The present invention relates to window shade rollers and the like and more particularly to the winding mechanism thereof.

The principal object of the present invention has been the provision of a novel and improved window shade roller mechanism which is efficient in operation and inexpensive from the standpoint of materials and labor required in the manufacture thereof.

More particularly, it has been an object of the invention to provide such a roller mechanism which is especially adapted to be made from plastic and metal parts but which is easy to assemble and which provides good operating characteristics.

A feature of the invention has been the provision of a flat metal plate in place of the conventional wooden spring stick and a cooperating hub construction which avoids the tendency for the operating spring to receive a permanent set due to the use of a flat spring stick.

Another feature of the invention has been the provision of a pawl supporting housing construction which permits the use of plastic materials but which avoids the tendency for the pawl mounting pins to be sheared off in service.

And further objects, features and advantages of the invention will appear more fully from the following description of an illustrative embodiment of the invention, taken in connection with the appended drawings in which:

FIG. 1 is an exploded view of a window shade roller assembly embodying the invention;

FIG. 2 is a longitudinal sectional view of the window shade roller of FIG. 1;

FIG. 3 is a longitudinal sectional view of the window shade roller of FIG. 1 taken in a plane at right angles to the view shown in FIG. 2; and

FIG. 4 is a sectional view of the construction of the hub and flange portion of the ratchet and pawl housing.

Referring now to the drawings, the window shade roller of the invention comprises a hollow cylindrical roller 10, which is preferably made of plastic and which carries in one end a spring motor mechanism 11 and in the other end a suitable supporting pin construction 12. The roller 10 may have a bore thereto in any suitable way a window shade or other flexible web which is intended to be rolled onto and unrolled from the roller 10. The window shade, which is not shown, may be affixed to the roller 10 by adhesive, by staples or by other convenient fastening means.

The supporting pin construction 12 comprises a hollow cylindrical housing 13 which fits within an end of roller 10 and is held in position therein and caused to rotate with roller 10 by means of retaining pins 14 and 15 acting in aligned holes in roller 10 and housing 13. The outer end of housing 13 is closed by a flat integral face 16 from which projects supporting pin 17. Pin 17 is journaled for rotation in a suitable bracket 18 mounted at one side of the window frame or other convenient location as is well known in the art. Bracket 18 acts to support one end of the roller.

As is best shown in FIG. 1, the spring motor mechanism 11 comprises a retaining housing 19, a combination ratchet and gudgeon 20, a spring stick 21, a pair of ratchet pawls 22 and 23, a ratchet and pawl housing 24, and a shade spring 25.

Retaining housing 19 is generally cylindrical in shape with a central axially extending circular bore 26 adapted to receive and rotatably support a cylindrical surface of the combination ratchet and gudgeon 20. The inner end of bore 26 is enlarged to accommodate the outer end of ratchet portion 28 of combination ratchet and gudgeon 20. For convenience in describing the spring motor mechanism, the "outer" end will be the left end in FIGS. 2 and 3 and the "inner" end will be the right end in FIGS. 2 and 3.

Housing 19 has an outer radially extending ring 29 which is slightly greater than the internal diameter of roller 10 so that the inner face of ring 29 contacts the adjacent radial end surface of roller 10. Ring 29 has an annular boss 30 surrounding bore 26. Housing 19 also has a radially extending inner ring 31 which fits within roller 10 and which is spaced from ring 29 by the width of a circular slot 32.

As shown in FIG. 3, housing 19 is held in place in the end of roller 10 by pins 33 and 34 acting in aligned radially extending holes in roller 10 and ring 31.

Housing 19 is provided with a pair of circular holes 35 and 36 extending axially outwardly from the inner face of ring 31 on opposite sides of bore 26. Housing 19 is also provided with a pair of thin narrow fingers extending axially inwardly from the inner face of ring 31 adjacent the periphery thereof and on opposite sides of bore 26. Only one of these fingers is visible in the drawings, this being the finger 37 shown in FIGS. 1 and 2. The fingers are provided with wedge shaped inner ends, as shown at 38, affording a radially extending locking surface 39. Housing 19 is also provided with generally semicircular axially extending recesses 40 and 41 extending outwardly from the inner face of ring 31.

Combined ratchet and gudgeon 20 has the usual gudgeon or spear 42 projecting outwardly from cylinder 27 and adapted to be received in and retained against rotation by a bracket 43 (FIG. 2). Bracket 43 may be of the usual type provided to support the spear end of a window shade roller. Ratchet surface 28 is shaped to provide a plurality of radially extending circumferentially spaced pawl engaging tooth surfaces 44 of which any desired number may be provided, although four spaced 90° apart will usually be satisfactory.

At its inner end the combined ratchet and gudgeon 20 is hollow and the walls thereof are provided with a narrow axially extending slot 45 which receives and holds rigidly the outer end of spring stick 21.

Spring stick 21 is a flat plate, preferably made of metal, and has a narrow central tooth 46 projecting axially from the outer end thereof. An axially extending slot 47 is provided in the other end of spring stick 21.

Ratchet and pawl housing 24 is in the form of a generally cylindrical washer having a central bore 48 which accommodates a reduced diameter portion 49 of ratchet portion 28. The outer end of bore 48 is enlarged in diameter as shown at 50 to accommodate the inner ends of the ratchet teeth 44.

A pair of tapered pins 51 and 52 project axially outwardly from the outer radial face of housing 24 on opposite sides of bore 48. Upon assembly of the spring motor, the pins 51 and 52 extend into the holes 35 and 36 of housing 19 and act to prevent relative rotation between the housings 19 and 24. A pair of fingers 53 and 54 project axially outwardly from the outer face of housing 24 on opposite sides of the periphery thereof. Upon assembly of the spring motor, the outer ends of the fingers 53 and 54 contact the inner radial face of ring 31 and serve to maintain the spacing between the adjacent faces of housing 19 and 24 by preventing these housings from coming together.

The periphery of housing 24 is provided with notches 55 and 56 which, upon assembly of the spring motor, permit the wedge-shaped ends of the fingers 37 to ride
over the radial edges of housing 24 whereby the finger locking surfaces 39 contact the inner radial surface of housing 24 to lock housings 19 and 24 together. The fingers 37 are preferably somewhat resilient to facilitate the snapping action required for the wedge-shaped ends of the fingers 37 to ride over the notches 55 and 56. It will be evident that the fingers 53 and 54 serve as spacers to maintain housings 19 and 24 axially spaced apart, while fingers 37 act as locks to prevent housings 19 and 24 from moving axially apart. The locking action can be overcome, as by inserting a screwdriver between housings 19 and 24, thus permitting disassembly.

The pins 51 and 52 also act as pivot pins for ratchet pawls 23 and 22, respectively. For this purpose pawls 22 and 23 are provided with circular holes 57 and 58, respectively, whose diameter is slightly greater than the maximum diameter of pins 51 and 52. This permits the pawls to pivot freely about the pins 51 and 52.

The free ends of pawls 22 and 23 are notched, as shown at 59 and 60, respectively, to provide ratchet engaging surfaces which are adapted to engage ratchet teeth 44 in the usual manner well known in the art to limit rotation of the roller in a roller lifting direction. Since the upper pawl will be active to limit roller rotation, one of the pawls may be omitted. Centrifugal force acts to permit substantial static motion before the other pawl engages the ratchet, as is well known in the art.

The housings 19 and 24 and the combination ratchet and gudgeon 20 are preferably made from any suitable relatively rigid plastic material. The pins 51 and 52 are integral with the housing 24 and, since they are necessarily of relatively small diameter, are likely to be sheared off if subjected to substantial shear stress. To avoid such a shear stress as would tend to break off the pins 51 and 52, the holes 57 and 58 are made large enough so that when a pawl engages a ratchet tooth to lock the roller against rotation, the pawl can move along the face of housing 24 sufficiently to contact the adjacent one of arcuate back-up surfaces 61 and 62 of lugs 63 and 64, respectively. Lugs 63 and 64 are integral with and project axially outwardly from the outer face of housing 24 and surfaces 61 and 62 thereof are shaped to receive and support the rounded rear edges of pawls 22 and 23, respectively. Thus when a pawl engages a ratchet tooth, the thrust exerted on the ratchet tooth is transmitted to the adjacent one of lugs 63 and 64 rather than to the pins 51 or 52. The lugs 63 and 64 can be made large enough so as to be able to withstand this thrust without danger of breaking.

A hub 65 projects axially inwardly from the inner face of housing 24 and is provided with a radially extending flange 66, the circumferential extent of which is slightly less than 180°. Flange 66 is axially spaced from the body of housing 24. The peripheral surface of hub 65 and the adjacent radial surfaces of the body portion of housing 24 and flange 66 define a slot 67, the radial depth of which decreases in a circumferential direction from free end 68 of flange 66 to a point 69, as best shown in FIG. 4. FIG. 4 is a longitudinal sectional view through the hub 65 and illustrates the relationship between hub 65 and flange 66.

Beyond point 69, hub 65 is provided with a radially extending slot 70 which is adapted to accommodate a rolled end of eye 71 of spring 25. To assemble spring 25 into the spring motor assembly, a rolled end or eye 72 of spring 25 is placed in spring stick slot 47 and eye 71 is placed over hub 65 with the eye 71 resting at the entrance to slot 67, i.e., adjacent free end 68 of flange 66. A simple turning motion of spring 25 will cause eye 71 to ride up slot 67 and fall into slot 70, thus locking the eye 71 of spring 25 onto hub 65.

It will be observed that contact between spring 25 and hub 65 imposes a curved shape on the adjacent portion of spring 25 thus preventing spring 25 from being sharply bent on spring stick 21. Were spring 25 merely wrapped around the flat spring stick without having the end wrapped around the hub, the spring would tend to acquire a permanent set as the spring became tightly wound up during shade operation.

In operation, when the shade is pulled down, roller 10 is rotated in a counterclockwise direction (FIG. 1), causing housings 19 and 24 to rotate in a like direction. Since spring stick 21 is fixed against rotation by engagement of gudgeon 42 in bracket 41, spring 25 will be wound up on spring stick 21 because end 72 of spring 25 is fixed to the spring stick while end 71 is locked to housing 24. When downward motion of the shade is stopped, the upper pawl (23 in FIG. 1) will engage a ratchet tooth to prevent spring 25 from rolling up the shade. A slight downward pull on the shade thereby release thereof will permit spring 25 to rotate roller 10 in a clockwise direction (FIG. 1) whereby the shade will be rolled up in the customary manner.

When the pawl engages the ratchet, the pawl is permitted to slide backwards so that the corresponding lug will take the ratchet-pawl thrust, thus reducing the corresponding pawl pivot pin from shear stresses.

While the invention has been described in connection with a specific embodiment thereof and in a specific use, various modifications thereof will occur to those skilled in the art without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:
1. An operating mechanism for window shade rollers and the like, comprising a hollow roller open at one end; a roller housing mounted in said open end of said roller; means to affix said retainer housing to said roller whereby said retainer housing and said roller rotate in unison, said retainer housing having a central bearing surface; a ratchet and gudgeon unit supported in said bearing surface of said retainer housing, said unit having a gudgeon end projecting outwardly of said roller and adapted to be supported in a fixed bracket; a ratchet-teeth member and a spring stick receiving slot; a flat spring stick having one end held in said stick receiving slot and having a free end; an annular ratchet and pawl housing located within said roller and having a central opening accommodating said spring stick, said ratchet and pawl housing having a hub surface with a circumferentially extending radially inclined slot having a deep entrance end and a shallow exit end, said hub surface having a radially extending recess located adjacent said exit end; means to join said housings whereby said housings are rotatable together as a unit; a coil spring surrounding said spring stick and having one end affixed to said free end of said spring stick and having the other end in contact with said recess and said inclined slot whereby said other end of said spring rotates with said housing; and pawl means pivotally mounted on said ratchet and pawl housing and arranged to engage said ratchet means to limit rotation of said roller in one direction.
2. An operating mechanism for window shade rollers and the like, comprising a hollow cylindrical roller open at one end; an annular retainer housing mounted in said open end of said roller; means to affix said retainer housing to said roller whereby said retainer housing and said roller rotate in unison, said retainer housing having a bearing surface; a ratchet and gudgeon unit having a bearing surface supported in said bearing surface of said retainer housing, said unit having a gudgeon end projecting outwardly of said roller and adapted to be supported in a fixed bracket, a plurality of ratchet teeth and a spring stick receiving slot; a flat spring stick having one end held in said stick receiving slot and having a free end; an annular ratchet and pawl housing located with said roller and having a central opening accommodating said spring stick, said ratchet and pawl housing having a hub with a circumferentially extending radially inclined slot having a deep entrance end and a shallow exit end, said hub having a radially extending recess located adjacent said exit end;
means to join said housings whereby said housings are rotatable together as a unit; a coil spring surrounding said spring stick and having one end affixed to said free end of said spring stick and having the other end in contact with said recess and said inclined slot whereby said other end of said spring stick rotates with said housing; and pawl means pivotally mounted on said ratchet and pawl housing and arranged to engage said ratchet teeth to limit rotation of said roller in one direction.

3. An operating mechanism for window shade rollers and the like, comprising a hollow cylindrical roller open at one end; an annular retainer housing mounted in said open end of said roller; means to affix said retainer housing to said roller whereby said retainer housing and said roller rotate in unison, said retainer housing having a central bearing surface; a ratchet and gudgeon unit having a bearing surface supported in said bearing surface of said retainer housing, said unit having a pivot projecting outwardly of said roller and adapted to be supported in a fixed bracket, a plurality of ratchet teeth and a spring stick receiving slot; a flat spring stick having one end held in said stick receiving slot and having a free end; an annular ratchet and pawl housing located in said roller and having a central opening accommodating said spring stick, a pair of circumferentially spaced axially extending pivot pins and a pair of axially extending backing lugs each located adjacent a respective one of said pivot pins, said ratchet and pawl housing having a hub with a circumferentially extending radially inclined slot having a deep entrance end and a shallow exit end, said hub having a radially extending recess located adjacent said exit end; releasable means to join said housings whereby said pivot pins are not subjected to substantial shear stresses.

4. An operating mechanism for window shade rollers and the like, comprising a hollow cylindrical roller open at one end; an annular retainer housing mounted in said open end of said roller; means to affix said retainer housing to said roller whereby said retainer housing and said roller rotate in unison, said retainer housing having a central bearing surface; a ratchet and gudgeon unit having a bearing surface supported in said bearing surface of said retainer housing, said unit having a gudgeon end projecting outwardly of said roller and adapted to be supported in a fixed bracket, a plurality of ratchet teeth and a spring stick receiving slot; a flat spring stick having one end held in said stick receiving slot and having a free end; an annular ratchet and pawl housing located in said roller and having a central opening accommodating said spring stick, an axially extending pivot pin and a backing lug spaced from but adjacent to said pivot pin, said ratchet and pawl housing having a hub with a circumferentially extending radially inclined slot having a deep entrance end and a shallow exit end, said hub having a radially extending recess located adjacent said exit end; releasable means to join said housings whereby said housings are rotatable together as a unit; a coil spring surrounding said spring stick and having one end affixed to said free end of said spring stick and having the other end in contact with said recess and said inclined slot whereby said other end of said spring stick rotates with said housing; a pawl having a circular opening, said pawl being mounted on said pivot pin by means of said circular opening whereby said pawl is free to pivot into engagement with a ratchet tooth to limit rotation of said roller in one direction, the diameter of said circular opening being greater than the diameter of said pin thereby to permit said pawl to contact said lug when said pawl engages a ratchet tooth to thereby prevent said pawl from exerting any substantial shear stress on said pin.

5. An operating mechanism as set forth in claim 3 in which said pivot pins are tapered toward a pointed free end and in which said retainer housing has a pair of slots aligned with and arranged to receive said free ends of said respective pivot pins.

6. An operating mechanism as set forth in claim 3 in which said releasable means comprises a pair of circumferentially spaced fingers projecting axially from said retainer housing and each having a locking end arranged to snap over a corresponding rim area of said ratchet and pawl housing.

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