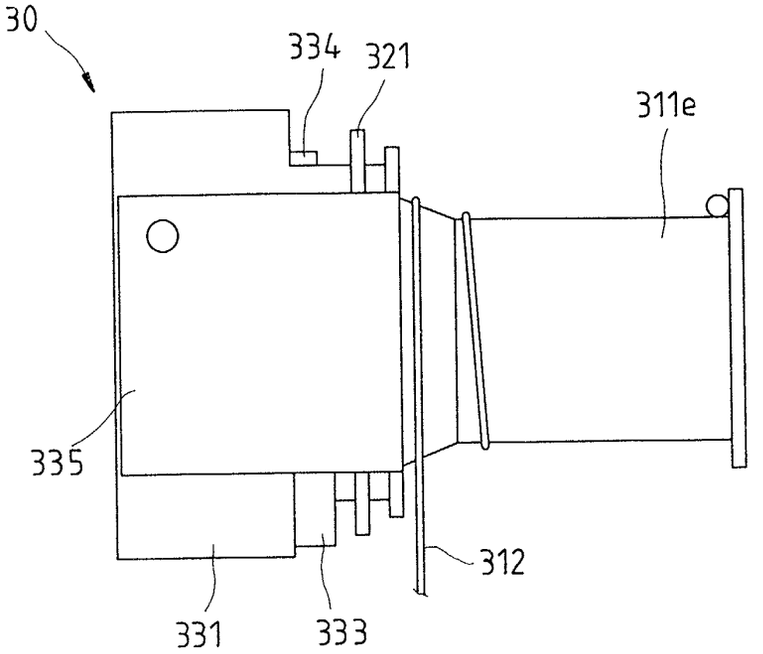
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FIG. 5

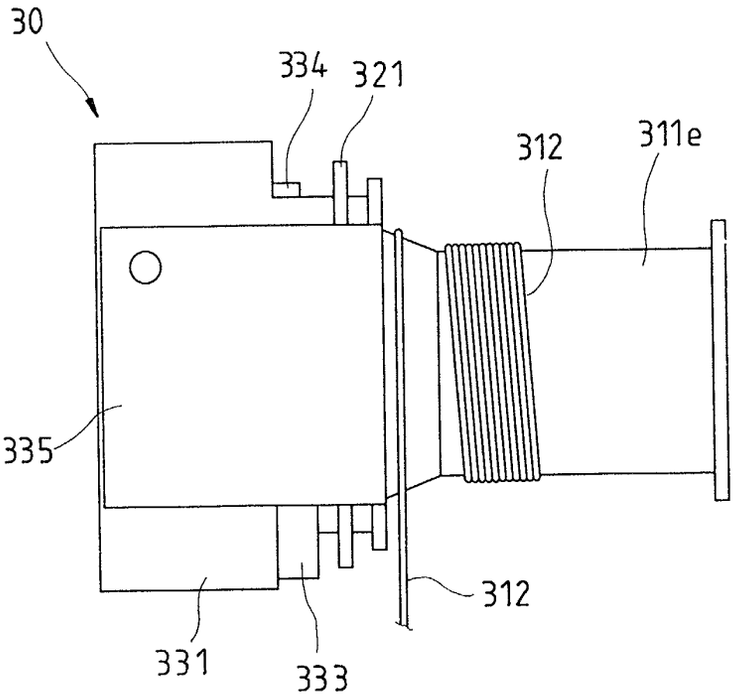
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FIG. 6

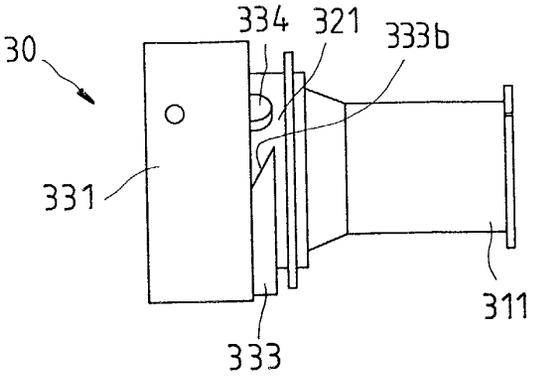


FIG. 7

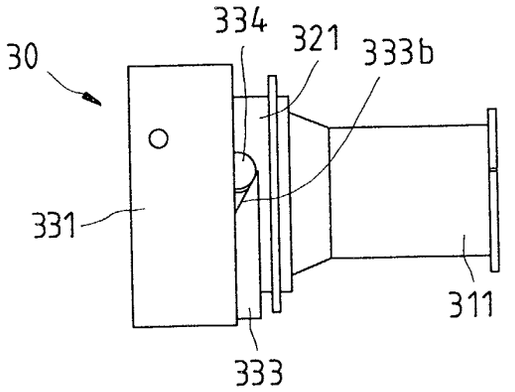


FIG. 8

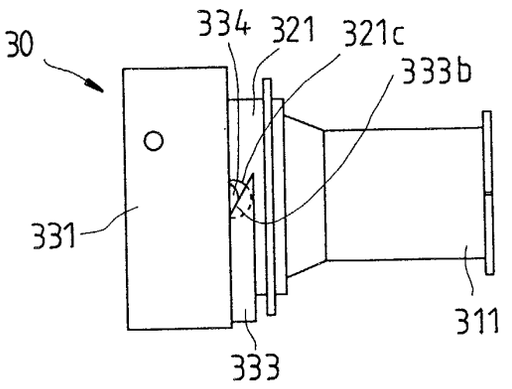


FIG. 9

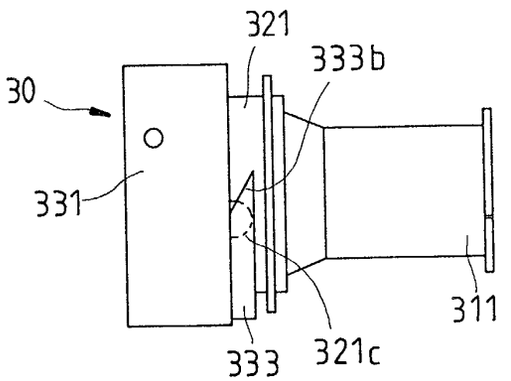


FIG. 10

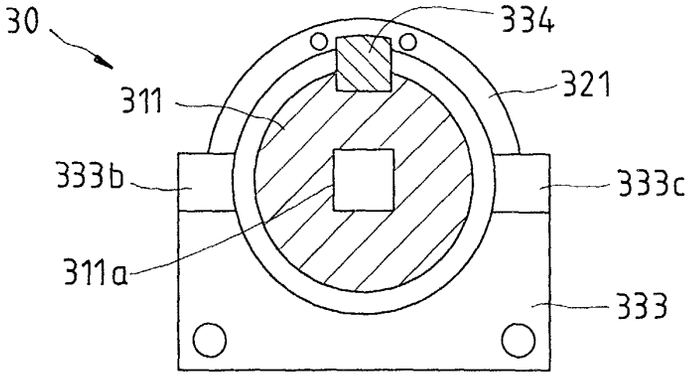


FIG.11

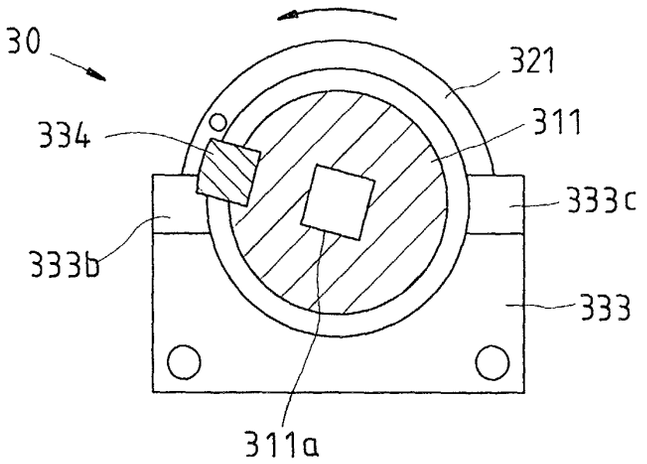
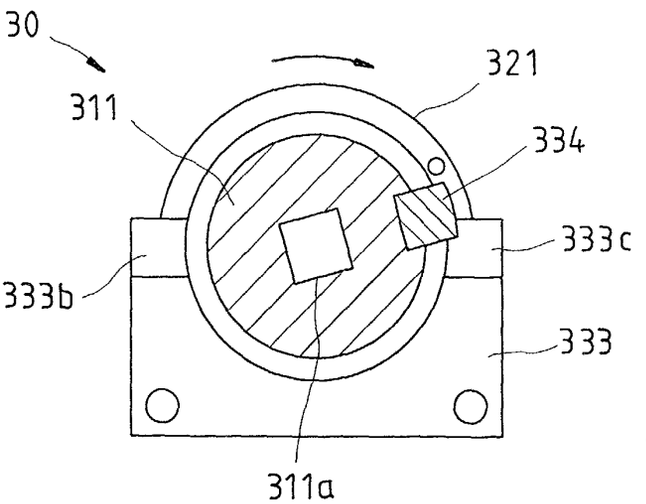


FIG.12



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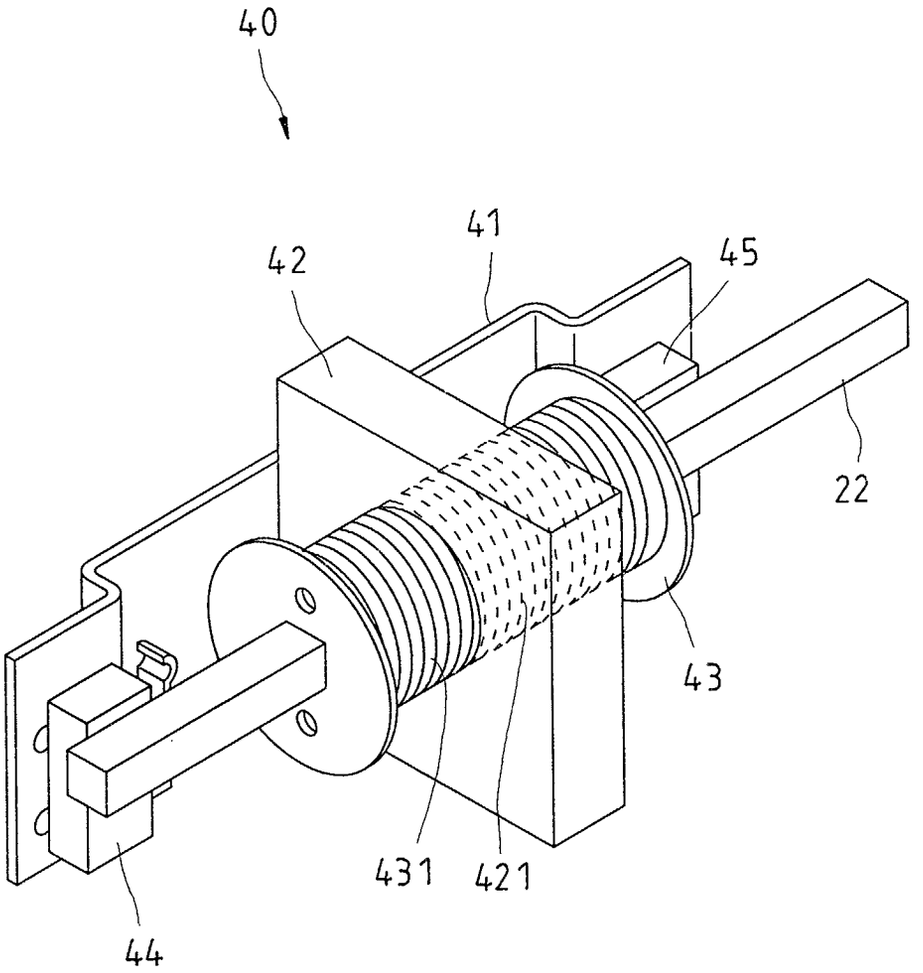

FIG. 14

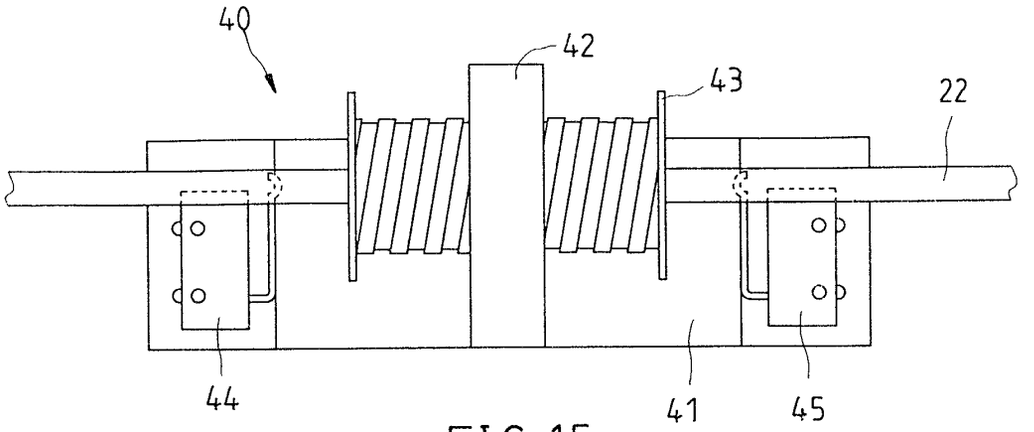

FIG. 15

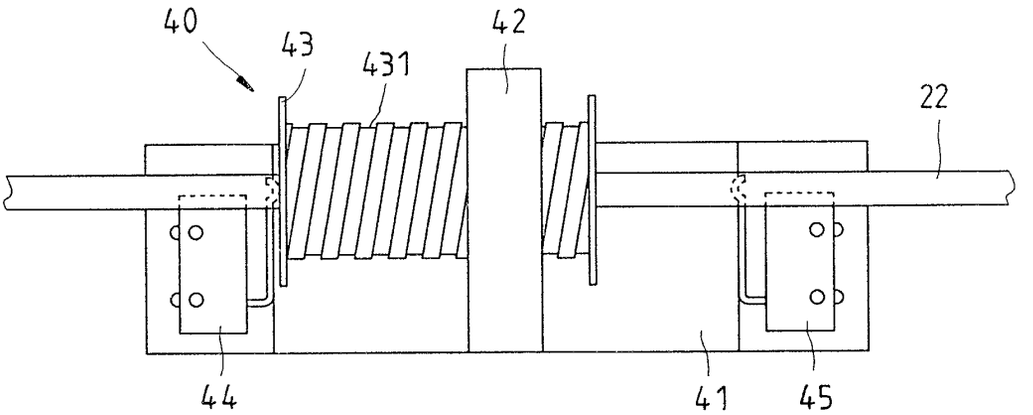

FIG. 16

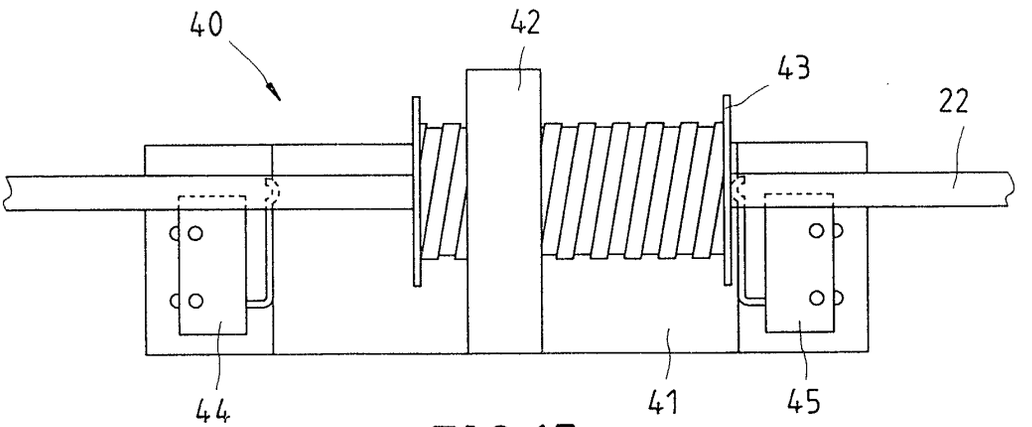

FIG. 17

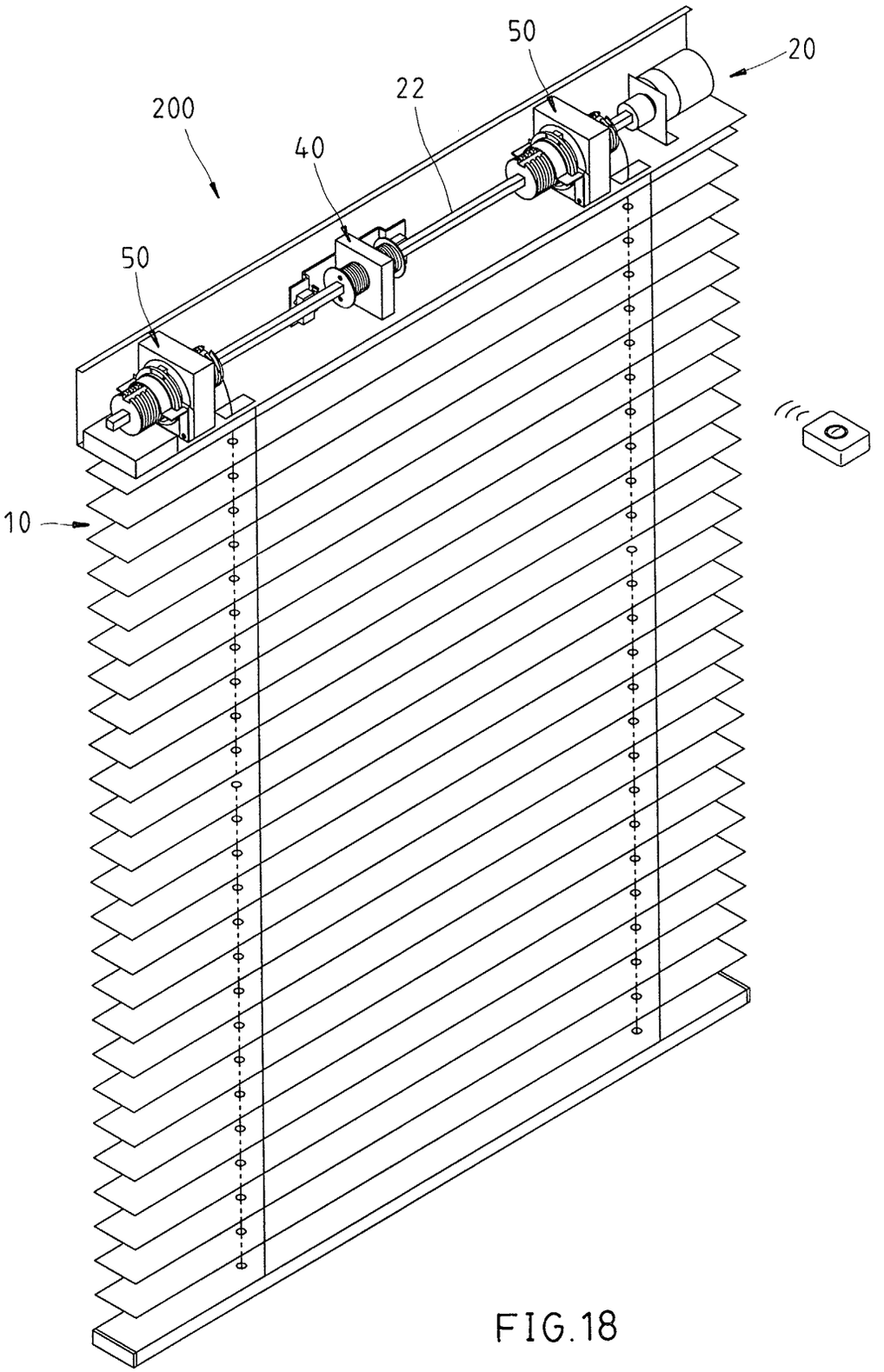

FIG.18

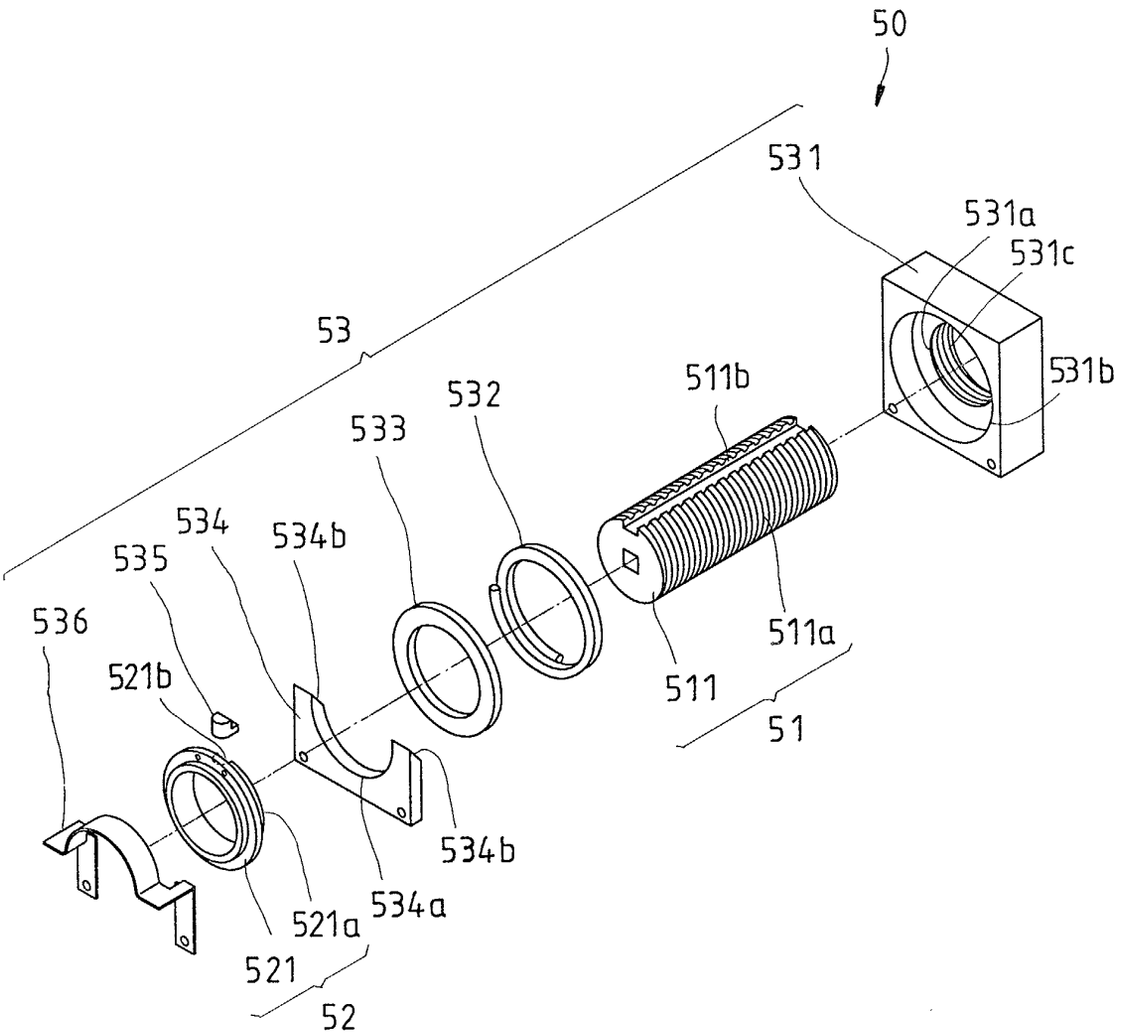
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FIG.19

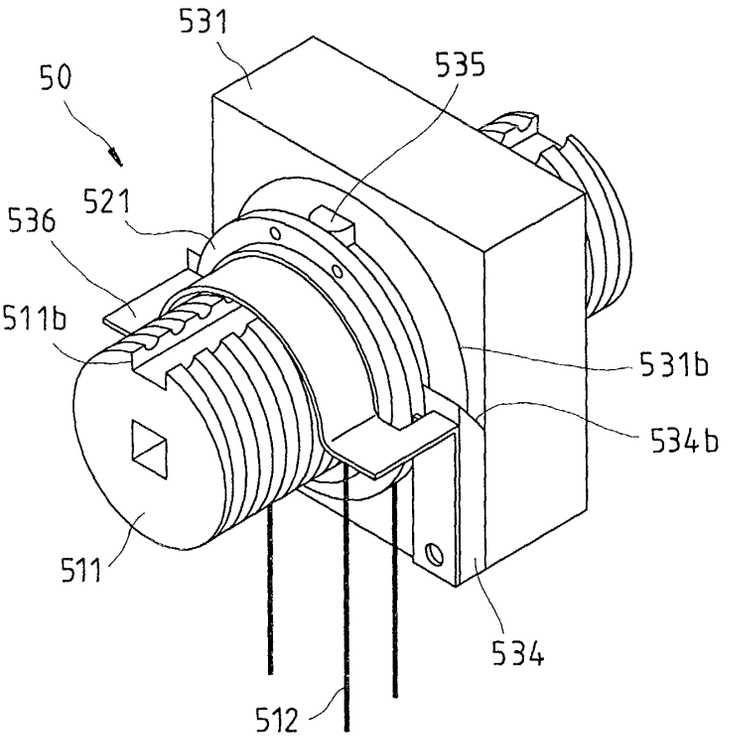
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FIG. 20

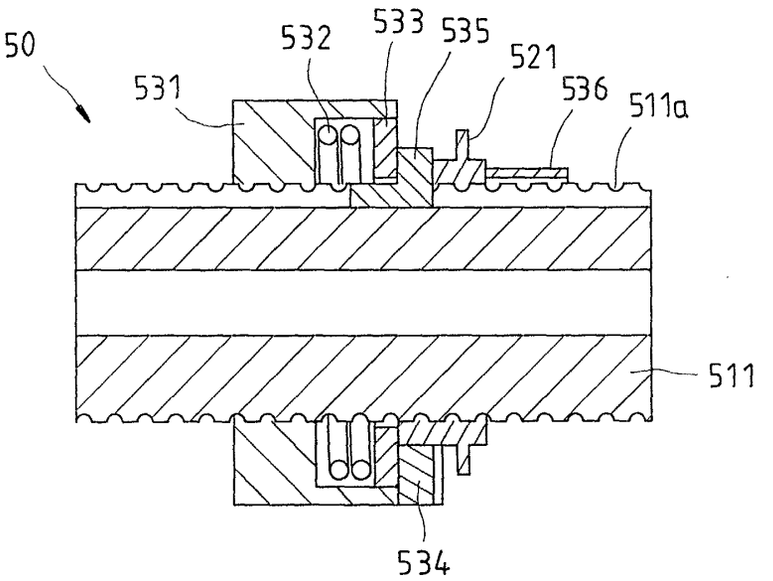
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FIG. 21

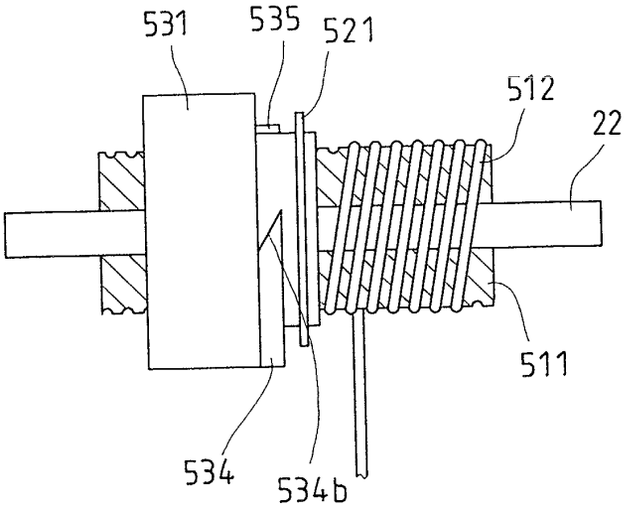
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FIG. 22

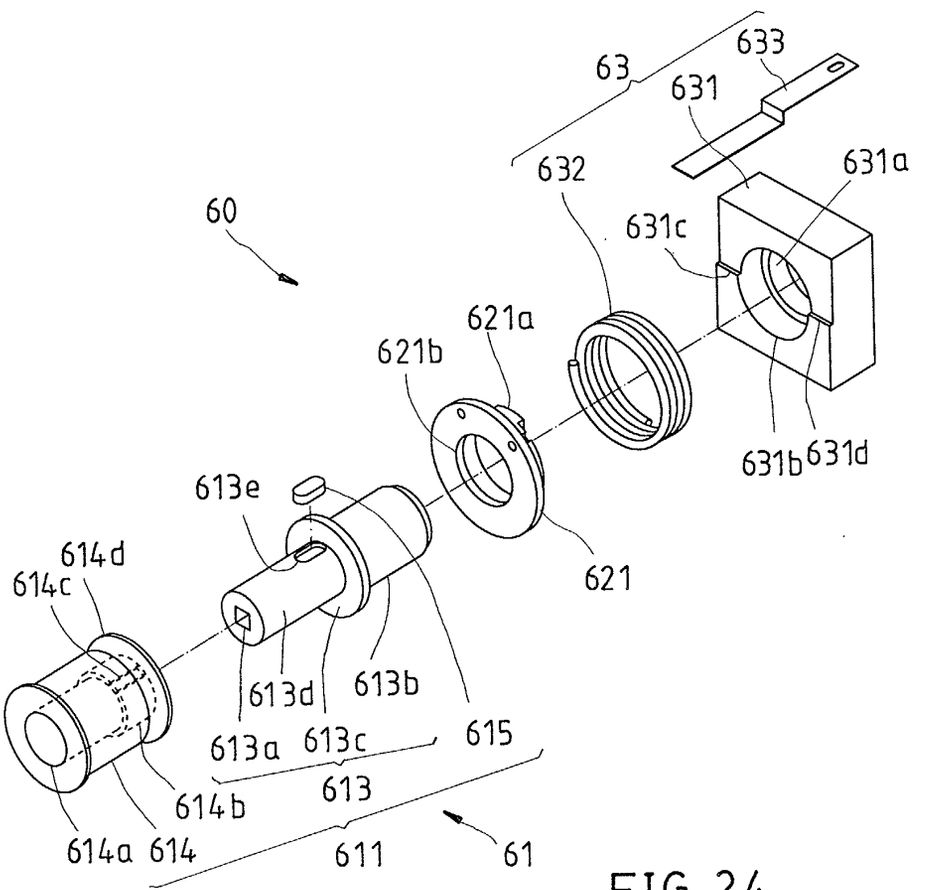
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FIG. 24

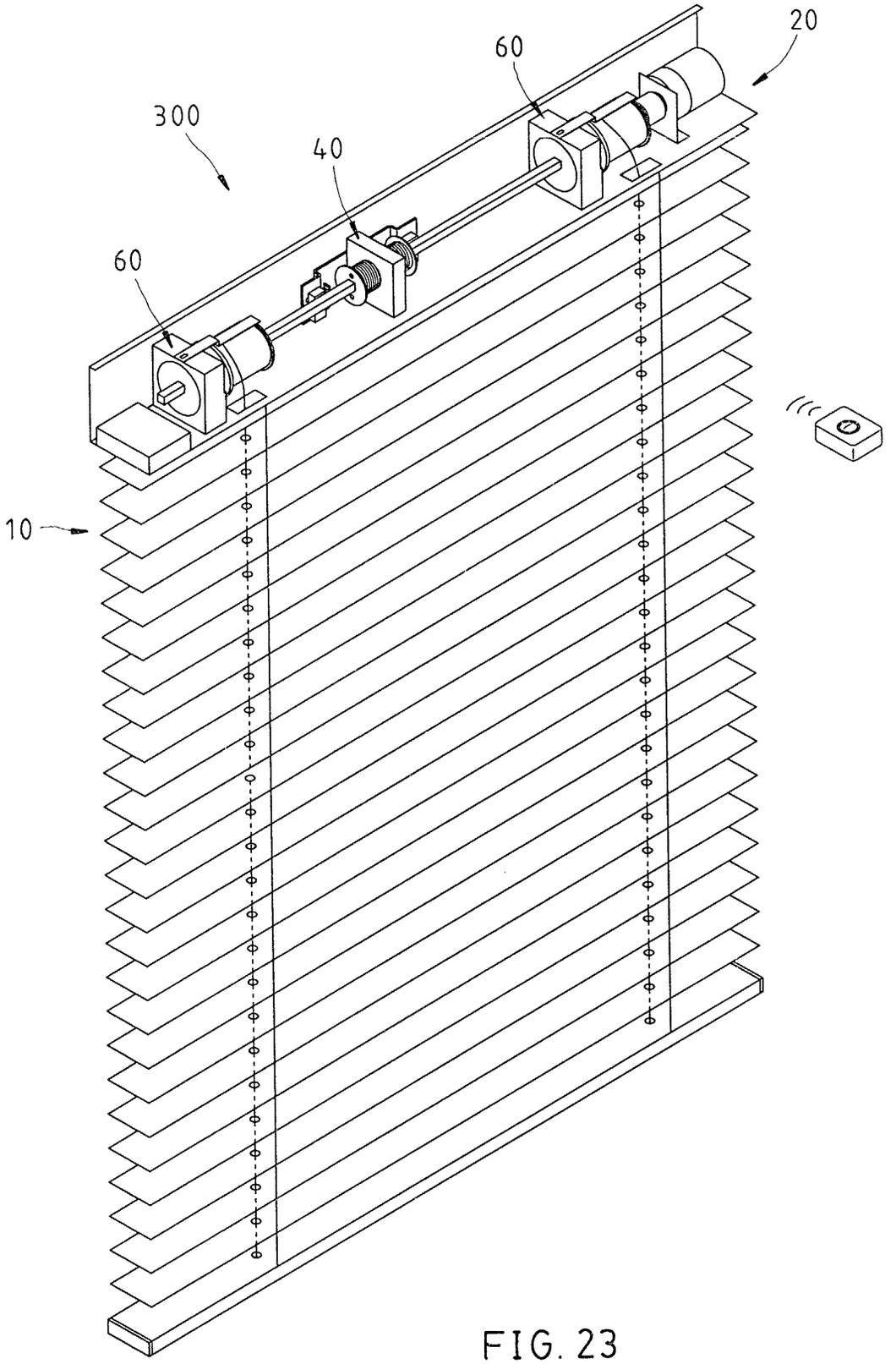

FIG. 23

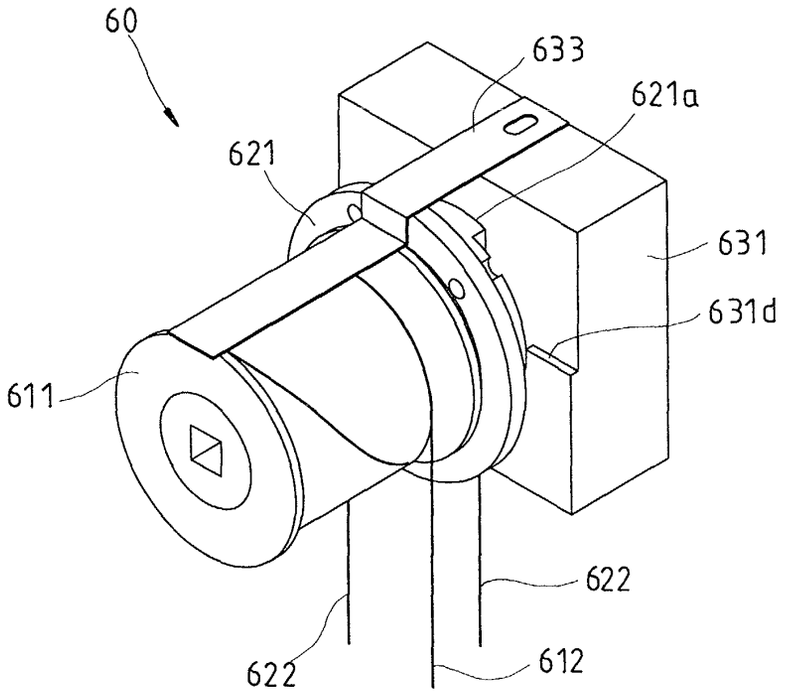
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FIG. 25

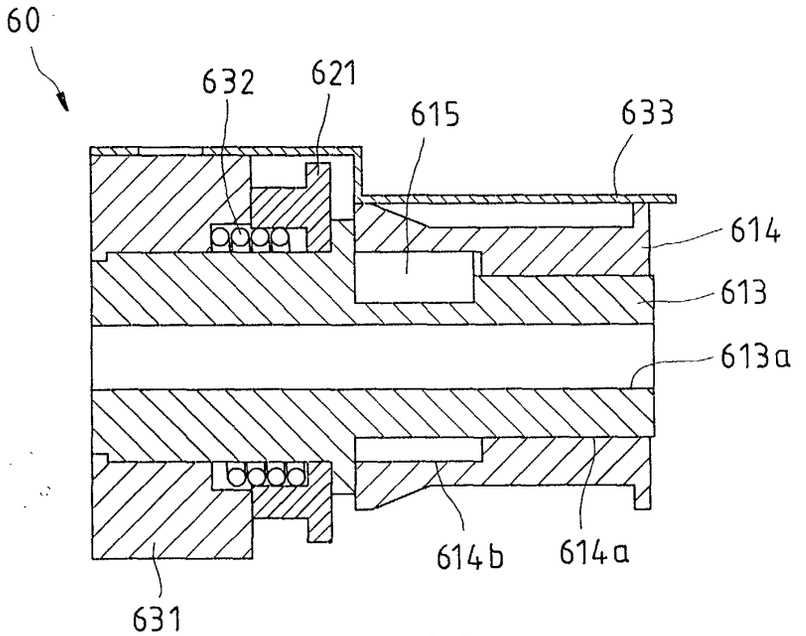
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FIG. 26

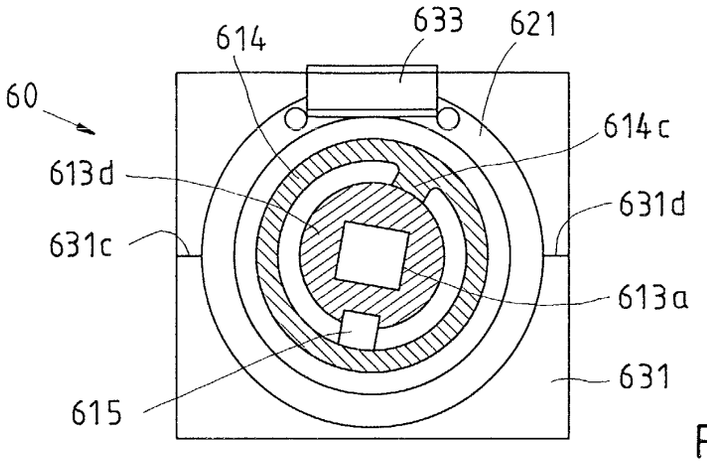

FIG.27

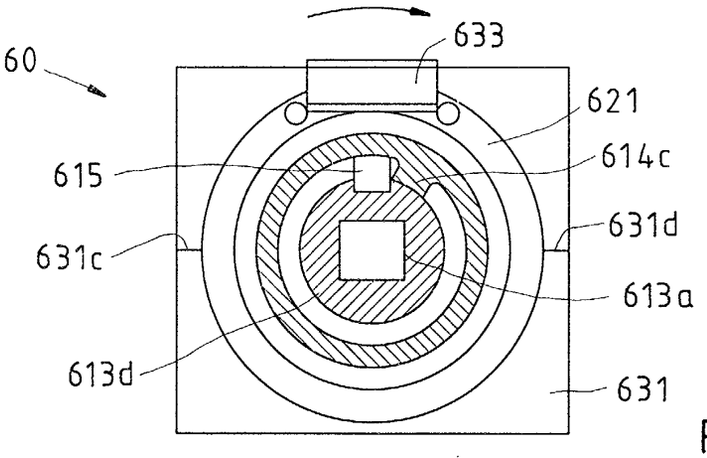

FIG.28

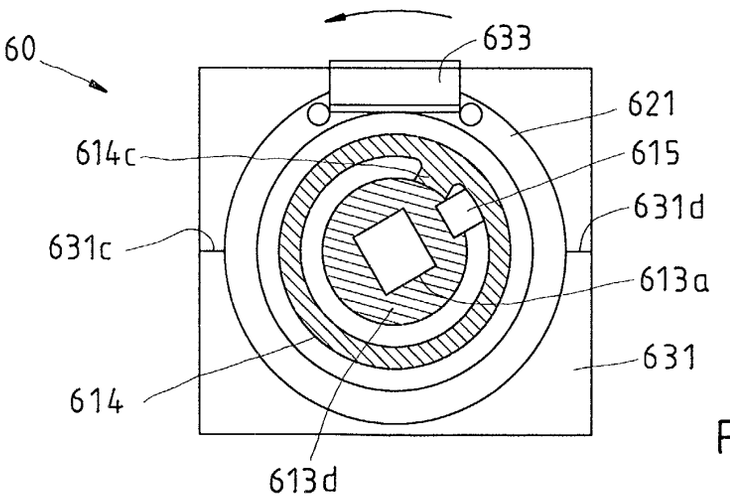

FIG.29

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 25 5528

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	DE 36 25 365 A (WAREMA RENKHOFF GMBH & CO KG) 4 February 1988 (1988-02-04) * column 3, line 36 - column 4, line 12 * * figures 3,8 *	1,4,5	E06B9/322
Y		2	
A		6	

X	PATENT ABSTRACTS OF JAPAN vol. 018, no. 143 (M-1574), 9 March 1994 (1994-03-09) -& JP 05 321546 A (SEKISUI JUSHI CO LTD), 7 December 1993 (1993-12-07) * abstract * * figures 3,4 *	1,4,11	
A		12,15	

Y	PATENT ABSTRACTS OF JAPAN vol. 1997, no. 01, 31 January 1997 (1997-01-31) -& JP 08 246767 A (HIRATA YOSHIO), 24 September 1996 (1996-09-24) * abstract * * figures 4,5 *	2	TECHNICAL FIELDS SEARCHED (Int.Cl.7) E06B

A	DE 198 03 678 A (CHERUBINI ITALO) 6 August 1998 (1998-08-06) * column 1, line 42 - column 2, line 40 * * figures 1,2 *	3	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 November 2002	Geivaerts, D

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

European Patent Office

Application Number
EP 02 25 5528

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☒ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

European Patent Office

LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 02 25 5528

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-24

1.1. Claims: 1-3
End of course system with limit switches

1.2. Claims: 1,4-24
transmission mechanism with clutch for lifting/lowering the bottom rail and tilting the slats

Please note that all inventions mentioned under item 1, although not necessarily linked by a common inventive concept, could be searched without effort justifying an additional fee.

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 25 5528

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

25-11-2002

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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JP 05321546 A	07-12-1993	NONE	
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EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82