CLAIMS

1. A roller blind including

- a roller of having a roller length and a roller outer diameter,
- a fabric attached to said roller for winding und unwinding from said roller, the fabric having a fabric length, a fabric weight, a fabric height, and fabric thickness,
- a bottom bar having a bottom bar weight,
- and at least one helically wound torsion spring operatively connected to the roller to drivingly rotate the roller in at least one direction of rotation

wherein the spring is selected according to a Protocol such that its length ensures that the blind operates with a constant operating force.

2. The roller blind of claim 1, additionally including an operating member to driving rotate the roller.

3. The roller blind of claim 1, further including an electrically powered drive motor for drivingly rotating the roller in addition to the at least one spring.

4. The roller blind of claims 1, 2 or 3 wherein the blind includes at least two springs each having a identical lengths and wherein the springs are selected according to the Protocol and which springs in combination drive the roller with the constant operating force.

5. The roller blind of claims 1, 2 or 3 wherein the blind includes at least two springs each having a different lengths and wherein the springs are selected according to the Protocol and which springs in combination drive the roller with constant operating force.

6. The roller blind according to claims 4 or 5 wherein the springs have identical wire diameters and/or spring diameters.

7. The roller blind of claims 4 or 5 wherein the springs have wire diameters and/or spring diameters.

8. The roller blind of any of the preceding claims wherein the Protocol according to which the springs are selected includes at least formula 1 as follows:

$$M = \left\lceil \frac{\left(\frac{\sqrt{\frac{4\times h_{st}\times t_{st}}{\pi}+d_{we}^2}-d_{we}}{2\times t_{st}} + \frac{\sqrt{\frac{4\times h_{st}\times t_{st}}{\pi}+d_{we}^2}\times b_{st}\times G_{st}\times\left(\sqrt{\frac{4\times h_{st}\times t_{st}}{\pi}+d_{we}^2}-d_{we}\right)}{\left[d_{we}\times b_{st}\times\left(G_{ul}+h_{st}\times G_{st}\right)-\sqrt{\frac{4\times h_{st}\times t_{st}}{\pi}+d_{we}^2}\times b_{st}\times G_{ul}\right]\times 2\times t_{st}} \right) \times \left[d_{we}\times b_{st}\times\left(G_{ul}+h_{st}\times G_{st}\right)-\sqrt{\frac{4\times h_{st}\times t_{st}}{\pi}+d_{we}^2}\times b_{st}\times G_{ul} \right]\times t_{st}}{Md0_{Fe}\times n0_{Fe}} \right\rceil$$

$$\sqrt{\frac{4\times h_{st}\times t_{st}}{\pi}+d_{we}^2}-d_{we}$$

in which formula 1:

M = number of springs in the roller blind

d_{we} = outer diameter of the roller

h_{st} = height of the fabric sheet

b_{st} = width of the fabric sheet

t_{st} = thickness of the fabric sheet

G_{st} = Weight of the fabric sheet

G_{ul} = Weight of the bottom rail

$Md0_{Fe}$ = assumed torque increase of the spring w.r.t. it's length $LK0_{Fe}$

$n0_{Fe}$ = maximum number of rotations for $LK0_{Fe}$

9. The roller blind of any one of claims 1-8 wherein the Protocol according to which the springs are selected includes at least formula 2 as follows:

$$LK1_{Fe} = \frac{LK0_{Fe}\times Md0_{Fe}\times M\times\left(\sqrt{\frac{4\times h_{st}\times t_{st}}{\pi}+d_{we}^2}-d_{we}\right)}{\left[d_{we}\times b_{st}\times\left(G_{ul}+h_{st}\times G_{st}\right)-\sqrt{\frac{4\times h_{st}\times t_{st}}{\pi}+d_{we}^2}\times b_{st}\times G_{ul}\right]\times t_{st}}$$

in which Formula 2::

M = number of springs in the roller blind

d_{we} = outer diameter of the roller

h_{st} = height of the fabric sheet
b_{st} = width of the fabric sheet
t_{st} = thickness of the fabric sheet
G_{st} = Weight of the fabric sheet
G_{ul} = Weight of the bottom rail
$Md0_{Fe}$ = assumed torque increase of the spring w.r.t. it's length $LK0_{Fe}$
$LK0_{Fe}$ = assumed spring length w.r.t. to $Md0_{Fe}$
$LK1_{Fe}$ = calcuted spring length adapted to the roller blind
$n0_{Fe}$ = maximum number of rotations for $LK0_{Fe}$
$n1_{Fesp}$ = number of rotations as pre-tension of the blind in the lifted position

10. The roller blind according to any one of the claims 2-9 the blind further including a spring assist module holding the spring or springs,
the module including

- a stationary carrier connectable to the operating member;
- at least one torsion spring having a first and a second spring end;
- at least one rotatable member to be keyed to the roller such that rotation of the roller rotates the rotatable member; and;

the torsion spring having a first end operatively coupled to the stationary member and a second end operatively coupled to the rotatable member; whereby in use upon rotation of the rotatable member in one direction of rotation kinetic energy may be stored by the torsion spring from the rotatable member and upon rotation of the rotatable member in an opposite direction of rotation any kinetic energy stored by the torsion spring may be released to the rotatable member and wherein the spring assist module is pre-assembled as a self-contained unit.

11. The roller blind of claim 10 wherein the stationary carrier includes a central shaft.

12. The roller blind of claim 11 wherein the stationary carrier is a shaft with a continuous unround profile.

13. The roller blind of claim 11 or 12, wherein the torsion spring concentrically surrounds the central shaft.

14. The roller blind according to any of the claims 10-13, wherein the rotatable member includes a radially extending flange having a circumferentially shaped contour for engaging a mating formation the roller of the roller blind.

15. The roller blind according to any one of claims 10-14, wherein the stationary carrier has a connector on each axial end for keeping the stationary carrier respect to the roller blind with which the spring assist module is adapted to cooperate.

16. The roller blind according to claim 15, wherein the connectors on either axial end of the stationary carrier maintain the integrity of the spring assist module as a self-contained unit.

17. A spring assist module for window covering, the module including

- a stationary carrier connectable to an operating member of the window covering ;
- at least one helically wound torsion spring having a first and a second spring end;
- at least one rotatable member to be keyed to a driven part of the window covering, such that rotation of the driven part rotates the rotatable member; and;

the torsion spring having a first end operatively coupled to the stationary carrier and a second end operatively coupled to the rotatable member; whereby in use upon rotation of the rotatable member in one direction of rotation kinetic energy may be stored by the torsion spring from the rotatable member and upon rotation of the rotatable member in an opposite direction of rotation any kinetic energy stored by the torsion spring may be released to the rotatable member and wherein the spring assist module is pre-assembled as a self-contained unit.

18. The spring assist module of claim 17 wherein the stationary carrier includes a central shaft.

19. The spring assist module of claim 18 wherein the stationary member is a shaft with a continuous unround profile.

20. The spring assist module of claim 18 or 19, wherein the torsion spring concentrically surrounds the central shaft.

21. The spring assist module according to any preceding claims 17-20, further including an electrically powered drive motor operatively arranged between the stationary carrier and the at least one rotatable member.

22. The spring assist module of any of the preceding claims 17-21 wherein, the at least one spring is selected according to a Protocol taking into account a set of parameters of the window covering to be assisted by the spring assist module, such that the at least one spring selected by the Protocol has a length that ensures that it drives the window covering with a constant operating force.

23. The spring assist module of the claims 17 to 22 wherein the module includes at least two springs each having a equal lengths and wherein the springs are selected according to the Protocol and which springs in combination drive the window covering with constant operating force.

24. The spring assist module of the claims 17 to 22 wherein the module includes at least two springs having different lengths and wherein the springs are selected according to the Protocol and which springs in combination drive the window covering with constant operating force.

25. The spring assist module according to claims 23 or 24 wherein the springs have identical wire diameters and/or spring diameters.

26. The spring assist module of claims 23 or 24 wherein the springs have different wire diameters and/or spring diameters.

27. The spring assist module of any of the claims 22-26 wherein the Protocol includes at least formula 1 as follows:

$$M = \left\lceil \left(\frac{\sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} - d_{we}}{2 \times t_{st}} + \frac{\sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} \times b_{st} \times G_{ut} \times \left(\sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} - d_{we} \right)}{\left[d_{we} \times b_{st} \times (G_{ut} + h_{st} \times G_{st}) - \sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} \times b_{st} \times G_{ut} \right] \times 2 \times t_{st}} \right) \times \left[d_{we} \times b_{st} \times (G_{ut} + h_{st} \times G_{st}) - \sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} \times b_{st} \times G_{ut} \right] \times t_{st} \times \sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} - d_{we} \right\rceil$$

$$Md0_{Fe} \times n0_{Fe}$$

in which formula 1:

M = number of springs in the roller blind

d_{we} = outer diameter of the roller

h_{st} = height of the fabric sheet

b_{st} = width of the fabric sheet

t_{st} = thickness of the fabric sheet

G_{st} = Weight of the fabric sheet

G_{ut} = Weight of the bottom rail

$Md0_{Fe}$ = assumed torque increase of the spring w.r.t. it's length $LK0_{Fe}$

$n0_{Fe}$ = maximum number of rotations for $LK0_{Fe}$

28. The spring assist module of any one of claims 22-27 wherein the Protocol according to which the springs are selected includes at least formula 2 as follows:

$$LK1_{Fe} = \frac{LK0_{Fe} \times Md0_{Fe} \times M \times \left(\sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} - d_{we} \right)}{\left[d_{we} \times b_{st} \times \left(G_{ul} + h_{st} \times G_{st} \right) - \sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} \times b_{st} \times G_{ul} \right] \times t_{st}}$$

in which Formula 2::
M = number of springs in the roller blind

d_{we} = outer diameter of the roller

h_{st} = height of the fabric sheet

b_{st} = width of the fabric sheet

t_{st} = thickness of the fabric sheet

G_{st} = Weight of the fabric sheet

G_{ul} = Weight of the bottom rail

$Md0_{Fe}$ = assumed torque increase of the spring w.r.t. it's length $LK0_{Fe}$

$LK0_{Fe}$ = assumed spring length w.r.t. to $Md0_{Fe}$

$LK1_{Fe}$ = calcuted spring length adapted to the roller blind

$n0_{Fe}$ = maximum number of rotations for $LK0_{Fe}$

$n1_{Fesp}$ = number of rotations as pre-tension of the blind in the lifted position

CLAIMS

1. A roller blind (1) including

- a roller (7) having a roller length and a roller outer diameter,
- a fabric (9) attached to said roller for winding and unwinding from said roller, the fabric having a fabric length, a fabric weight, a fabric height, and fabric thickness,
- a bottom bar having a bottom bar weight,
- and at least one helically wound torsion spring (35) operatively connected to the roller to drivingly rotate the roller in at least one direction of rotation

wherein the helically wound torsion spring (35) is selected according to a Protocol such that its length ensures that the blind operates with a constant operating force.

2. The roller blind of claim 1, additionally including an operating member (5) to drivingly rotate the roller.

3. The roller blind of claim 1, further including an electrically powered drive motor (5) for drivingly rotating the roller in addition to the at least one spring.

4. The roller blind of claims 1, 2 or 3 wherein the blind includes at least two springs (135A, 135B) each having identical lengths and wherein the springs are selected according to the Protocol and which springs in combination drive the roller with the constant operating force.

5. The roller blind of claims 1, 2 or 3 wherein the blind includes at least two springs (135A, 135B) each having different lengths and wherein the springs are selected according to the Protocol and which springs in combination drive the roller with constant operating force.

6. The roller blind according to claims 4 or 5 wherein the springs have identical wire diameters and/or spring diameters.

7. The roller blind of any of the preceding claims wherein the Protocol according to which the springs are selected includes at least formula 1 as follows:

$$M = \left| \frac{\left(\frac{\sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} - d_{we}}{2 \times t_{st}} + \frac{\sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} \times b_{st} \times G_{ul} \times \left(\sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} - d_{we} \right)}{\left[d_{we} \times b_{st} \times (G_{ul} + h_{st} \times G_{st}) - \sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} \times b_{st} \times G_{ul} \right] \times 2 \times t_{st}} \right) \times \frac{\left[d_{we} \times b_{st} \times (G_{ul} + h_{st} \times G_{st}) - \sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} \times b_{st} \times G_{ul} \right] \times t_{st}}{\sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} - d_{we}}}{Md0_{Fe} \times n0_{Fe}} \right|$$

in which formula 1:

M = number of springs in the roller blind

d_{we} = outer diameter of the roller

h_{st} = height of the fabric sheet

b_{st} = width of the fabric sheet

t_{sl} = thickness of the fabric sheet

G_{st} = Weight of the fabric sheet

G_{ul} = Weight of the bottom rail

$Md0_{Fe}$ = assumed torque increase of the spring w.r.t. it's length $LK0_{Fe}$

$n0_{Fe}$ = maximum number of rotations for $LK0_{Fe}$

8. The roller blind of any one of claims 1-7 wherein the Protocol according to which the springs are selected includes at least formula 2 as follows:

$$LK1_{Fe} = \frac{LK0_{Fe} \times Md0_{Fe} \times M \times \left(\sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} - d_{we} \right)}{\left[d_{we} \times b_{st} \times (G_{ul} + h_{st} \times G_{st}) - \sqrt{\frac{4 \times h_{st} \times t_{st}}{\pi} + d_{we}^2} \times b_{st} \times G_{ul} \right] \times t_{st}}$$

in which Formula 2::

M = number of springs in the roller blind

d_{we} = outer diameter of the roller

h_{st} = height of the fabric sheet
b_{st} = width of the fabric sheet
t_{st} = thickness of the fabric sheet
G_{st} = Weight of the fabric sheet
G_{ut} = Weight of the bottom rail
$Md0_{Fe}$ = assumed torque increase of the spring w.r.t. it's length $LK0_{Fe}$
$LK0_{Fe}$ = assumed spring length w.r.t. to $Md0_{Fe}$
$LK1_{Fe}$ = calcuted spring length adapted to the roller blind
$n0_{Fe}$ = maximum number of rotations for $LK0_{Fe}$
$n1_{Fesp}$ = number of rotations as pre-tension of the blind in the lifted position

9. The roller blind according to any one of the claims 2-8 the blind further including a spring assist module (11) holding the spring or springs, the module including

- a stationary carrier connectable to the operating member;
- at least [one] helically wound [one] torsion spring (35) having a first (37) and a second (39) spring end;
- at least one rotatable member (23) to be keyed to the roller such that rotation of the roller rotates the rotatable member; and;

the helically wound torsion spring (35) having a first end (37) operatively coupled to the stationary carrier and a second end (39) operatively coupled to the rotatable member (23); whereby in use upon rotation of the rotatable member in one direction of rotation kinetic energy may be stored by the helically wound torsion spring (35) from the rotatable member and upon rotation of the rotatable member in an opposite direction of rotation any kinetic energy stored by the helically wound torsion spring (35) may be released to the rotatable member and wherein the spring assist module is pre-assembled as a self-contained unit.

10. The roller blind of claim 9 wherein the stationary carrier includes a central shaft (25), optionally with a continuous unround profile.

11. The roller blind of claim 10, wherein the torsion spring concentrically surrounds the central shaft.

12. The roller blind according to any one of claims 9-11, wherein the stationary carrier has a connector on each axial end for keeping the stationary carrier stationary with respect to the roller blind with which the spring assist module is adapted to cooperate and wherein optionally the connectors on either axial end of the stationary carrier maintain the integrity of the spring assist module as a self-contained unit.

13. A spring assist module (11) for a window covering, the module including

- a stationary carrier (25) connectable to an operating member of the window covering;

- at least one helically wound torsion spring (35) having a first and a second spring end;

- at least one rotatable member (23) to be keyed to a driven part of the window covering, such that rotation of the driven part rotates the rotatable member; and;

the helically wound torsion spring (35) having a first end (37) operatively coupled to the stationary carrier and a second end (39) operatively coupled to the rotatable member (23); whereby in use upon rotation of the rotatable member in one direction of rotation kinetic energy may be stored by the helically wound torsion spring (35) from the rotatable member and upon rotation of the rotatable member in an opposite direction of rotation any kinetic energy stored by the helically wound torsion spring (35) may be released to the rotatable member and wherein the spring assist module is pre-assembled as a self-contained unit, wherein the helically wound torsion spring (35) is selected according to a Protocol such that its length ensures that the window covering operates with a constant operating force.

14. The spring assist module of claim 13 further having the features of the spring assist module defined for the roller blind according to any one of claims 9 to 12.

15. The spring assist module according to claim 13 or 14, further including an electrically powered drive motor operatively arranged between the stationary carrier and the at least one rotatable member.