Oct. 3, 1950 F. W. BOPP ET AL 2,524,373

WINDOW SHUTTER

Filed June 13, 1949

3 Sheets-Sheet 1

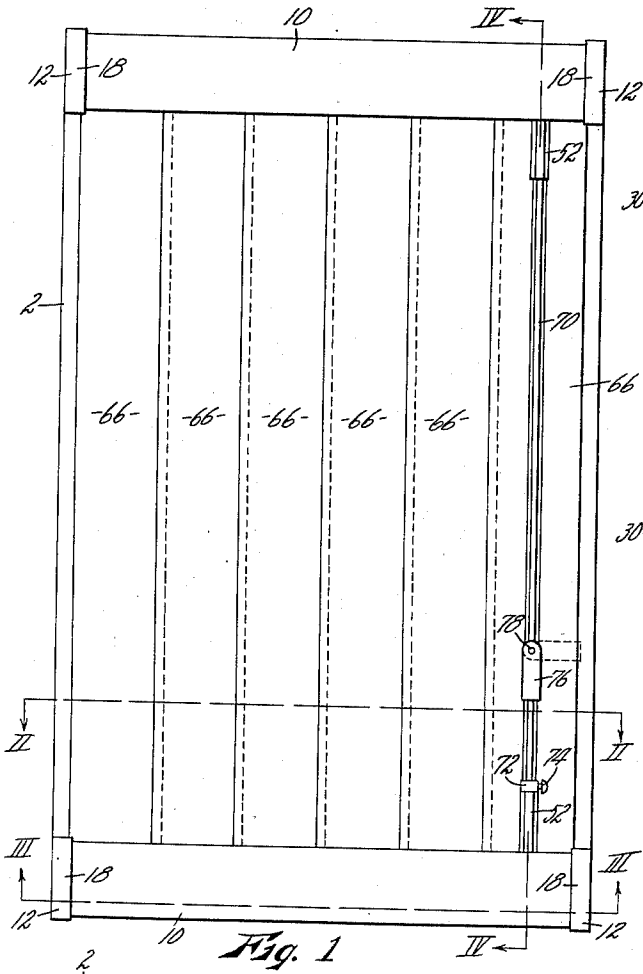


Fig. 1

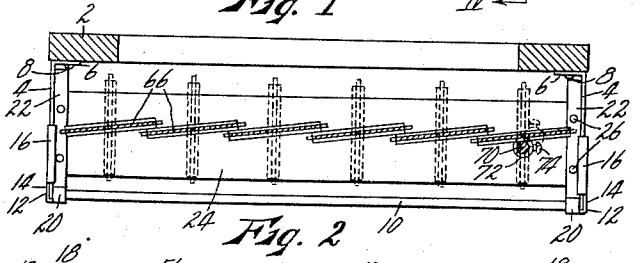


Fig. 2

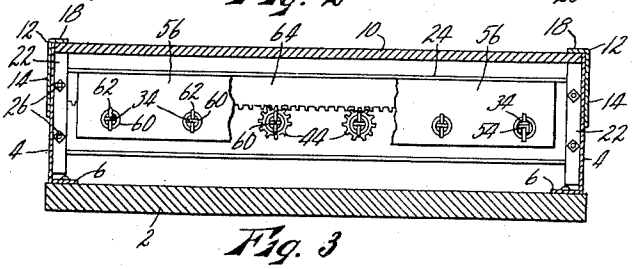


Fig. 3

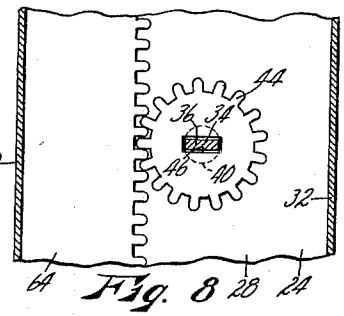


Fig. 8

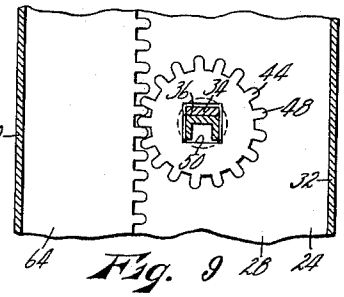


Fig. 9

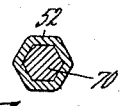


Fig. 10

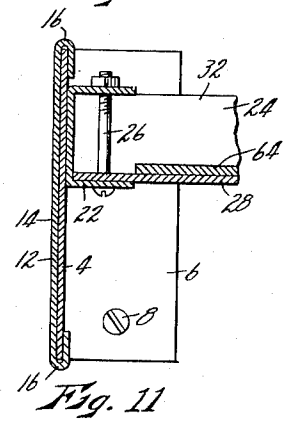


Fig. 11

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WINDOW SHUTTER

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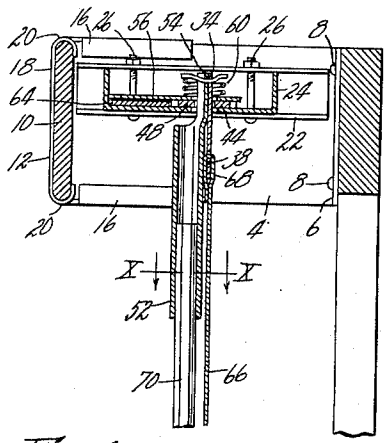


Fig. 4

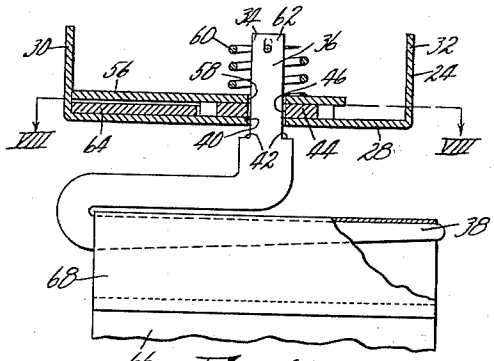
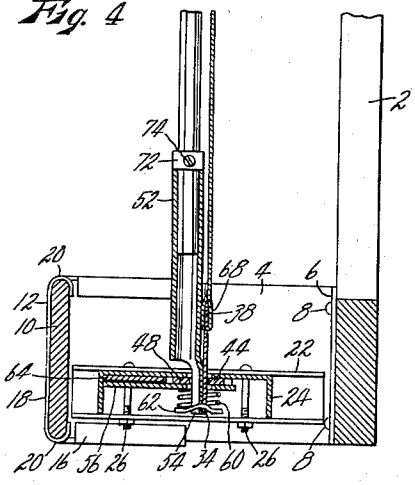


Fig. 6



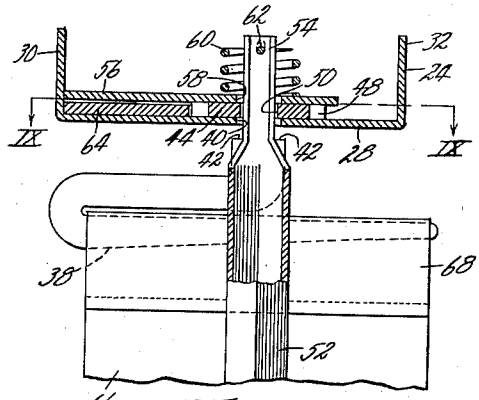


Fig. 7

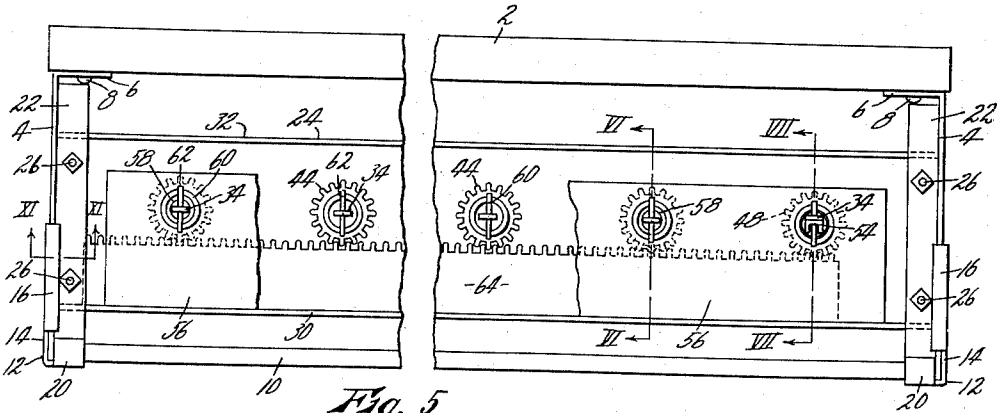


Fig. 5

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WINDOW SHUTTER

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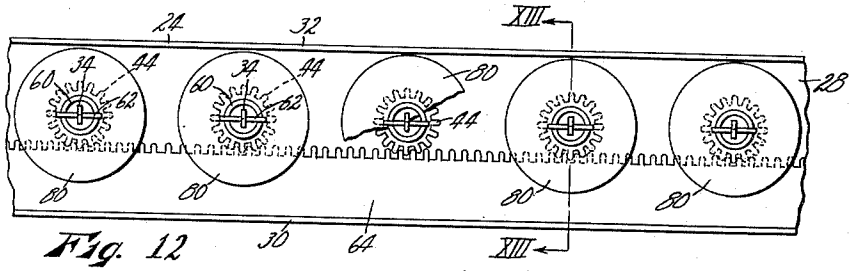


Fig. 12

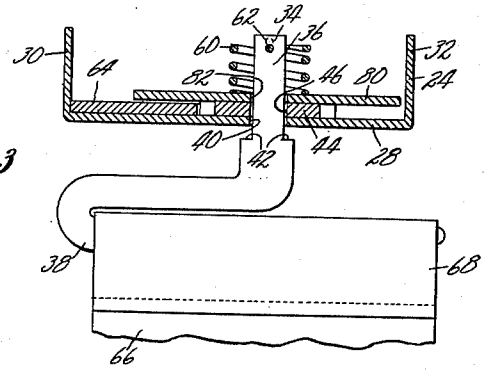


Fig. 13

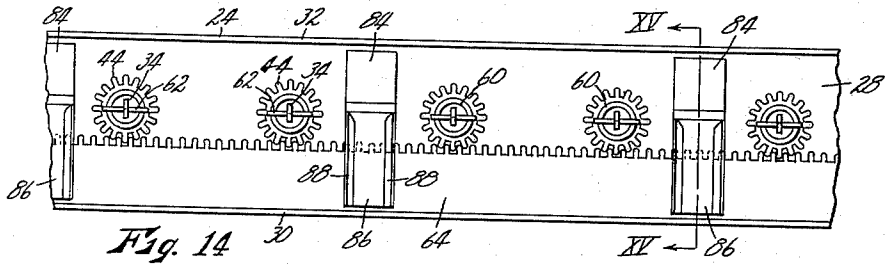


Fig. 14

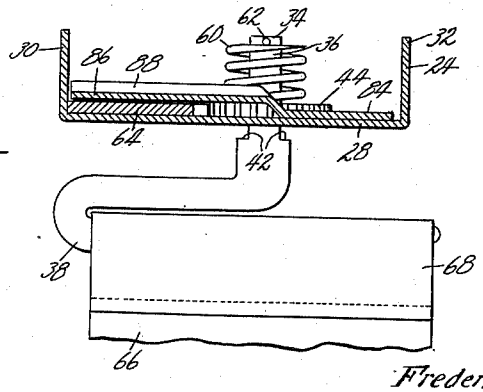


Fig. 15

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UNITED STATES PATENT OFFICE

2,524,373

WINDOW SHUTTER

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Application June 13, 1949, Serial No. 98,746

5 Claims. (Cl. 160—166)

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This invention relates to new and useful improvements in window shutters or blinds, and is an improvement over the shutters shown in our co-pending applications, Serial No. 577,359½, filed February 12, 1945, which issued Aug. 29, 1950, as Patent Number 2,520,272; Serial No. 741,150, filed April 14, 1947, which issued Aug. 29, 1950, as Patent Number 2,520,273; Serial No. 18,186, filed March 31, 1948; Serial No. 54,219, filed October 13, 1948; and Serial No. 63,765, filed December 6, 1948.

The principal object of the present invention is the provision, in a window shutter having a plurality of parallel, flexible slats under tension, of improved rack and gear means, whereby said slats may be rotated about their respective axes to control the passage of light and air therebetween.

Another object of the present invention is the provision of a window shutter having planar support members carried adjacent the upper and lower edges of a window, like series of vertically disposed shafts carried by each of said support members for axial oscillation, vertically disposed flexible slats each connected at its opposite ends to corresponding shafts of said series of shafts, a pinion carried by each of said shafts against the associated support member, a rack connecting all of the pinions associated with each series of shafts and disposed against said support member in coplanar relation with said pinions, and means for holding said rack against movement away from said support member.

A further object is the provision, in a shutter of the class described, of springs carried by each of the shafts and adapted both to tension the slats and to urge said pinions against said support members, and members mounted on said shafts beneath said springs, and overlapping the rack, whereby said rack is maintained in coplanar relation with said pinions.

Other objects are simplicity and economy of construction, and ease of assembly and operation.

With these objects in view, as well as other objects which will appear in the course of the specification, reference will be had to the drawing, wherein—

Figure 1 is a front elevation of a window shutter embodying the present invention, mounted on the inside of a window frame.

Fig. 2 is a sectional view taken on line II—II of Fig. 1, showing the slats closed or in coplanar relation in solid lines, and open in dotted lines.

Fig. 3 is a sectional view taken on line III—III of Fig. 1.

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Fig. 4 is an enlarged and foreshortened sectional view taken on line IV—IV of Fig. 1.

Fig. 5 is an enlarged and foreshortened plan view of the shutter.

Fig. 6 is an enlarged fragmentary section taken on line VI—VI of Fig. 5 with parts broken away, and with the slats turned at right angles to the plane of the window.

Fig. 7 is an enlarged fragmentary section taken on line VII—VII of Fig. 5, with parts left in elevation and broken away, and with the slats turned at right angles to the plane of the window.

Fig. 8 is a fragmentary section taken on line VIII—VIII of Fig. 6.

Fig. 9 is a fragmentary section taken on line IX—IX of Fig. 7.

Fig. 10 is an enlarged section taken on line X—X of Fig. 4.

Fig. 11 is an enlarged fragmentary section taken on line XI—XI of Fig. 5.

Fig. 12 is a plan view of the rack and pinion supporting channel, showing a modified form of rack retaining means.

Fig. 13 is a fragmentary section taken on line XIII—XIII of Fig. 12.

Fig. 14 is a view similar to Fig. 12, showing another modification of the rack retaining means.

Fig. 15 is a fragmentary sectional view taken on line XV—XV of Fig. 14.

Like reference characters apply to similar parts throughout the several views, and the numeral **2** applies to a window frame of the usual type. A pair of mounting brackets **4** are mounted respectively at opposite sides of said window frame on the inner face thereof adjacent the upper and lower ends of the window. Each of said brackets comprises a vertically disposed sheet of metal projecting outwardly from said window frame and having a flange **6** at its rearward edge adapted to be secured to said window frame by screws **8**. A front or cover panel **10** extends between the outer ends of said upper and lower pairs of brackets, and are removably attached to said brackets by means of corner fixtures **12**. Said corner fixtures each comprise a sheet of metal having a portion **14** disposed adjacent the outer surface of the associated mounting bracket, the upper and lower edge portions of portion **14** being rebent inwardly to form channels **16** adapted to engage slidably the upper and lower edge portions of bracket **4**, and a portion **18** disposed adjacent the outer surface of front panel **10** and having its upper and lower edge portions rebent inwardly to form channels **20** for engaging the upper and lower edge portions of front panel **10**. Thus said

front panels may be removed simply by slidably disengaging corner fixtures 12 from mounting brackets 4. An inwardly opening, horizontally disposed channel 22 is welded or otherwise securely fixed to the inner surface of each bracket 4.

Referring principally to the structure at the top edge of the window, as shown in Figs. 4 to 9, it will be seen that a horizontally disposed support channel 24 extends between mounting brackets 4, the end portions thereof being slidably enclosed in channels 22 and removably secured therein by bolts 26. Said channel opens upwardly, and comprises base portion 28 and side walls 30 and 32. A series of vertically spaced apart shafts 34 are carried for rotational and longitudinal movement by base portion 28 of channel 24. All of said shafts are identical, and may be economically stamped from sheet metal or the like. As best shown in Fig. 6, each shaft comprises an axial portion 36 and a transversely disposed horizontal hook portion 38 positioned beneath channel 24 to engage the slats as hereinafter described. Axial portion 36 of each shaft is rectangular in cross-section, and passes rotatably through a round hole 40 formed therefor in channel base portion 28. Axial portion 36 of the shaft is reduced in width adjacent the lower surface of channel base 28, thereby forming shoulders 42 adapted to engage said channel base to limit the upward movement of the shaft.

A pinion 44 is carried slidably on the upwardly extended end portion of shaft 34. All of said pinions except one is provided with a central rectangular hole 46 through which said shaft extends, thereby preventing rotation of said pinion on said shaft. One of said pinions, further designated by the numeral 48, and disposed at the right side of the shutter as viewed in Fig. 5, is provided with an enlarged, substantially square, central hole 50, as shown in Figs. 7 and 9. A polygonal tube 52 is disposed beneath support channel 24, being adjacent and parallel to the shaft 34 associated with pinion 48, and said tube is provided with an upwardly projecting non-circular extension 54 which, together with the associated shaft 34, projects upwardly through hole 40 of support channel 24 and through square hole 50 of pinion 48, the shape of said hole being such as to prevent relative rotation of extension 54 and shaft 34, and to prevent rotation of pinion 48 thereon. A metal sheet 56 extending approximately the full length of channel 24 and disposed therein, is provided with a plurality of round holes 58 through which shafts 34 extend for axial rotation. Said metal plate covers pinions 44, and a longitudinal edge thereof extends in proximity to side wall 30 of channel 24. Said plate rests on said pinions, and is held thereby in parallel relation with base 28 of channel 24. A helical spring 60 is disposed against the upwardly extended end portion of each shaft 34, bearing at its lower end against plate 56 and at its upper end against a pin 62 inserted transversely through said shaft adjacent its upper end. Spring 60 associated with pinion 48 also encircles tube extension 54, and pin 62 passes through said extension as shown in Fig. 7, thereby securing said tube member in position. Springs 60 serve to urge shafts 34 upwardly, and to retain pinions 44 against the base 28 of channel 24 regardless of the longitudinal positioning of said shafts.

A planar rack 64 lies against the inner surface of base portion 28 of channel 24, having its toothed edge meshing with each of pinions 44 carried by said channel, and having its back edge resting in sliding engagement with side wall 30. The rack is positioned between channel 24 and plate 56, and is retained thereby in mesh with pinions 44. It will be noted also that rack 64 is slightly thinner than pinions 44, thereby providing that the rack is only loosely held and is free to move longitudinally with a minimum of friction.

As shown in Figs. 3 and 4, support channel 24 and the structure carried thereby at the bottom of the window is identical with that at the top of the window, except that it is inverted. A plurality of flexible vertical slats or strips 66 are disposed in parallel relation between the upper and lower series of shafts 34. Said slats may be made of fabric or other suitable flexible material, and each slat is looped at each end as at 68 to engage the hook portions 38 of shafts 34 at the top and bottom of the window. Said slats are so positioned that their longitudinal edge portions overlap when the slats are moved to substantially coplanar relation, as shown in Fig. 1 and in solid lines in Fig. 2, thereby completely covering the window opening. The slats are of such length that springs 60 are slightly compressed and shoulders 42 of shafts 34 are held out of contact with channels 24, said springs thereby maintaining said slats taut. Said springs will also take up slight variations in the length of the slats caused by inaccuracies of manufacture.

Slats 66 may be turned about their respective longitudinal axes by means of a vertical rod 70 having its end portions carried slidably in tubes 52 at the top and bottom of the window. Said rod is polygonal in cross-section, and said tubes are correspondingly shaped, as shown in Fig. 10, whereby rotation of said rod in said tubes is prevented. Said rod is supported by a collar 72 clamped thereon by set screw 74 and adapted to rest on the upper end of lower tube 52. Rod 70 may be manually oscillated by a handle 76 pivoted thereto at 78. Said handle may be pivoted to lie against said rod when not in use, as shown in solid lines in Fig. 1, or extended as shown in dotted lines whenever it is desired to adjust the shutter.

Thus when rod 70 is turned, pinions 48 associated therewith will be turned, and these pinions will drive racks 64 to turn the remainder of pinions 44, which in turn rotate shafts 34. Slats 66 carried by said shafts may thereby be continuously adjusted from a closed, substantially coplanar position, as shown in Figs. 1 and 2, to a full open position as shown in dotted lines in Fig. 2, wherein the slats are substantially normal to the plane of the window. The slats may be oscillated through approximately 180 degrees. By lifting rod 70 free from lower tube 52, the upper and lower series of shafts 34 may be turned independently, thereby causing slats 66 to be twisted about their longitudinal axis to provide novel lighting and decorative effects. When the desired degree of twist is obtained, rod 70 is reinserted in tube 52. The shortening of slats 66 caused by said twisting is compensated for by springs 60, which permit longitudinal movement of shafts 34.

In the modification shown in Figs. 12 and 13, the rack retaining plate 56 of the preferred form is replaced by a planar disc 80 carried concentrically on each shaft 34 against the outer surface of pinion 44. Said disc is of great enough diameter to overlap substantially rack 64, and to retain said rack in position. Said disc is of course free to rotate with its associated pinion 44, and the hole 82 provided in said disc for shaft 34 may be rectangular to correspond with the shape of said shaft. This modification eliminates the fric-

tion which occurs in the preferred form between pinions **44** and plate **56**, and thus provides an easier, more frictionless operation.

In the modification shown in Figs. 14 and 15, rack **64** is retained in position by a series of clips **84**. Said clips comprise strips of metal welded or otherwise rigidly secured to the inner surface of base portion **28** of channel **24**, and having portions **86** offset from said channel base to pass over rack **64**. It will be noted that the space between clip portion **86** and channel base **28** is slightly thicker than rack **64** to permit free sliding of the rack, and that the edge portions of clip portions **86** are turned up as at **88** to prevent possible interference with the teeth of the rack.

While we have shown specific embodiments of our invention, it is apparent that minor variations of construction and operation could be made without departing from the spirit of the invention.

What we claim is:

1. A window shutter of the class described comprising a pair of parallel elongated support members adapted to be carried respectively adjacent opposite edges of a window opening and having longitudinal recesses formed in the distal sides thereof, like series of transversely disposed shafts carried for oscillatory and longitudinal movement by each of said support members, a plurality of flexible slats each connected at its opposite ends to corresponding shafts of said series of shafts, a geared pinion carried non-rotatively for axial sliding movement on each of said shafts and disposed against the bottom of the recess of the associated support member, a rack disposed in each of said recesses in coplanar relation with said pinions, said rack resting in sliding contact with the bottom of said recess, having its toothed edge meshed with each of said pinions and having its opposite edge in sliding contact with the wall of said recess, a planar retaining member carried for axial sliding movement on the shafts associated with each of said support members and overlapping the outer surface of the associated rack, resilient means whereby said two series of shafts are urged apart to tension said slats and whereby said retaining members are urged toward the bottom of said recesses, thereby retaining said pinions and said racks in coplanar relation against the bottoms of said recesses, and means for driving said racks.

2. A window shutter of the class described comprising a pair of parallel elongated support members adapted to be carried respectively adjacent opposite edges of a window opening and having longitudinal recesses formed in the distal sides thereof, like series of transversely disposed shafts carried for oscillatory and longitudinal movement by each of said support members, a plurality of flexible slats each connected at its opposite ends to corresponding shafts of said series of shafts, a geared pinion carried non-rotatively for axial sliding movement on each of said shafts and disposed against the bottom of the recess of the associated support member, a rack disposed in each of said recesses in coplanar relation with said pinions, said rack resting in sliding contact with the bottom of said recess, having its toothed edge meshed with each of said pinions and having its opposite edge in sliding contact with a wall of said recess, a planar retaining member carried for axial sliding movement on the shafts associated with each of said support members and overlapping the outer surfaces of the associated rack, a compression spring carried on the outwardly extended end of each of said shafts and bearing against the outer surface of the associated retaining member, whereby said two series of shafts are urged apart to tension said slats, and whereby said retaining members are caused to retain said racks and pinions in coplanar relation against the bottoms of said recesses, and means for driving said racks.

3. A window shutter of the class described comprising a pair of parallel elongated support members adapted to be carried respectively adjacent opposite edges of a window opening and having longitudinal recesses formed in the distal sides thereof, like series of transversely disposed shafts carried for oscillatory and longitudinal movement by each of said support members, a plurality of flexible slats each connected at its opposite ends to corresponding shafts of said series of shafts, a geared pinion carried non-rotatively for axial sliding movement on each of said shafts and disposed against the bottom of the recess of the associated support member, a rack disposed in each of said recesses in coplanar relation with said pinions, said rack resting in sliding contact with the bottom of said recess, having its toothed edge meshed with each of said pinions and having its opposite edge in sliding contact with a wall of said recess, a planar retaining member carried for axial sliding movement on the shafts associated with each of said support members and overlapping the outer surface of the associated rack, a compression spring carried on the outwardly extended end of each of said shafts and bearing against the outer surface of the associated retaining member, whereby said two series of shafts are urged apart to tension said slats, and whereby said retaining members are caused to retain said racks and pinions in coplanar relation against the bottoms of said recesses, said pinions being thicker than said racks whereby to provide clearance allowing free longitudinal movement of said racks, and means for driving said racks.

4. A window shutter of the class described comprising a pair of parallel elongated support members adapted to be carried respectively adjacent opposite edges of a window opening and having longitudinal recesses formed in the distal sides thereof, like series of transversely disposed shafts carried for oscillatory and longitudinal movement by each of said support members, a plurality of flexible slats each connected at its opposite ends to corresponding shafts of said series of shafts, a geared pinion carried non-rotatively for axial sliding movement on each of said shafts and disposed against the bottom of the recess of the associated support member, a rack disposed in each of said recesses in coplanar relation with said pinions, said rack resting in sliding contact with the bottom of said recess, having its toothed edge meshed with each of said pinions and having its opposite edge in sliding contact with a wall of said recess, a planar washer carried for axial sliding movement on the outwardly extended end portion of each of said shafts and overlapping the outer surface of the associated rack, resilient means whereby said two series of shafts are urged apart to tension said slats and whereby said washers are urged to retain said pinions and racks in coplanar relation against the bottom of said recesses, and means for driving said racks.

5. A window shutter of the class described comprising a pair of parallel elongated support members adapted to be carried respectively adjacent opposite edges of a window opening and having longitudinal recesses formed in the distal sides

thereof, like series of transversely disposed shafts carried for oscillatory and longitudinal movement by each of said support members, a plurality of flexible slats each connected at its opposite ends to corresponding shafts of said series of shafts, a geared pinion carried non-rotatively for axial sliding movement on each of said shafts and disposed against the bottom of the recess of the associated support member, a rack disposed in each of said recesses in coplanar relation with said pinions, said rack resting in sliding contact with the bottom of said recess, having its toothed edge meshed with each of said pinions and having its opposite edge in sliding contact with a wall of said recess, a planar washer carried for axial sliding movement on the outwardly extended end portion of each of said shafts and overlapping the outer surface of the associated rack, a compression spring carried on the outwardly extended end of each of said shafts and bearing against the outer surface of the associated washer, whereby

said two series of shafts are urged apart to tension said slats and whereby said washers are urged to retain said pinions and said racks in coplanar relation against the bottoms of said recesses, and means for driving said racks.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
425,542	Hantsche	Apr. 15, 1890
550,559	Joseph	Nov. 26, 1895
2,158,454	Zubiria	May 16, 1936
2,165,669	Wade	July 11, 1939
2,251,375	Reed et al.	Aug. 5, 1941
2,370,794	Houmere	Mar. 6, 1945