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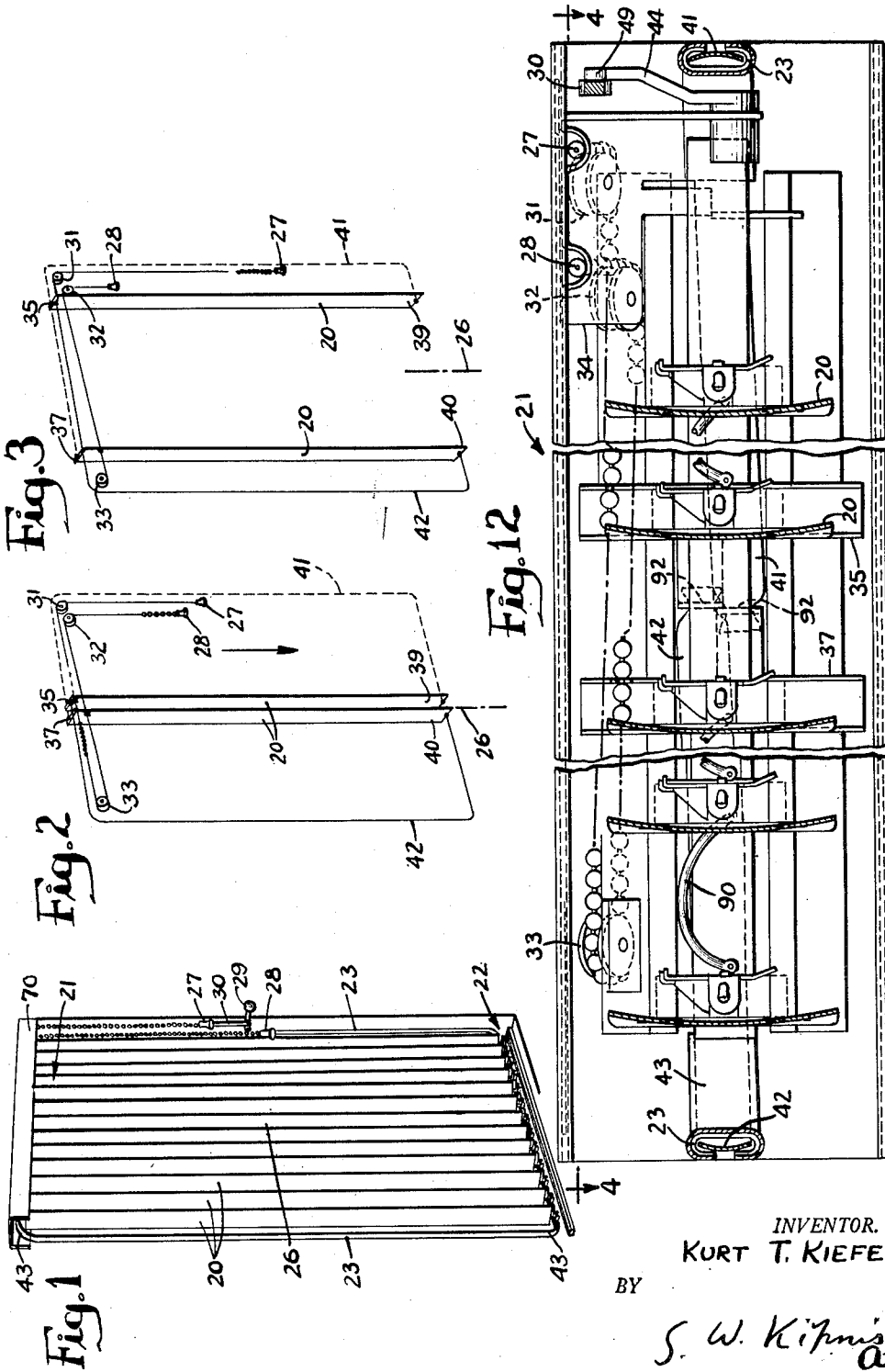
K. T. KIEFER

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VENETIAN BLIND MECHANISM

Filed Oct. 9, 1953

4 Sheets-Sheet 1



INVENTOR.  
KURT T. KIEFER

BY

*S. W. Kiefer's*  
Atty.

Oct. 30, 1956

K. T. KIEFER

2,768,679

VENETIAN BLIND MECHANISM

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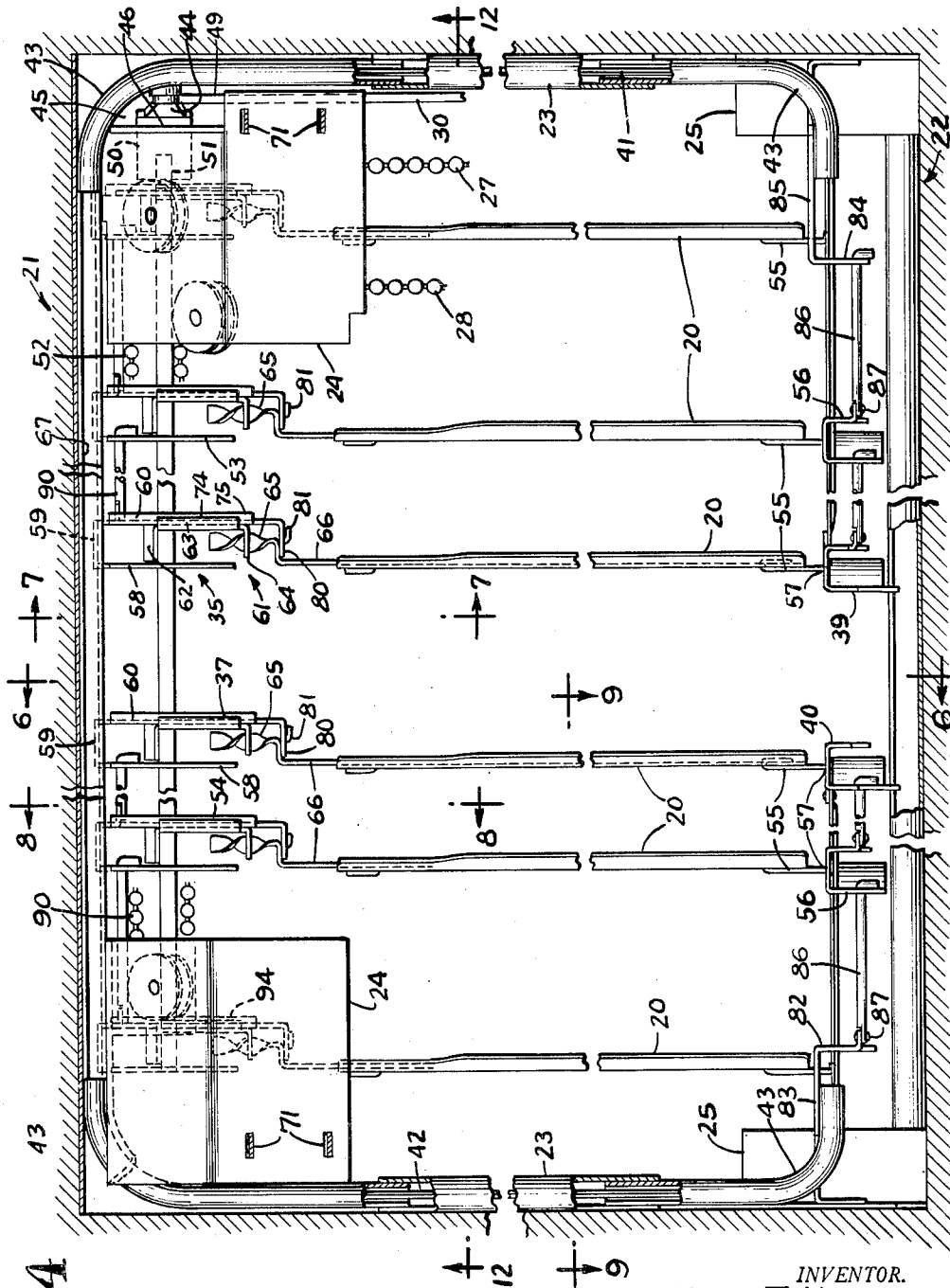


Fig. 4

INVENTOR.  
KURT T. KIEFER  
BY  
J. W. Kipnis  
Atty.

**Oct. 30, 1956**

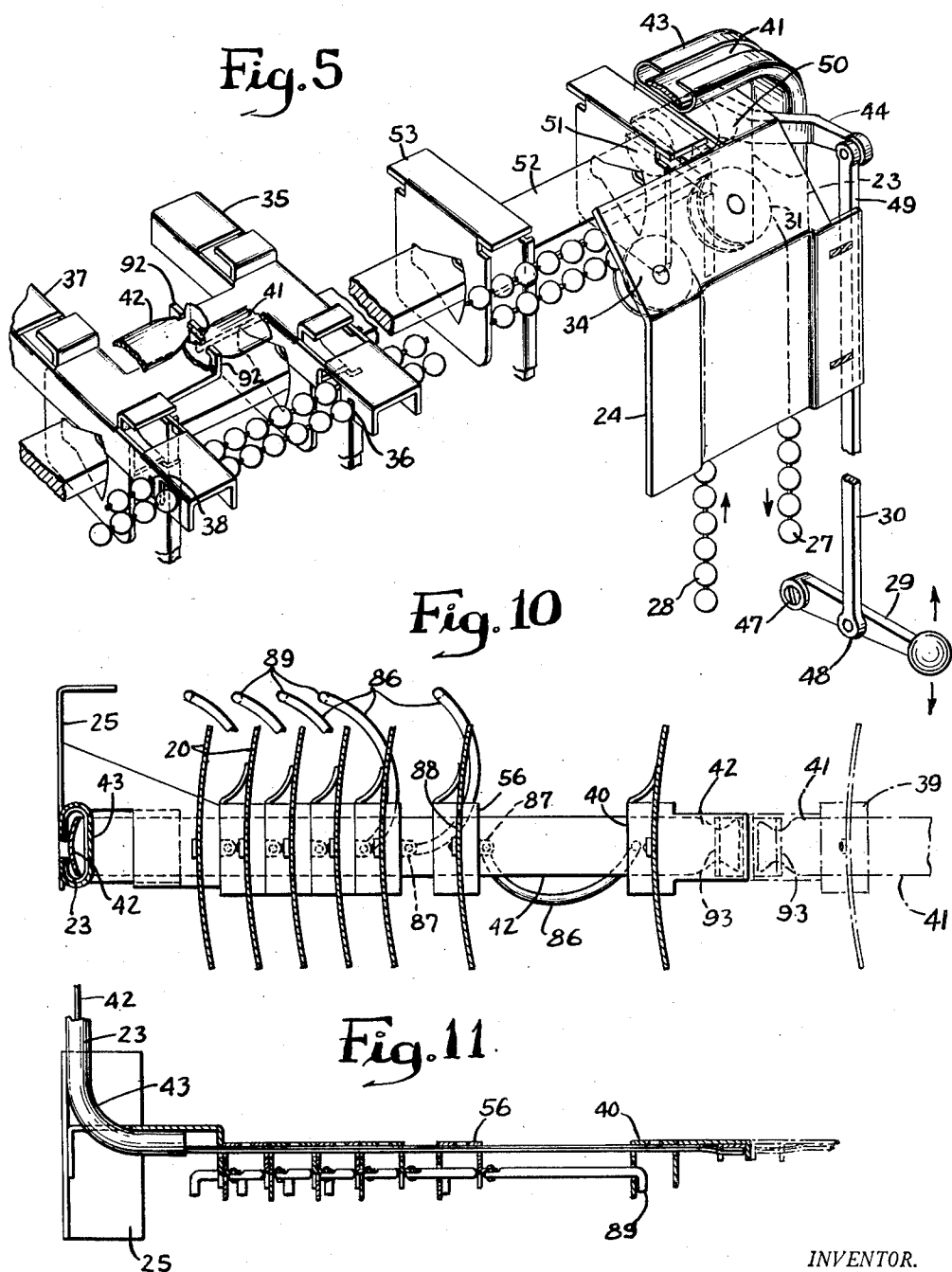
K. T. KIEFER

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# VENETIAN BLIND MECHANISM

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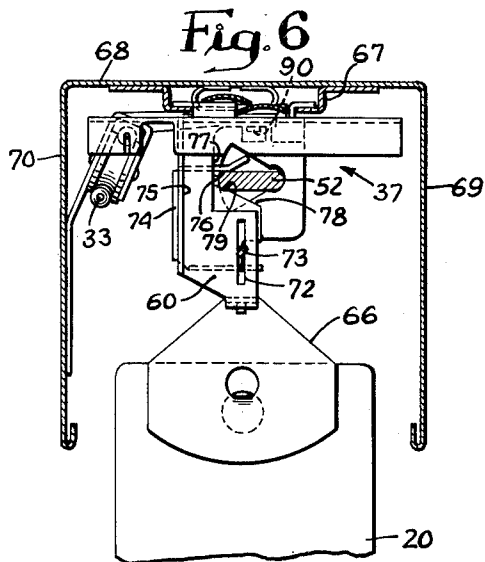
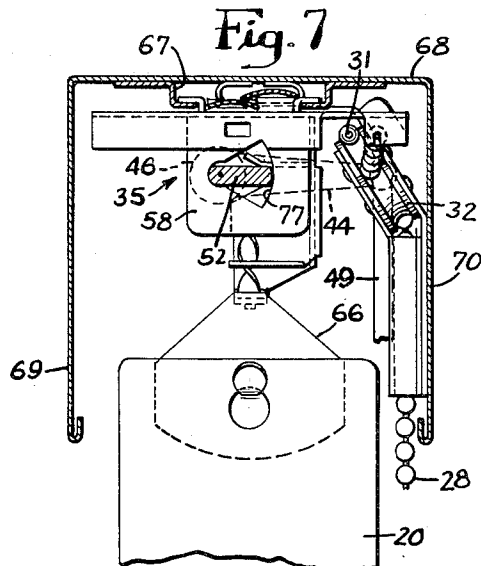
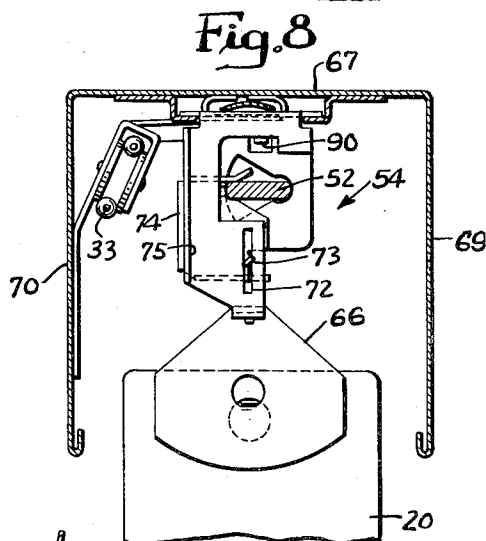
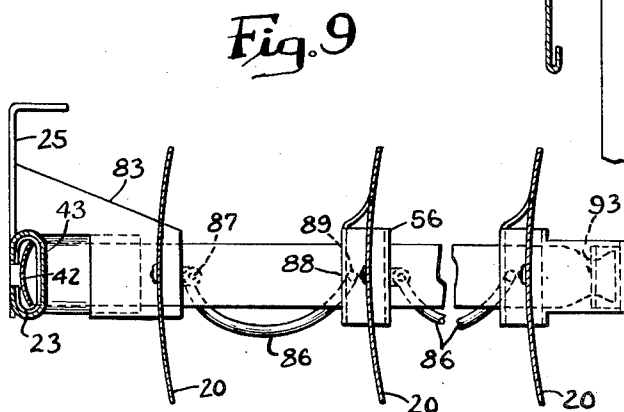
K. T. KIEFER

2,768,679

VENETIAN BLIND MECHANISM

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4 Sheets-Sheet 4



INVENTOR.  
KURT T. KIEFER  
BY  
S. W. Kipnis  
Atty.

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2,768,679

## VENETIAN BLIND MECHANISM

Kurt T. Kiefer, Chicago, Ill., assignor to Kurdon, Inc.,  
Chicago, Ill., a corporation of Illinois

Application October 9, 1953, Serial No. 385,118

3 Claims. (Cl. 160—172)

This invention relates to mechanism for venetian blinds, particularly of the vertical, semi-rigid slat type. A new combination of actuators, controls and followers has been provided whereby the desired sliding or tilting or both can be achieved more accurately and safely than before, while employing mechanical parts which do not tend to add appreciably to the cost of the installation.

The sliding of the slats in venetian blinds of this kind is lateral and is usually of the convergent-divergent type, wherein the venetian blind installation has two halves which are expected to move symmetrically with respect to a vertical center line. It is an important object of these installations that such movement should be truly lateral and symmetrical, that is, that non-vertical positions of the slats should be safely avoided and that the lateral opening or partial opening of the blind should be precisely the same in each half. Moreover it is universally required that this operation be performed by a mere pair of pull-cords, as used also in other drape installations; such cords being required to be soft and flexible in order that they may be handled conveniently and safely both by grown-ups and children. It is unavoidable that such cords are stretchable, and great difficulties have been encountered as a result. These difficulties were particularly apparent when an attempt was made to utilize, together with the pull-cords, a desirably simple and efficient mechanism for the tilting of the slats.

This tilting mechanism by itself has the object of controlling and varying the light shuttering effect of the venetian blind. In this respect it is vital that the angularity of tilting should be the same at the top and bottom of each slat and also the same for all of the slats of the entire installation, irrespective of whether they are to the right or left of the vertical center line. Many attempts have been made to insure such uniformity of angular movement, while at the same time preserving the freedom for lateral movement as aforementioned. The control parts of each individual slat must necessarily be mass-produced by simple procedures; they can therefore not be expected to be absolutely precise. Some looseness in these tilting controls is unavoidable, and in many of the prior designs, errors due to such looseness were accumulated over the entire set of slats, or over one-half of it, or at least over a substantial number of slats, thereby producing very noticeable differences in angular position. These are unsightly and undesirable. They are entirely avoided by the new tilting control.

Another object of the present type of installations is that it should be possible to gather the slats to both sides into the closest possible arrangement, so as to allow the widest possible window opening. This has also been achieved in a manner at least as efficient as in earlier vertical slat mechanisms and so as to avoid interference with the other objectives mentioned above.

Still another object is that the blind when fully closed toward the vertical center line should provide uniform distances between all slats including those at the center.

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This too has been achieved without interference with the other requirements.

Still other objects are to allow slat rotation of 180° or more in the tilting operations so that either side of each slat may be exposed to the inside or outside of the room; to conceal the mechanical actuators, controls and followers except the ends of the sliding pull-cords and the cord or handle to control the tilting; to facilitate installation of the blind by incorporating all of its mechanical parts or at least major sub-assemblies thereof in compact units and so on. Still other objects will be mentioned or alluded to in the description which follows. It will be seen that they also have been achieved.

The aforementioned improvement in control and accuracy has been achieved primarily by the use of a novel top mechanism which comprises a novel and compact assembly of stationary guide channels; one set of such channels being installed at the corners of the top assembly and another between said corners, to guide respectively, a steel band or the like to accurately interconnect the upper and lower ends of the central or master slat units, and, in the other channel, to guide the master and auxiliary slat units themselves. The vertical relationship between these channels is such as to minimize the required height of installation and this object is further attained by installing a relatively thin, horizontal bar or rod element for the tilting control, this element being inserted in matching apertures of the master and auxiliary slides directly below the guiding channel for such slides. The tilting bar, just mentioned, is substantially rigid along its entire length and transmits tilting impulses to each slat carrier, through an individual, sliding link, thereby avoiding differential tilting of slats in spite of the use of fairly loose linkages. The sliding links just mentioned are so designed as to be controlled by tilting movements of the actuator rod about a horizontal axis, to react to such tilting movements by a vertically directed movement of the sliding links and thereby to cause tilting of the slat carriers about a vertical axis; this transmission being designed so that each unit thereof, both in master and auxiliary slides, occupies a minimum of vertical as well as horizontal space, that it can be mass-produced simply and cheaply and that it still provides the aforementioned accuracy as well as strength and ruggedness in prolonged service.

Other features of the new installation relate to the bottom control mechanism or to still other parts, as will be explained more fully in the description which follows. A preferred embodiment of the new invention is disclosed in this description and in the drawings appended hereto, with the understanding that a number of modifications can be made within the scope of the claims appended at the end hereof.

In the drawing:

Figure 1 is a perspective, diagrammatic, partial view of a small venetian blind installation in accordance herewith, seen from the inside of the room.

Figure 2 is a view generally similar to that of Figure 1 but still more diagrammatic, showing merely the innermost vertical slats of the installation, adjacent the center line, together with their pull-cords and interconnecting tapes.

Figure 3 shows the apparatus of Figure 2 in widely opened condition.

Figure 4 is a front elevation of the apparatus, with part of the top and bottom assemblies removed to disclose mechanical parts, also with portions broken away to disclose still other parts and to simplify the illustration.

Figure 5 is a perspective view of the upper right hand parts shown in Figure 4.

Figure 6 is a section taken along lines 6—6 in Figure 4.

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Figure 7 is a section taken along lines 7—7 in Figure 4.

Figure 8 is a section taken along lines 8—8 in Figure 4.

Figure 9 is a plan view partly in section taken along lines 9—9 in Figure 4.

Figure 10 is a view generally similar to Figure 9 but showing the slats at a different degree of opening.

Figure 11 is a front elevation of the apparatus shown in Figure 10.

Figure 12 is a bottom view taken along lines 12—12 in Figure 4.

Referring first to Figure 1, the installation comprises a set of vertically elongated venetian blind slats 20, preferably made of steel or other semi-rigid materials withstanding the normal mechanical conditions of use and maintenance. The surfaces of these slats may be finished in identical or different manners on both sides, with materials which withstand exposure to light, etc., in well known manner. Since the installation is semi-rigid, that is, vertical rolling up of the slats is not involved but sufficient rigidity is provided to transmit tilting impulses from a top mechanism to the bottom of each slat; for these reasons the slats are preferably curved transversely of their elongation as best shown in Figures 9 and 10.

The top installation is generally designated by the numeral 21 in Figure 1; it will be noted that it occupies only a minor portion of the total vertical height of the window. The bottom installation 22 is largely omitted in Figure 1; in actual practice it is frequently concealed in manner similar to that employed at the top. The installation also comprises a pair of side channels 23 of identical construction, one at the right and the other at the left end of the venetian blind and rigidly secured to the top and bottom installations by top corner plates 24 and bottom corner plates 25 best shown in Figures 5, 10 and 11.

The venetian blind of Figure 1 can be parted or closed, that is shifted laterally in symmetrical manner about the vertical center line 26, by shift control means desirably consisting in the usual pair of pull-cords 27, 28, as will be disclosed hereinafter. A tilt control actuator handle 29 installed adjacent the ends of these pull-cords and swingable in a vertical plane controls the tilting of the slats about their vertical axes, by means of the top mechanism to be described, connected with the handle by a rod 30.

Referring now to Figures 2 and 3 it will be noted that the pull-cords 27, 28 are trained over pulleys 31, 32 and 33; one of these pulleys, 31, being provided for the first pull-cord 27 and two of them, 32 and 33, for the second pull-cord 28. Two of these pulleys, 31 and 32, are installed adjacent one another, on a suitable part 34 of the right hand corner plate 24 as clearly shown in Figure 5; the third pulley 33 being similarly installed on the left side, see also Figure 12. The pull-cord 27 extends from its free operating end upward to and over the pulley 31 and then horizontally to the left hand pulley 33, wherefrom it returns as pull-cord 28, to and over the pulley 32 and vertically downward therefrom to the other free and operating end. Thus the two cords form in effect a single loop the principal operating portion of which extends horizontally between the three pulleys and the free ends of which hang freely downward from the pulleys 31, 32. One of the two strands of the horizontally extending portion of the loop is attached to an upper right hand master guide 35, as shown at 36 while the other strand of said horizontal loop is similarly attached to an upper left hand master guide 37 at 38. This basic part of the sliding control is well known and is not claimed herein by itself.

Lower left and right hand master slides are provided as shown respectively at 39 and 40, best shown in Figures 4, 10 and 11. Additionally means are provided to maintain accurately uniform superposition between the right hand master slides 35, 39 and likewise between the left

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hand master slides 37, 40. For these purposes Figures 2 and 3 show diagrammatically a pair of interconnecting metal bands 41, 42; the former being generally on the right hand side of the installation and interconnecting the upper left hand master guide 37 with the lower right hand master guide 39 while the other is generally at the left hand side of the installation and interconnects the right hand top master guide 35 with the left hand bottom master guide 40. The metal bands 41, 42 extend through the vertical side channels 23 of their respective sides, see Figure 1; at the top and bottom ends of said channels these bands are guided into horizontal directions by suitably curved corner portions or nozzles 43, having such radius of curvature as to allow passage of the metal bands over the corner portions with a minimum of friction.

Referring now to Figures 4 and 5 the principal parts for the tilting mechanism of the master and auxiliary slides and their slats can be explained as follows, starting with the actuator rod 30 which is raised or lowered by the handle 29 at the right hand side of the installation. The raising and lowering of this rod causes a rocking motion of a lever 44, pivoted at 45 to a side plate 46 suitably attached to the corner plate 24. Such rocking of the lever 44 may suitably occur across a substantially horizontal position, shown in Figure 5, both levers 44 and 29 being raised and lowered relative to such positions by approximately 15°. For this purpose the lever 29 is suitably pivoted at 47 and interconnected with the lever 44 by pivoted end joints 48, 49 of the vertical arm 30.

A clevis 50 is rigidly secured to and pivoted with the rocking arm 44, on the other side of the plate 46, and is provided with one radial slot 51. This slot receives the right hand end of a rigid, horizontal rod 52 which as shown may have substantially rectangular cross section. The opposite or left hand end of this rod may be tiltably supported from the left hand corner plate 24 by somewhat similar mechanism, not shown, without actuating means such as the rocking arm 44.

It will be noted that the rod 52, tiltable by the levers 29 and 44, extends through the top master slides 35 and 37 and also through the right hand auxiliary top slides 53 and the left hand auxiliary top slides 54 for the various slats 20 between the corresponding master slides and stationary sides. Only a few of these auxiliary slides are shown in the present figures but it will be understood that any desired number of such slides can be provided and can be uniformly actuated by a single rigid tilt rod 52.

The entire tilting operation is performed in the top sub-assembly 21, the bottom ends of the slats being held in carriers 55 which are merely laterally shifted by and freely pivoted in the bottom master slides 39, 40 or bottom auxiliary slides 56, by means of simple pivots 57.

Figures 4, 6, 7 and 8 disclose the manner in which the tilting of the horizontal rod 52 causes the tilting of the vertical slats 20. It will be noted that in this respect the top master and auxiliary slides 35, 37, 53, 54 are uniformly constructed, oriented and generally arranged, so that for instance Figures 6 and 7 can be considered, in this respect, as right hand and left hand views, respectively, of any one of these top slides.

Each of these slides forms a small channel transverse of the longitudinal extension of the top installation 21, as best shown in Figure 4. For instance the slide 35 forms a channel which has a vertical left hand wall 58, a horizontal top wall 59 and a vertical right hand wall 60. Vertically slidable between the walls 58 and 60 is an intermediate link or clip generally designated by numeral 61, which serves to be raised or lowered by the tilting of the horizontal rod 52 and as a result to tilt the vertical slat carriers. For these purposes each intermediate link 61 has the approximate form of a channel member with an upper horizontal wall 62, a vertical web or wall 63, and a lower horizontal wall 64. The web 63 is adapted to slide along the right hand wall 60 of the surrounding slide 35 or 53, etc. The horizontal tilt bar 52 extends

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through the intermediate link 61 as well as through the surrounding slide, and causes raising and lowering of the link by engagement with suitable cut-out surfaces on the vertical link wall 63 as will be described in greater detail hereinafter. The lower horizontal wall 64 of the intermediate link serves as an actuating nut for a helix 65 vertically extending therethrough; the lower end of this helix being secured to an upper slat carrier 66. Slat carriers and helix elements of this kind have previously been proposed and tried. However heretofore great difficulties have been encountered with them whereas the new arrangement of the sliders 35, etc. and intermediate links 31 provides a very sensitive, uniform yet rugged and economical tilt control.

This improvement is largely connected with the provision of the two co-acting channels 58—59—60 (facing downward) and 62—63—64 (facing laterally), both of which extend transversely of the top installation 21 and have the tilt rod 52 extending through their vertical walls 60, 63 and 58.

Each of the slides or downwardly facing channels 58—59—60 is not only laterally slidable but also held in proper, downwardly facing orientation, by a simple and generally known engagement with a horizontally extending top channel 67. This top channel is shown as being rigidly installed in the uppermost part of the top installation 21, being secured to the underside of the top wall 68 which forms part of the top mechanism 21; a pair of depending walls 69 and 70 being secured to said top 68 and being suitably held in known manner as by engagement with the top corner plates 24, by a slot and clip mechanism 71. The channel 67 serves in known manner to slidably position each slide member or downwardly facing channel 58—59—61, restraining each of them individually from any appreciable tilting in any one of the three dimensions, whereby cumulative tilting and binding due to looseness or weakness of parts is avoided although each individual slide can be made in form of a light, thin walled member, rapidly and economically mass-produced by stamping operations or the like.

Likewise tilting of any individual, intermediate link or clip 61 is prevented, in all of the three dimensions, while the rising and falling of the link, the tilting of the horizontal tilt rod 52 and the rotation of the vertical helix 65 is facilitated. For these purposes, there is provided a vertical slot 72 in each vertical right hand wall of a downwardly facing slide, and a pin 73 extending through and guided by said slot and rigid with the vertical wall or web 63 of the intermediate link 61. Tilting in the plane of the walls 60 and 63 is additionally prevented by a flange 74 rigid with each link wall 63 and slidably engaging the adjacent vertical edge 75 of the corresponding vertical slide wall 60. Tilting of a link 61 in a vertical plane along the top installation 21 is prevented by the engagement between the helix 65 and nut 64, with the further help of the adjacent and slidably co-acting walls 60, 63 and of the left hand edge of each upper link wall 62, adjacent the inside of the corresponding left hand slide wall 58. This edge together with the walls 60 and 63 serves also to avoid tilting of an intermediate link 61 in a horizontal plane. The link 61 as well as the slide can be produced by punching or stamping operations or the like.

In the particular embodiment shown, wherein the top installation is made as low as possible and therefore the slidable flange and edge 74, 75 are made very short, tilting in the plane of Figure 6 is additionally counteracted by a pin 76 secured to the slide 61 opposite to the flange 74 and slidable along a vertical edge 77 on the slide wall 60.

A keyhole type opening 78, oriented oppositely to the opening 77, is formed in the vertically slidable link wall 63 and symmetrically therewith about the center line of the cross section of the tilt rod 52, so that downward tilting of the front edge of the tilt rod depresses an apex portion 79 of this latter opening 78 while upward tilting

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of the rod raises it. This opening 78 is most clearly shown in Figure 6.

Support for the slat carrier 66, at uniform elevations, is provided by a small flange 80 leftwardly extending from the right hand vertical wall 60 of each slide at the bottom thereof. These flanges 80 serve also to provide simple journals 81 for the bottom ends of the corresponding helix members 65. These journals 81 are suitably aligned with the superposed helix actuating nut openings in the walls 64, thereby avoiding difficulties due to inclination or irregular motion of the upper slat portions, and facilitating the link and slat motion.

Referring now to Figures 9 to 11, there is shown a further refinement of the mechanism whereby the maximum spacing apart of different slats is uniformly controlled both at the top and bottom thereof while undesirable, loose spacing chains or the like are avoided. Figure 9 shows the left hand part of the blind fully extended in the manner of Figure 2, so that identical spacing is maintained between the left hand master bottom slide 40, the next following auxiliary bottom slides 56 and the terminal slat carrier 82 at the left hand end of the installation; the latter carrier 82 being stationary and secured to the plate 25 by a suitable plate 83. It will be understood that a similar terminal carrier is provided also at the right hand end of the bottom installation at 84, with support at 85.

Each master, auxiliary or stationary bottom slat carrier is interconnected with the adjacent bottom slat carrier or carriers by a horizontally swingable link 86, curved in a horizontal plane, which link is pivoted to one slat carrier at 87 while it slidably extends into and through a vertical wall of the connected slat carrier as indicated at 88. At the free end of each link 86, opposite the pivot 87, a hook or stop member 89 is formed, so that the body of a link 86 can slide through the opening 88 as the slides and slats are separated from one another, but the sliding of the link 86 is stopped by engagement of the hook 89 and the corresponding slide wall.

Thus the bottom installation 22 can be made very low and shallow indeed, as will best be noted from Figure 11. Whereas interconnection of the slides by freely hanging chains or cords tends to require a considerably greater depth of installation while providing less positive and uniform guidance.

As shown in Figure 12, spacing links 90 generally similar to the lower links 86 are provided in the top installation 21. Here as well as in the bottom installation the conservation of vertical height is important and it is fully obtained with the aid of these links, as will also be noted from Figure 4. The links 86 and 90 are shown as installed in vertical planes which are spaced but very slightly from the guide surfaces of their respective upper and lower guide channels for the slides, thereby not only minimizing the bulk of the mechanism but also reducing any tendency to tilt the slides in vertical planes incident to their sliding. The closeness between the top guide channel 67 and the top spacers 90 is most evident from Figure 8, wherein the slide opening for the spacer 90 is shown at 91. It is quite obvious that, if freely depending spacer cords were used instead of the horizontally swinging spacer rods, the vertical spacing between the channel 67 and tilt rod 52 would have to be materially increased in order to avoid mutual interference between the spacers and the tilting mechanism. On the other hand it is of course undesirable to install spacers, either freely hanging or otherwise, below the tilting mechanism 52, etc., since such installation of spacers would lead to tilting of sliders 53, 54 in the plane of the venetian blind, and to consequent binding and/or high resistance to the sliding and pulling operation. Thus it may be said that the horizontally swinging spacers are even more important in the top installation than in the bottom installation.

No spacer rods 86 or 90 of course can be provided between opposite master slides 35, 37 or 39, 40. However identical ultimate spacing of these master slides, matching

the spacing between the auxiliary slats when fully extended, is provided in a manner most clearly disclosed in Figures 5 and 12. For this purpose each top master slide 35, 37 has an abutment member 92 secured thereto which is adapted to abut with the corresponding member 92 of the opposite top master slide when the fully extended position according to Figure 2 has been obtained, and thereby to space the top master slides apart by a distance similar to that governed by each of the spacers 90. Similarly, abutment members 93 are attached to the bottom master slides 39 and 40 as shown in Figure 10. The abutment members 92 and 93 may also serve to provide the aforementioned connection between the master slides and their corresponding metal bands 41 and 42. Since the abutment members are desirably arranged partly in front of one another in order to conserve vertical space, it will be seen that the bands 41, 42 will run at a very slight angle to the longitudinal extension of the installation, as clearly disclosed in Figure 12.

This slightly inclined extension of the metal tapes over their horizontal stretches is facilitated by the arrangement wherein the guide channels 23 stop adjacent the corners of the top and bottom installations, as previously described. Between these corner positions at the top, the metal tapes extend through the channel 67 as most clearly shown in Figures 6, 7 and 8. Accordingly the channel 67 substantially abuts with the opposite end outlets of the tape nozzles 43 as best shown in Figure 4. This is still another expedient to conserve vertical height of installation in the top mechanism. In addition it provides a very simple means of preventing loss of slide members 35, 37, 53 and 54, at the right and left hand ends of the channel 67, even in the absence of terminal slat retainers 94 at the top, which may be constructed in manner similar to the terminal bottom slat carriers 82.

The operation of the venetian blind according to this invention is believed to be obvious from the foregoing explanations but attention is drawn to the simplicity of this operation. For instance sliding can be effected to close the blind by merely pulling down the pull-cord 23, and the improved slide and spacer mechanism described causes automatic, accurate motion of each slat, without manipulation of any additional pull-cord or the like. This also applies to the opening of the blind by downward pulling of the other pull-cord 27. There is no tendency whatsoever to cause any inclined positions of slides, as is frequently encountered in most other venetian blind installations, both vertical and horizontal; yet the conventional means to counteract such tendencies, involving manipulation of a plurality of actuator cords, is not required at all. Likewise the sliding is very free and easy, largely by virtue of the spacer arrangements which have been explained. Oiling of sliding elements and rods, which is highly objectionable because of possible injury to slats and furnishings, is not required; adequate looseness being allowable between sliders and other parts and accuracy of each individual slat position being obtained nevertheless by the positive pulling and spacing devices described.

Assuming that the venetian blind is in the position of Figure 2 and that it shall be opened, this is effected by pulling downward on pull-cord 27, which separates the top master sliders 35 and 37 in known manner. Incident to this motion of the right hand top master slide 35, tension is applied to the left hand metal band 42, the vertical stretch of which is pulled upward, thereby pulling the left hand bottom master slide 40 toward the left, directly below the left hand top master slide 37. Likewise the tape 41 pulls the right hand bottom master slide 39 to the right. As these master slides are being separated they gradually gather the successive auxiliary slide carriers of their respective sets, swinging the slide spacers into backward positions in this process. Since the slats of the

master slides are kept vertical, the same thing obviously applies to the slats of the auxiliary slides.

The return motion, starting in the position of Figure 3, is equally positive by virtue of the use of metal tapes 41, 42, which can be made semi-flexible or semi-rigid for this purpose, particularly by giving them a slight curvature in cross section as shown in Figure 12 and elsewhere. The pull-cord 28 unites the top master slides 35 and 37 in known manner. As the top master slide 35 moves toward the left it applies a slight compression upon the tape 42. If the tape were free to bend this compression would lead to difficulties. Practically however the tape is well restrained by the top channel and the side channels 23 and I have found that even the relative width of the top channel, apparent from Figure 12, causes no difficulties in this respect. Thus the bottom master slide 40 is kept below the top master slide 37 not only by gravity but additionally by the push of the tape 42. Additional aid in the required inward movement of the bottom slides is obtained by such slight friction as occurs between these bottom slides and the tape 42 passing through the same. Again the actuation of the other set of slats occurs in the same manner.

The tilting operation is equally simple. It can be performed by the single control member 29 regardless of the closed, opened or partly opened condition of the venetian blind. All slats move to substantially the same orientation and angularity without noticeable difference, in spite of the use of light and inexpensive control parts with simple, loose and unlubricated engagement.

It will be obvious to persons skilled in this art that a variety of modifications can be applied, within the scope of this invention. This scope is claimed as follows:

1. A venetian blind comprising a set of vertical slats and a mechanism for extending and contracting the set and for keeping the slats vertical; said mechanism comprising a channel extending horizontally along the top of the blind; a top slider for substantially each slat, supported from the channel and supporting the corresponding slat; a tilt control actuator for the slats; a straight rod horizontally extending through the sliders, below and parallel to the channel; means controlled by the actuator to tilt the rod about a horizontal axis; linkage in each slider for converting the horizontal-axis tilting of the rod into corresponding vertical-axis tilting of the slat supported by the slider, said linkage in each slider comprising a link adapted to be raised and lowered by the tilting of the rod, slidably guided vertically by the corresponding slider and connected with the respective slat by a helix and nut mechanism; shift actuator means for moving one slider of the set along the channel, and tension means interconnecting the sliders so as to minimize tilting and consequent friction of the sliders incident to the extending and contracting of the set.

2. A venetian blind as described in claim 1 wherein each slider and each link therein forms a body, extending across the plane of the venetian blind and the two bodies slidably engage one another so as to minimize tilting of the link in any plane.

3. A venetian blind as described in claim 1 wherein said tension means interconnects the sliders between the channel and the rod.

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