Feb. 4, 1947. L. SPENCER 2,415,222

VENETIAN BLIND

Filed Dec. 11, 1944 3 Sheets-Sheet 1

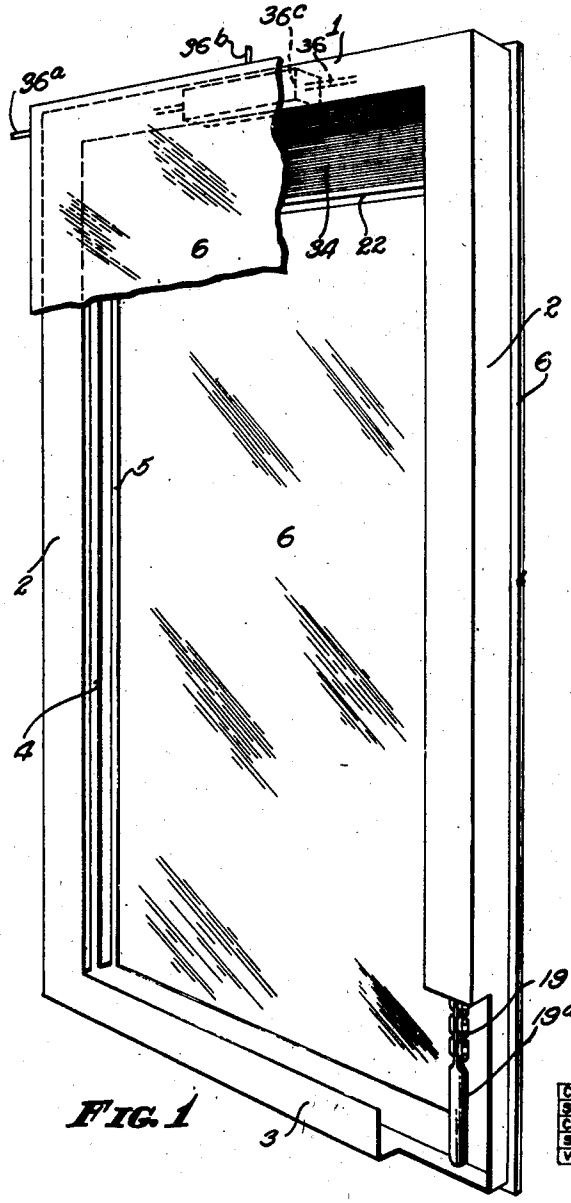
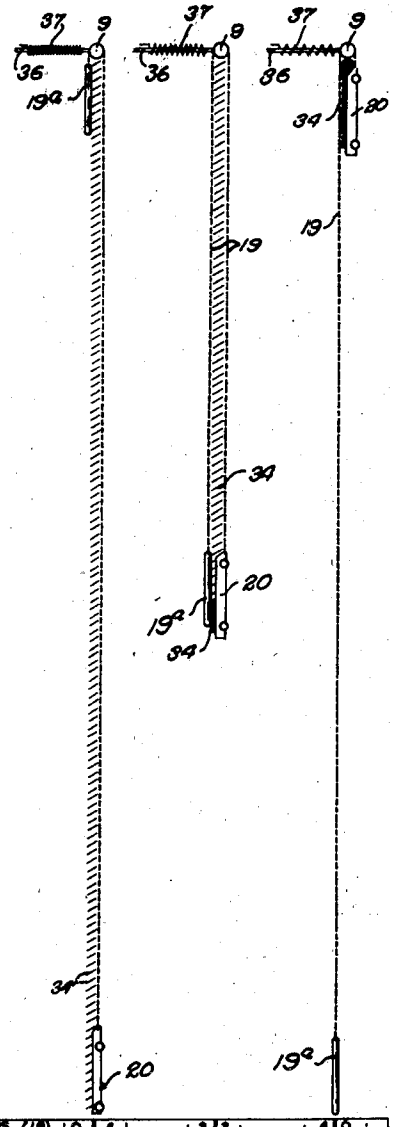


FIG. 1



CHAINS (19)	0	4			2	2			4	0	
SLATS (34)	0	0			0	2			0	4	
CARRAGE (20)	0	1			0	1			0	1	
SPRING (37)	14	0	1		12	0	1		10	0	1
WEIGHTS (19a)	1	0			1	0			1	0	

FIG. 2

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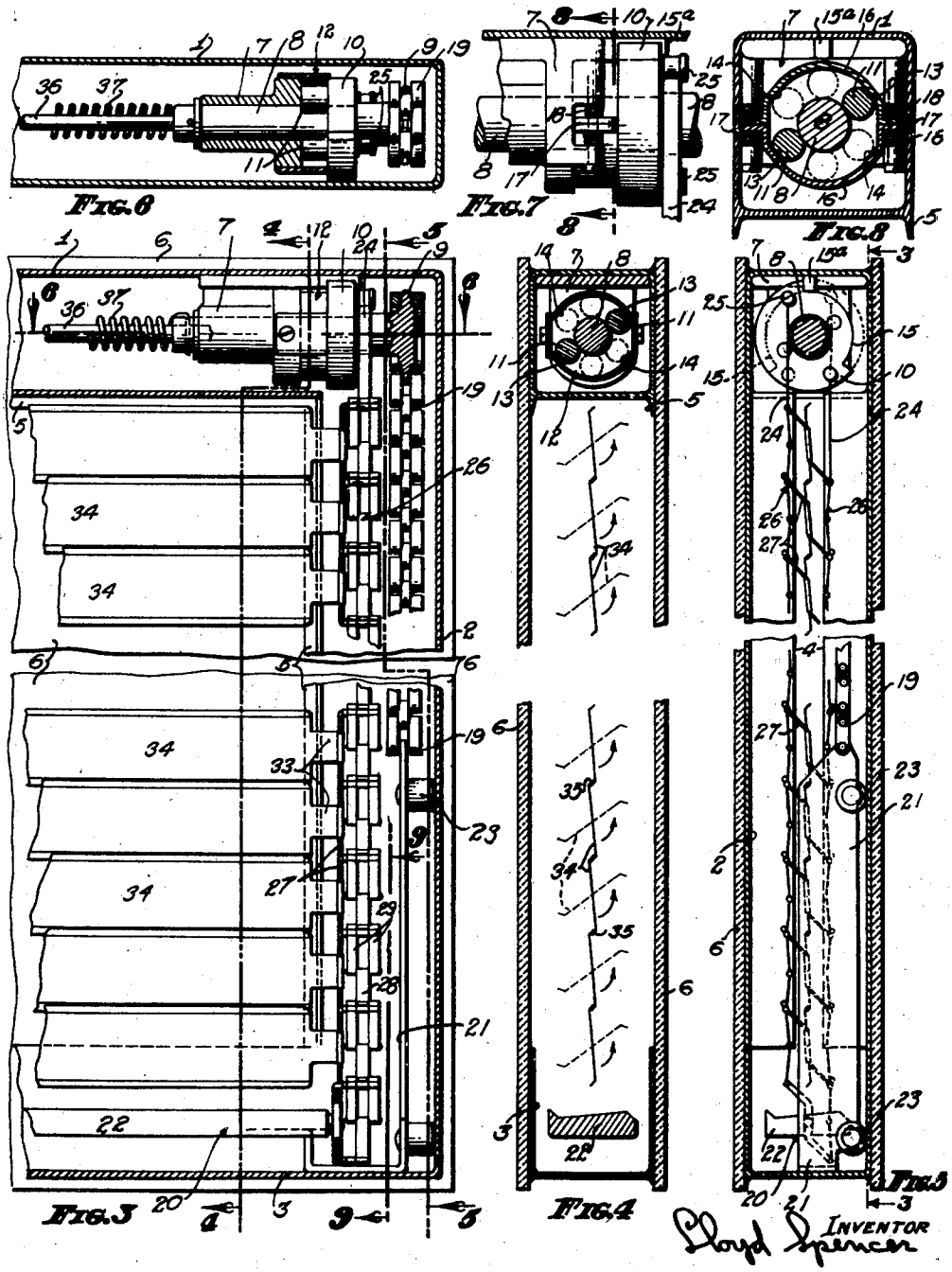
Feb. 4, 1947. L. SPENCER 2,415,222

VENETIAN BLIND

Filed Dec. 11, 1944 3 Sheets-Sheet 2



Feb. 4, 1947. L. SPENCER 2,415,222

VENETIAN BLIND

Filed Dec. 11, 1944 3 Sheets-Sheet 3

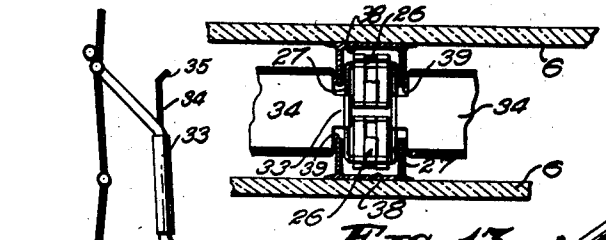


FIG. 13

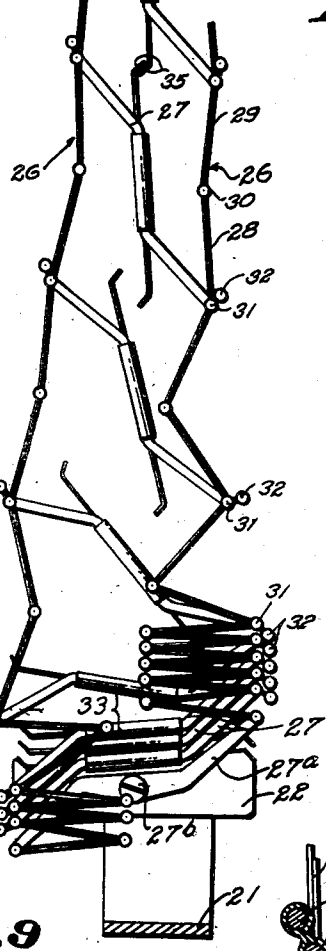


FIG. 9

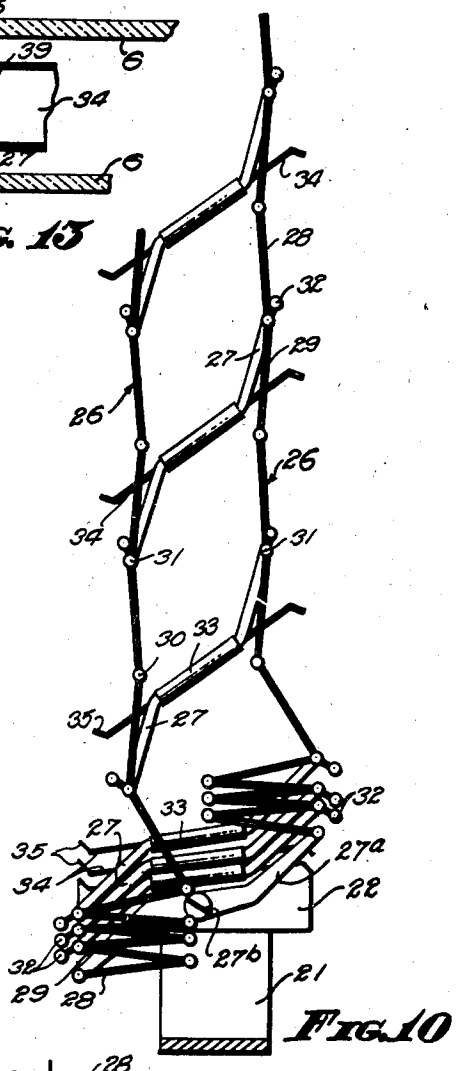


FIG. 10

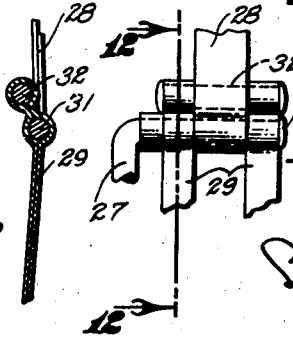


FIG. 11

FIG. 12

Inventor

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Patented Feb. 4, 1947 2,415,222

UNITED STATES PATENT OFFICE

2,415,222

VENETIAN BLIND

Lloyd Spencer, Los Angeles, Calif.

Application December 11, 1944, Serial No. 567,626

16 Claims. (Cl. 160—107)

1

My invention relates to Venetian blinds and among the objects of my invention are:

First, to provide a Venetian blind which is particularly designed so that it may be hermetically sealed between panels of glass and is therefore protected from dirt and damage.

Second, to provide a Venetian blind which, by reason of the protection afforded by the covering panes of glass may utilize slats which are extremely thin and light in weight, thereby, not only enhancing the appearance of the Venetian blind but also permitting closer stacking when the blind is raised.

Third, to provide a Venetian blind wherein all the mechanism for supporting, tilting, raising and lowering the blind is contained in a relatively narrow marginal frame thereby avoiding the unsightliness of the cords and tapes of the conventional Venetian blind.

Fourth, to provide a Venetian blind which incorporates a novel control mechanism whereby the initial lowering or raising movement of the Venetian blind is employed to tilt the slats of the blind from one extreme position to the other, thereby providing a Venetian blind which lends itself to electric motor control; for example, a reversible motor and two control buttons are capable of accomplishing tilting adjustment as well as raising and lowering the blind.

Fifth, to provide a Venetian blind which is counterbalanced and which, together with the fact that the moving parts, particularly the slats, may be extremely light weight, requires only a minimum amount of power to operate.

Sixth, to provide a Venetian blind wherein the slats may be so arranged that they interlock in their closed position to provide a sight proof and virtually light proof partition.

With the above and other objects in view, reference is directed to the accompanying drawings, in which:

Figure 1 is a perspective view of my Venetian blind shown installed between panes of glass in its raised position with the forward pane broken away and a portion of the Venetian blind frame shown in section.

Figure 2 comprises a series of diagrammatical views illustrating the manner in which counterbalance of the Venetian blind is accomplished.

Figure 3 is a fragmentary sectional view of my Venetian blind taken through 3—3 of Figs. 1 and 5 showing the Venetian blind in its lowered and closed position.

Figure 4 is a fragmentary sectional view through 4—4 of Figure 3, indicating by dotted lines the open position of the Venetian blind slats.

2

Figure 5 is a fragmentary sectional view through 5—5 of Figure 3.

Figure 6 is a fragmentary sectional view through 6—6 of Fig. 3 with the glass panels omitted.

Figure 7 is an enlarged fragmentary side view of a modified form of slat tilting mechanism, the blind frame being indicated in section.

Figure 8 is a sectional view thereof taken through 8—8 of Fig. 7.

Figure 9 is an enlarged fragmentary sectional view taken through 9—9 of Figure 3 showing the manner in which the slats raise and move into their closed position as the Venetian blind is lowered.

Figure 10 is a view similar to Fig. 9, showing the manner in which the slats move from their open position to the stack of slats as the Venetian blind is raised.

Figure 11 is an enlarged fragmentary view of ladder chain employed to connect and tilt the slats.

Figure 12 is a sectional view through 12—12 of Fig. 11.

Figure 13 is a fragmentary sectional view illustrating the adaption of the ladder chain to support the slats at intermediate points in those cases where the width of the window is too great to suspend the slats solely by their ends.

My Venetian blind is preferably housed in a marginal frame structure which comprises a top tubular member 1, vertical tubular members 2 and a bottom tubular or channel member 3 formed of metal. The vertical members 2 are provided with vertical slots 4. Both the top and vertical members are square in cross section and are provided with marginal flanges 5 which, as will be brought out later, overlap the upper and vertical edges of the slat assembly. The bottom member 3 is preferably channel shaped in order to accommodate the lower end of the slat assembly when the Venetian blind is in its lowered position.

The frame structure may be mounted in any suitable manner between glass panels 6. Preferably the panels are cemented to the sides of the frame structure by a process such as employed in the construction of double and triple glazed windows, known commercially as "Thermopane."

Near each end of the upper frame member 1 is a bracket bearing 7 in which are journaled shafts 8. These overhang the upper ends of the vertical frame members 2 and their extremities are

provided with sprockets 9. Between the sprockets 9 and the bearings 7 the shafts carry slat supporting collars 10.

The portion of each shaft between its collar 10 and its bearing 7 functions as the sun element of a planetary drive mechanism. A pair of planetary rollers 11 ride on the shaft and are supported from the collar 10. Around the planetary rollers is a ring member 12, which is flattened at diametrically opposite portions and there provided with lugs which project axially for securing the ring member 12 to the adjacent bearing 7. At four points, preferably located on two diametrical planes disposed in 120° relationship, the ring member 12 is shaped to provide two sets of opposed wedging portions 13 and 14 which are in converging relation with the curvature of the shaft 8, the set 13 being directed counterclockwise as viewed in Fig. 4 and the other set 14 being directed clockwise.

The spacing between the shaft 8 and the ring member 12 and between the sets of wedging portions 13 and 14 is slightly less than the diameters of the rollers 11, but these portions of the ring member are yieldable so that instead of wedging fast between the shaft 8 and ring member 12 the rollers 11 upon initial movement in either direction form a planetary drive connection which rotates the collar 10 at a reduced speed in the direction of the shaft 8 until the rollers enter the other set of wedging portions whereupon the rollers are freed and the wedging portions function as overriding clutches.

By this means a partial rotation of the collars is effected with each initial movement of the shaft in a new direction and such partial rotation is employed to tilt the slat assembly of the Venetian blind as will be described hereinafter. To limit definitely the oscillative movement of the collars, they are provided with arcuate notched portions 15 forming spaced shoulders which engage a stop 15a projecting from the corresponding bracket bearing 7.

An alternative form of tilting mechanism is shown in Figures 7 and 8, which however operates similarly to the above described structure. In the construction shown in Figs. 7 and 8, the ring member 16 is split diametrically and provided with abutting flanges 17 yieldably held in abutment by springs 18 compressed between shoulders extending from the bracket bearing 7. As in the first construction sets of wedging portions 13 and 14 are provided. The two halves of the ring member 16 are thus yieldable outwardly to afford the necessary drive connection.

A pair of combined elevating and counterbalancing chains 19 pass over the sprockets 9 and support a carriage or carrier structure 20 which comprises a pair of hanger straps 21 of J-form suspended by their longer legs from said chains and a base bar 22 supported by the shorter legs of the hanger straps. The hanger straps are provided with rollers 23 which ride against a wall of the vertical frame members 2. The base bar remains substantially horizontal and forms a base upon which those Venetian blind slats which are not suspended by the ladder assemblies stack, as will be described in more detail hereinafter. The remaining ends of the chains are provided with weights 19a which counterbalance the carriage structure 20.

A pair of tapes 24 are journaled on pins 25 extending from each collar 10 at diametrically opposite points. Each pair of tapes support a ladder chain assembly each of which comprises a pair of chain units 26 connected at intervals

by cross bars 27. Each chain unit is formed by an alternate series of single links 28 and double links 29 joined alternately by hinge pins 30 and hinge arms 31 extending from the cross bars 27.

One end of each double link is provided with extensions joined by a pin 32 positioned to engage the adjacent link to prevent "overcenter" movement, that is provide a slightly yieldable stop tending to cause folding of the links in a predetermined direction. The arrangement is such that the links of the two chain units fold inwardly, that is, toward each other as shown best in Figures 9 and 10.

The lower ends of each pair of the chain units 26 are joined by a cross lever 27a which is pivotally connected intermediate its ends to an extremity of the base bar 22 by journal pins 27b. The looped lower ends of the hanger straps 21 clear the cross levers 27a.

The central portions of the cross bars 27 are connected to the extremities 33 of Venetian blind slats 34 which extend between the two vertical tubular frames 2. The extremities 33 are reduced in width to enter the slots 4.

It is preferred to move the Venetian blind slats between two positions displaced approximately 120°, in one extreme position the planes of the slats being vertical, and in the other extreme position the slats being inclined about 30°. The slat tilting mechanism and pivotal connections between the cross bars 27 and the chain units preferably move equal amounts or approximately 60° either side of a vertical axis. This is accomplished by twisting the central portion of each cross bar 27 approximately 30° with respect to the plane between the hinge arms 31 thereof.

The margins of the slats 34 are preferably bent to form rudimentary obtusely directed flanges 35 which are adapted to overlap when the slats are in their vertical planes as shown by solid lines in Figs. 4, 5, and in the upper portion of Fig. 9. The flanges 35 also serve to stiffen the slats which are constructed of extremely thin material. In fact, because of the protection afforded by the glass panes 6, much thinner material may be employed than is feasible with unprotected slats. The thin edge aspect of the slats and the compact nestling of the slats and their ladder chains made possible by the construction shown renders feasible the use of a narrower slat than is conventionally used so that spacing between the glass panes may be reduced to a minimum. This is important for it enables the Venetian blind with its covering of glass to form a single unit or package capable of installation in the manner now employed for multiple glazed windows, such as the window known commercially as "Thermopane."

The two shafts 8 are joined by a drive shaft 36 about which is wound a torsion spring 37 which cooperates with the chains 19 and weights 19a suspended from the ends of said chains opposite from the carriage structure 20, as will be brought out hereinafter.

The drive shaft 36 may project through one of the shafts 8 and through the marginal frame, as indicated by 36a, to any suitable operating device, not shown: Or the drive shaft 36 may be connected by gears intermediate its ends to a shaft 36b extending upwardly from the upper frame 1. In either event packing means is provided about the protruding shaft. Still further, an electric motor 36c with its gear reduction unit may be mounted within the upper frame 1. These various means of actuating the shaft 7 are indicated in Fig. 1. While manual means of con-

trol is feasible, it is preferred to employ a reversible electric motor and a pair of push button controls as tilting of the Venetian blind is effected by the initial movement of the drive shaft in either direction; that is an "up" and a "down" button may effect both raising and lowering of the blind as well as tilting movement.

Operation of my Venetian blind is as follows:

Assuming first that the blind is in its upper position shown in Fig. 1 wherein all or virtually all the slats rest on the base bar **22** of the carriage structure **20**, and the shaft **7** is rotated in a direction to lower the blind. With initial lowering movement, the slat tilting mechanism comprising the shafts **8**, rollers **11** and collars **10** tilt the ladder chain assemblies into the position shown best in Fig. 9 and, as the slats are picked up from the stack of slats on the carriage they rotate individually from a horizontally to a vertical or closed position. When the blind has been lowered to a point slightly below the desired level, the drive shaft **7** is rotated in the opposite direction which causes the tilting mechanism to tilt the ladder chain supported slats from the position shown in Fig. 9 toward the position shown in Fig. 10 until the desired angular position of the slats is obtained. It should be noted that the right hand side of the several views such as Figs. 4, 5, 9 and 10 represents the "outdoor" side of the blind and the flanges **35** are so directed that one cannot look upwardly between the slats when they are closed. The extremities of the slats **34** extend between the flanges **5** so that one can not see through the margins of the blind.

When the slats are rotated to their other extreme position shown in Fig. 10 the slats present an edge aspect to downwardly directed rays of light. It will be noted in Fig. 10 that as the blind is raised the slats readily turn into the horizontal position as they are individually engaged by the ascending stack of slats on the carriage.

The Venetian blind is maintained in a counterbalanced condition irrespective of its position, this is best explained by reference to Fig. 2. While various combinations of values may be employed, one combination is represented for purposes of illustration; that is, assume that the total weight of the two chains **19** equals the total weight of the slats and their ladder chain assemblies; that the weights **38** balance the carriage structure **20**; that the spring **37** when wound exerts a torque equal to the weight of but in opposition to the chains **19**; and that those slats which are supported by the ladder chains are in balance, then:

When the blind is raised, the stacked slats balance the chains, the carriage balances the weights and the spring exerts zero torque as indicated in the right hand column of Fig. 2. When the blind is lowered midway the two halves of the chains balance themselves and the half-stack of slats is balanced by the partially wound spring, as shown in the middle column of Fig. 2.

When the blind is lowered, all of the slats are supported from the ladder chains and exert no torque on the shafts **8**, the spring is wound however, balancing the chain as shown in the left column of Fig. 2.

The lengths of the end straps **21** of the carriage structure is sufficient to place their junctures with the chains **19** above the center of gravity of the stack of slats thereon so that the stack is in stable balance in all positions.

Because of the fact that the slats may be extremely light weight the window may be relatively wide without requiring intermediate supports for the slats. When, however, the width of the window requires, additional ladder chains assemblies may be provided, as shown in Fig. 13. The ladder chains are similar to those previously described except that the cross bars are double; that is, a pair of cross bars form two sides of a loop and the hinge arms **31** the ends of the loop. To conceal the intermediate ladder chain assemblies channel ribs **38** extend between the top and bottom frame members **1** and **3** and define slots **39** corresponding to the slots **4**.

Though I have shown and described certain embodiments of my invention, I do not wish to be limited thereto, but desire to include all novelty inherent in the appended claims.

I claim:

1. A Venetian blind comprising: a plurality of slats; a suspension assembly adapted to support said slats in spaced series relation; a carrier adapted to be raised and lowered thereby to gather said slats into a stack relieved from the support of said suspension assembly and to release said slats from said stack for return to the support of said suspension assembly; a mechanism for raising and lowering said carrier; and a tilting instrumentality operable through said suspension assembly during a predetermined initial raising and lowering movement of said carrier for tilting said slats.

2. A Venetian blind comprising: a plurality of slats; a suspension assembly adapted to support said slats in spaced series relation; a carrier adapted to be raised and lowered thereby to gather said slats into a stack relieved from the support of said suspension and to release said slats from said stack for return to the support of said suspension assembly; and a mechanism for raising and lowering said carrier including a drive means, weighted suspension means having portions exerting opposing loads on said drive means, the one load compensating for the weight of slats stacked in said carrier, the opposing load substituting for the weight of the slats suspended from said assembly, and a device exerting a force counterbalancing the substitution load of said suspension means, whereby the resultant load on said drive means is substantially balanced for all positions of said carrier.

3. A Venetian blind comprising: a plurality of slats; a suspension assembly adapted to support said slats in spaced series relation; a carrier adapted to be raised and lowered thereby to gather said slats into a stack relieved from the support of said suspension assembly and to release said slats from said stack for return to the support of said suspension assembly; a mechanism for raising and lowering said carrier including a drive means, weighted suspension means having portions exerting opposing loads on said drive means, the one load compensating for the weight of slats stacked in said carrier, the opposing load substituting for the weight of the slats suspended from said assembly, and a device exerting a force counterbalancing the substitution load of said suspension means, whereby the resultant load on said drive means is substantially balanced for all positions of said carrier; and a tilting instrumentality operable through said suspension assembly during a predetermined initial raising and lowering movement of said carrier for tilting said slats.

4. A Venetian blind comprising: a plurality of slats; a suspension assembly adapted to support said slats in spaced series relation; a carrier

adapted to be raised and lowered thereby to gather said slats into a stack relieved from the support of said suspension assembly and to release said slats from said stack for return to the support of said suspension assembly; a mechanism for raising and lowering said carrier; and a combination clutch and planetary drive connection between said mechanism and said suspension assembly operable during initial raising and lowering of said carrier to cause tilting of said slats.

5. A Venetian blind comprising: a plurality of slats; a suspension assembly adapted to support said slats in spaced series relation; a carrier adapted to be raised and lowered thereby to gather said slats into a stack relieved from the support of said suspension assembly and to release said slats from said stack for return to the support of said suspension assembly; a mechanism for raising and lowering said carrier including a drive means, weighted suspension means having portions exerting opposing loads on said drive means, the one load compensating for the weights of slats stacked in said carrier, the opposing load substituting for the weight of the slats suspended from said assembly, and a device exerting a force counterbalancing the substitution load of said suspension means, whereby the resultant load on said drive means is substantially balanced for all positions of said carrier; and a combination clutch and planetary drive connection between said mechanism and said suspension assembly operable during initial raising and lowering of said carrier to cause tilting of said slats.

6. A Venetian blind comprising: a slat carrier; a slat suspension assembly; a plurality of slats alternatively adapted to be suspended in spaced relation by said assembly or stacked on said carrier; mechanism for raising and lowering said carrier to stack and unstack said slats; and a tilting instrumentality for said slats operable through said assembly on those slats suspended thereby, said tilting instrumentality being operably connected to said mechanism during initial raising and lowering movement of said carrier to effect tilting of said slats to one predetermined tilted position during continued raising of said slats and to another predetermined tilted position during continued lowering of said slats.

7. A Venetian blind comprising: a slat carrier, a slat suspension assembly; a plurality of slats alternatively adapted to be suspended in spaced relation by said assembly or stacked on said carrier; mechanism for raising and lowering said carrier to stack and unstack said slats; and a tilting instrumentality for said slats operable through said assembly on those slats suspended thereby, said tilting instrumentality being operably connected to said mechanism during initial raising and lowering movement of said carrier to offset tilting of said slats to one predetermined tilted position during continued raising of said slats and to another predetermined tilted position during continued lowering of said slats; and means for counterbalancing the load of said slats on said raising and lowering mechanism.

8. A construction as set forth in claim 6 wherein said tilting instrumentality includes a planetary means having a driving element actuated by said mechanism, a driven element rotatable thereby at a reduced speed for actuating said assembly, and dual overriding clutch means adapted to terminate the drive connection between said elements after a predetermined partial rotation of said driven element in either direction.

9. A construction as set forth in claim 7 wherein said tilting instrumentality includes a planetary means having a driving element actuated by said mechanism, a driven element rotatable thereby at a reduced speed for actuating said assembly, and dual overriding clutch means adapted to terminate the drive connection between said elements after a predetermined partial rotation of said driven element in either direction.

10. A Venetian blind comprising: a slat carrier; a slat suspension assembly; a plurality of slats alternatively adapted to be suspended in spaced relation by said assembly or stacked on said carrier; a mechanism for raising and lowering said carrier including a drive means, weighted suspension means having portions exerting opposing loads on said drive means, the one load compensating for the weight of slats stacked in said carrier, the opposing load substituting for the weight of the slats suspended from said assembly, and a device exerting a force counterbalancing the substitution load of said suspension means, whereby the resultant load on said drive means is substantially balanced for all positions of said carrier; and a tilting instrumentality for said slats operable through said assembly on those slats suspended thereby, said tilting instrumentality being operably connected to said mechanism during initial raising and lowering movement of said carrier to effect tilting of said slats to one predetermined tilted position during continued raising of said slats and to another predetermined tilted position during continued lowering of said slats.

11. A construction as set forth in claim 10 wherein said tilting instrumentality includes a planetary means having a driving element actuated by said mechanism, a driven element rotatable thereby at a reduced speed for actuating said assembly, and dual overriding clutch means adapted to terminate the drive connection between said elements after a predetermined partial rotation of said driven element in either direction.

12. A Venetian blind comprising: a marginal frame structure defining opposed vertical slots; transparent panels covering said frame structure; a plurality of slats extending between said slots and into said frame structure; a suspension assembly connected to the extremities of said slats within said frame structure for supporting said slats in spaced relation; a carrier extending under said slats and adapted to be raised and lowered thereby to stack and unstack said slats and form a support for said slats in substitution of said assembly; means within said frame structure for raising and lowering said carrier; and means also within said frame structure actuating said suspension assembly to effect tilting of said slats.

13. A Venetian blind comprising: a marginal frame structure defining opposed vertical slots; transparent panels covering said frame structure; a carrier extending between said slots and into said frame structure; a slat tilting and suspension assembly within said frame structure; a plurality of slats extending between said slots and into said frame structure and connected in spaced, tiltable relation by their extremities to said assembly; mechanism within said frame structure clear of said assemblies and the extremities of said slats for raising and lowering said carrier to stack and unstack said slats, said carrier forming a support for said slats in substitution of said assemblies.

14. A Venetian blind comprising: a slat carrier; a pair of slat suspension assemblies; a plu-

rality of slats alternatively adapted to be suspended in spaced relation by their extremities between said assemblies or stacked on said carrier; each of said suspension assemblies including a pair of suspension units and cross bars pivotally joined between said units at intervals, the extremities of said slats being secured to said cross bars in planes displaced arcuately from the planes defined by the points of connection between said cross bars and suspension units whereby the planes of said slats may tilt between a substantially vertical closed position and in inclined open position while said cross bars tilt substantially equal amounts either side a vertical axis; and mechanism for raising and lowering said carrier to effect stacking and unstacking of said slats, said mechanism including flexible suspension elements located beyond the extremities of said slats and said assemblies, and having points of connection with said carrier above the center of gravity of the maximum stack of slats carried thereby.

15. A Venetian blind construction as set forth in claim 14 wherein a tilting instrumentality is provided between said mechanism and said assemblies, said tilting instrumentality having an operative cycle during a predetermined initial raising or lowering movement of said carrier and an inoperative period during continued raising or lowering of said carrier.

16. A Venetian blind construction as set forth in claim 14 wherein the suspension elements of said mechanism are weighted to exert opposing loads one load acting to compensate for the weight of slats stacked on said carrier, the opposing load substituting for the weight of slats suspended from said assemblies, and a device exerting a force counterbalancing the substitution load of said suspension elements whereby the resultant load on said mechanism is in substantial balance for all positions of said carrier.

LLOYD SPENCER.

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

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