

VENETIAN BLIND OPERATING MECHANISM

This invention relates to improvements in a venetian blind operating mechanism of the type having a hollow pole with a hand grip and having two or three lift cord ends extending from the end of the grip, so that the
5 blind has its slats tiltable upon rotation of the grip and liftable by pulling the cord ends.

The mechanism as disclosed in German Patent 2 917 224 causes the slats of a venetian blind to tilt when an end grip of an operating pole is rotated, and causes the
10 bottom bar to be raised when the cord ends are pulled. It has an elongate head box, a gear housing mounted in the head box, a guide roll rotatably mounted in the gear housing, a hollow pole rotatably suspended from the gear housing with the intervention of a universal joint, an
15 annular grip mounted for sliding along the bottom portion of the pole, and a plug mounted in the grip and upwardly spring-biassed to grip a plurality of cords passing through the hollow pole against a surrounding socket within the bottom end of the pole. The gear
20 housing contains two bevel gears one of which has a hollow shaft and is connected to the tubular pole via the universal joint. The other bevel gear is secured to

a slat-tilting shaft which extends along within the head box and carries a plurality of drums. The slats are supported by front and rear ladder strings each having their ends attached to a drum. Upon rotation of the pole, the tilt shaft rotates, and its drums turn to raise either a front or a rear ladder string and lower the other thereby tilting the slats.

A plurality of lift cords are connected at their ends to suspend the bottom bar of the blind, the other ends being guided by the slanting guide roll, passing through the hollow shaft of the bevel gear, passing through the universal joint extending down the hollow pole, and protruding outwardly from the grip.

At rest, the cords are resilient locked between the plug and the socket, so that the bottom bar is held in a set position. When the cords are pulled down (against the frictional resistance between the plug and the socket) the bottom bar is raised. When the grip is pulled down against the spring biasing the plug becomes drawn out of the socket to release the cords so that the bottom bar falls under its own weight.

The known apparatus described above has a friction problem in that the cord and/or the frictional members such as the guide roll, the universal joint, and the plug are easy to wear out. Also, the slanting roll is

disposed in a narrow space, the width of which is less than a quarter of the diameter of the bevel gear, and is thus prevented from having a large diameter. Also, the cords become twisted as the tubular pole is turned, and bear with greater friction on their contacting surfaces.

The present invention sets out to solve the problem described above.

The invention consists in a venetian blind operating mechanism of the type in which (a) the slats of the blind are twistable by twisting an operating rod connected by the intermediary of bevel gears to a rotary tilt shaft above, parallel to, and supporting front and back ladder cords of, the blind slats and (b) the slats are raisable by lift cords attached to a bottom bar and extending through and beyond the operating rod for selective positioning and immobilisation relative thereto: wherein the bevel gears comprise (i) a first bevel gear attached to be rotatable by twisting the rod (ii) a second, larger, bevel gear meshing with the first bevel gear and possessing an additional internally circumferential gear surface and (iii) a pinion driving the rotary tilt shaft meshing with the internally circumferential gear surface of the larger bevel gear.

The bevel ratio i.e. the ratio between the number of teeth in said first bevel gear and the number of teeth in the second bevel gear is conveniently the same or about the same as the ratio between the number of teeth in the pinion and the number of teeth in the internal gear so that one twist of the pole is adequate for maximum tilting travel of the slats. A ratio of about 2:1 is preferred.

Preferably, the pinion is located towards the upper part of the larger bevel gear to maximise the available space beneath the tilt shaft in order to accommodate, and maximise diameters of, guide rollers for the lift cords. The tilt shaft can be higher than the center of the other bevel gear by a quarter of the diameter. This permits use of a slanting guide roll with a large diameter that is more resistant to wear and tear.

The invention further consists in a venetian blind operating mechanism comprising an elongate head box, a gear housing mounted in said box, a guide roll rotatably supported in said gear housing, two bevel gears rotatably mounted within said gear housing, a slat-tilting shaft drivable for rotation with one of said bevel gear, a hollow pole connected to the other, hollow, bevel gears by means of a hollow universal joint, whereby twisting the pole turns the said other bevel gear, an annular grip resiliently biased in an upward and axial direction and slidable on a bottom portion of said pole, a plug mounted within said grip for fitting engagement within a hollow socket fixed to

plurality of lift cords successively secured to a bottom bar of the blind and extending over said guide roll, and through said hollow bevel gear, said hollow joint, said hollow pole and said grip, with free ends extending
5 beyond said grip characterised in that the shaft-driving bevel gear is provided with an internal gear surface and has more bevel-surface teeth than the hollow bevel gear and that said slat-tilting shaft has a pinion engaged with the teeth of said internal gear surface and having
10 fewer teeth than the internal gear surface.

The plug and/or the socket can be made of ceramics or like anti-wear material.

Preferably, said hollow universal joint comprises a ring of metal with an internal sleeve of ceramics, and
15 fixedly four protruding pins pivoted in opposed pairs to constitute the joint.

The invention has the advantage that the cords and the members in frictional contact therewith become less worn through use and that the operating mechanism thus
20 remains operative for a long time.

A venetian blind itself, with such an operating mechanism, is an aspect of the invention.

The invention will be further described with reference to the accompanying drawings, which illustrate only one specific embodiment, in which:

5 Figure 1 is a front elevational view of the relevant portion of a venetian blind equipped with the mechanism of the invention;

Figure 2 is a perspective exploded view of the joint ring of a hollow universal joint as used in Figure 1;

10 Figure 3 is a side elevation partly in section of the venetian blind of Figure 1; and

Figure 4 is a section along the line IV-IV of Figure 3.

Figure 1 shows part of a venetian blind with the mechanism of the invention. A plurality of parallel slats 14 and a bottom bar 16 are suspended from a head box 10 by ladder strings 18 and lift cord 20. A gear housing 12 is mounted in the head box 10. A hollow universal joint 22 has an upper part (as described in more detail below) connected to the one end of the bevel gear 54 projecting from the corner part 58 (see Figure 4) of the gear housing 12, and a lower part connected to the upper end of a hollow tubular pole 24. The upper and

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lower parts of the joint 22 are joined with a hollow ring structure 34. Pole 24 is fitted with cord hangers 26 and has an end grip 28.

As shown in Figure 2, the ring construction 34 has a square body 42 with a circular bore 44 in which, in use, an anti-wear sleeve 46 of ceramics is fixedly inserted. The body 42 has protrusions 48 defining crossed axes to which the upper and lower parts of the universal joint pivot.

Figure 3 shows a tilt shaft 30 which passes along the head box 10. It carries drums (not shown) to which the upper ends of the front and rear ladder strings 18 are attached, so that these ladder strings 18 move in directions opposite to each other to tilt the slats 14 when tilt shaft 30 is rotated.

Each lift cord 20 extends from an end connected to the bottom bar 16, over a guide roll 32 slantingly mounted on the gear case 12, through the ring 34 in the universal joint 22, and through the tubular pole 24. The lift cords 20 eventually reach a tubular socket piece 36 screwed on to the bottom end of the pole 24 and thereafter pass via bores 37 in the end plug 40 to extend past the end of the grip 28. A coil spring 50 is interposed between an inner shoulder of the grip 28 and

the top of the socket piece 36 to bias the grip upwardly. The plug 40 is rotatably mounted and supported by a snap ring 52. Either or both of the socket 36 and the plug 40 are preferably made of an anti-wear material such as ceramics or the like material.

Figure 4 shows a small bevel gear 54 with a hollow shaft meshing with a larger bevel gear 56. Both are rotatably mounted within the gear case 12 in the head box 10, and the small bevel gear 54 has about half the number of teeth of the large bevel gear 56. The small gear 54 is journaled in and protrudes from the corner 58 of the gear housing 12 with a lower end projecting. The main part 60 of the gear housing 12 forms a circular cavity around the large bevel gear 56, and carries a pinion 64 rotatable in the cover part 62 of the gear case 12. The pinion 64 is fitted on the tilt shaft 30 for rotation therewith, and is in mesh with an internal gear surface 66 of the large bevel gear 56. The number of teeth in pinion 64 is about one half of the number on the internal gear 66, whereby the small bevel gear 54 and the tilt shaft 30 rotate at effectively the same rotational speed.

A guide roll 32 is rotatably fitted on an arbor 68 supported by the main part 60 of the gear base. The lift cords 20 pass over the guide roll 32 and down through

the hollow axis of the small bevel gear 54. The space below the tilt shaft 30 and the structure beneath is about the same as the radius of the large bevel gear 56. This permits the guide roll 32 to have a relatively
5 large diameter compared to that encountered in the prior art.

In operation, while the grip hangs freely, the weight of the bottom bar 16 is balanced against the frictional force exerted on the cords 20 between the plug 40 and
10 the socket 36. When the grip 28 is pulled down against the coil spring 50, the plug 40 slips a little out of the socket 36 and loosens the frictional locking to the cords 20. This permits the bottom bar 16 to slip down under its own weight. When the bottom bar 16 has lowered
15 itself to a desired position, grip 28 is released to stop the bottom bar at that position.

If the protruding ends of cords 20 are drawn down below the grip 28, against the frictional resistance, the bottom bar 16 is raised up.

20 Whenever the bottom bar 16 is raised and lowered, the cords 20 always make a somewhat severe frictional contact with the periphery of the guide roll 32. However, the increase of diameter of roll 32 available in the present invention minimises this disadvantage.

The ring 34 of the universal joint 22, the socket 36, and the plug 40 also rub against the cords 20 but, if made of anti-wear ceramics, are scarcely affected at all.

The rotation of the grip 28 is transmitted to the tilt shaft 30 through the pole 24, the joint 22, the bevel gears 56, 54 and the pinion 64 and as described above tilts the slats 14 back and forth. The gear ratio of about 2:1 encountered between the large and small bevel gears 54, 56 and between the inner gear 66 and the pinion 64 permits a complete slat-tilting operation to be performed by no more than one turn of the grip 28. Since the plug 40 is rotatable with the cords 20 within the grip 28, cords 20 remains substantially untwisted in the tubular pole 24 when the grip 28 is rotated by this small amount. Untwisted cords 20 gives less frictional damage to the contacting members such as the guide roll 32, the ring 34, the socket 36, the plug 40 than twisted cords. The apparatus accordingly has a more trouble-free life-time than that of known products.



CLAIMS.

1. A venetian blind operating mechanism of the type in which (a) the slats of the blind are twistable by twisting an operating rod connected by the intermediary of bevel gears to a rotary tilt shaft above, parallel to, and supporting front and back ladder cords of, the blind slats and (b) the slats are raisable by lift cords attached to a bottom bar and extending through and beyond the operating rod for selective positioning and immobilisation relative thereto: wherein the bevel gears comprise (i) a first bevel gear attached to be rotatable by twisting the rod (ii) a second, larger, bevel gear meshing with the first bevel gear and possessing an additional internally circumferential gear surface and (iii) a pinion driving the rotary tilt shaft meshing with the internally circumferential gear surface of the larger bevel gear.

2. A venetian blind operating mechanism as claimed in claim 1 in which the ratio between the numbers of teeth in the first and second bevel gears is the same or substantially the same as that between the numbers of teeth in the pinion and the internal gear surface, whereby a single twist of the rod is adequate for maximum tilting travel of the slats.

3. A venetian blind operating mechanism as claimed in

(24)



claim 1 wherein the pinion is located towards the upper part of the larger bevel gear to maximise the available space beneath the tilt shaft in order to accommodate and maximise diameters of, guide rollers for the lift cords.

- 5 4.A venetian blind operating mechanism comprising an elongate head box gear housing mounted in said box, a guide roll rotatably supported in said gear housing, two bevel gears rotatably mounted within said gear housing, a slat-tilting shaft drivable for rotation with one of
- 10 said bevel gear, a hollow pole connected to the other, hollow, bevel gears by means of a hollow universal joint, whereby twisting the pole turns the said other bevel gear, an annular grip resiliently biased in an upward and axial direction and slidable on a bottom
- 15 portion of said pole, a plug mounted within said grip for fitting engagement within a hollow socket fixed to the bottom end of said pole, a plurality of lift cords successively secured to a bottom bar of the blind and extending over said guide roll, and through said hollow
- 20 bevel gear, said hollow joint, said hollow pole and said grip, with free ends extending beyond said grip characterised in that the shaft-driving bevel gear is provided with an internal gear surface and has more bevel-surface teeth than the hollow bevel gear and that
- 25 said slat-tilting shaft has a pinion engaged with the teeth of said internal gear surface and having fewer



teeth than the internal gear surface.

5. A venetian blind operating mechanism as claimed in any of claims 1 to 4 wherein the gear ratio between said bevel gears, and between the gear surface and said pinion are about 2:1.

6. A venetian blind operating mechanism as claimed in claim 4 wherein said plug is rotatably mounted within said grip.

7. The apparatus of claim 1, wherein said plug is made of ceramics.

8. The apparatus of claim 1, wherein said socket is made of ceramics.

9. A venetian blind operating mechanism as claimed in claim 4 wherein said hollow universal joint comprises a ring of metal with an internal sleeve of ceramics, and fixedly four protruding pins pivoted in opposed pairs constitute the joint.

10. A venetian blind operating mechanism as claimed in claim 1 and substantially as herein described with reference to the accompanying drawings.



11. A venetian blind incorporating the mechanism as claimed in any one preceding claim.
