Feb. 11, 1941. N. H. SWANSON 2,231,778

VENETIAN BLIND AND OPERATING MECHANISM THEREFOR

Filed April 23, 1938 3 Sheets-Sheet 1

Fig. 1.

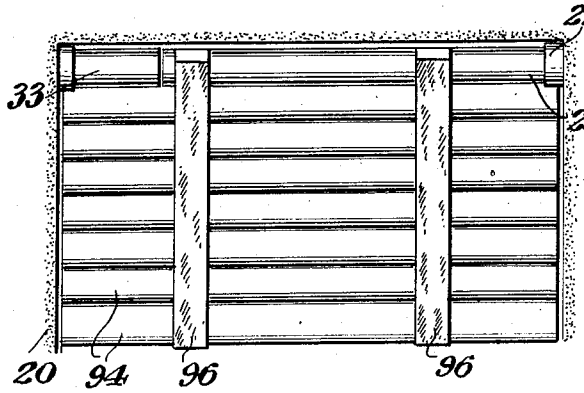
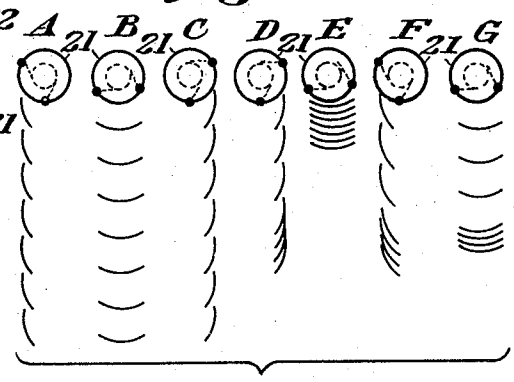


Fig. 2.



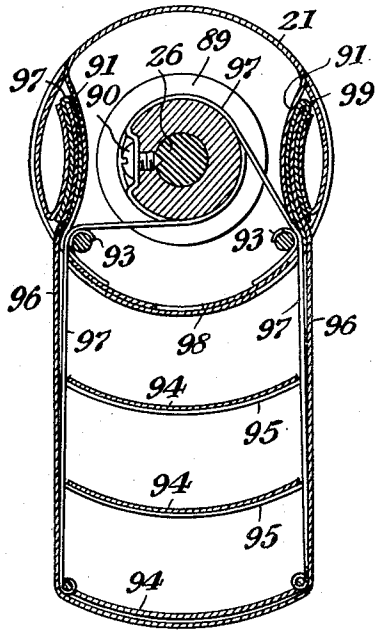


Fig. 4.

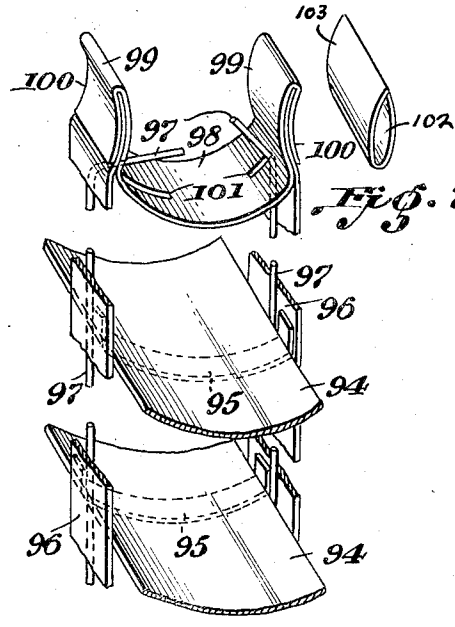


Fig. 7.

Fig. 5.

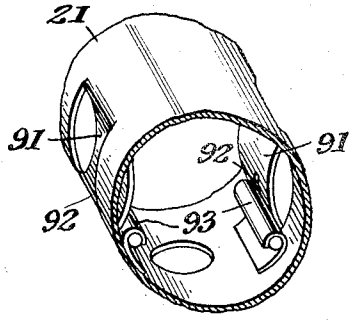


Fig. 6.

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Feb. 11, 1941. N. H. SWANSON 2,231,778

VENETIAN BLIND AND OPERATING MECHANISM THEREFOR

Filed April 23, 1938 3 Sheets-Sheet 2

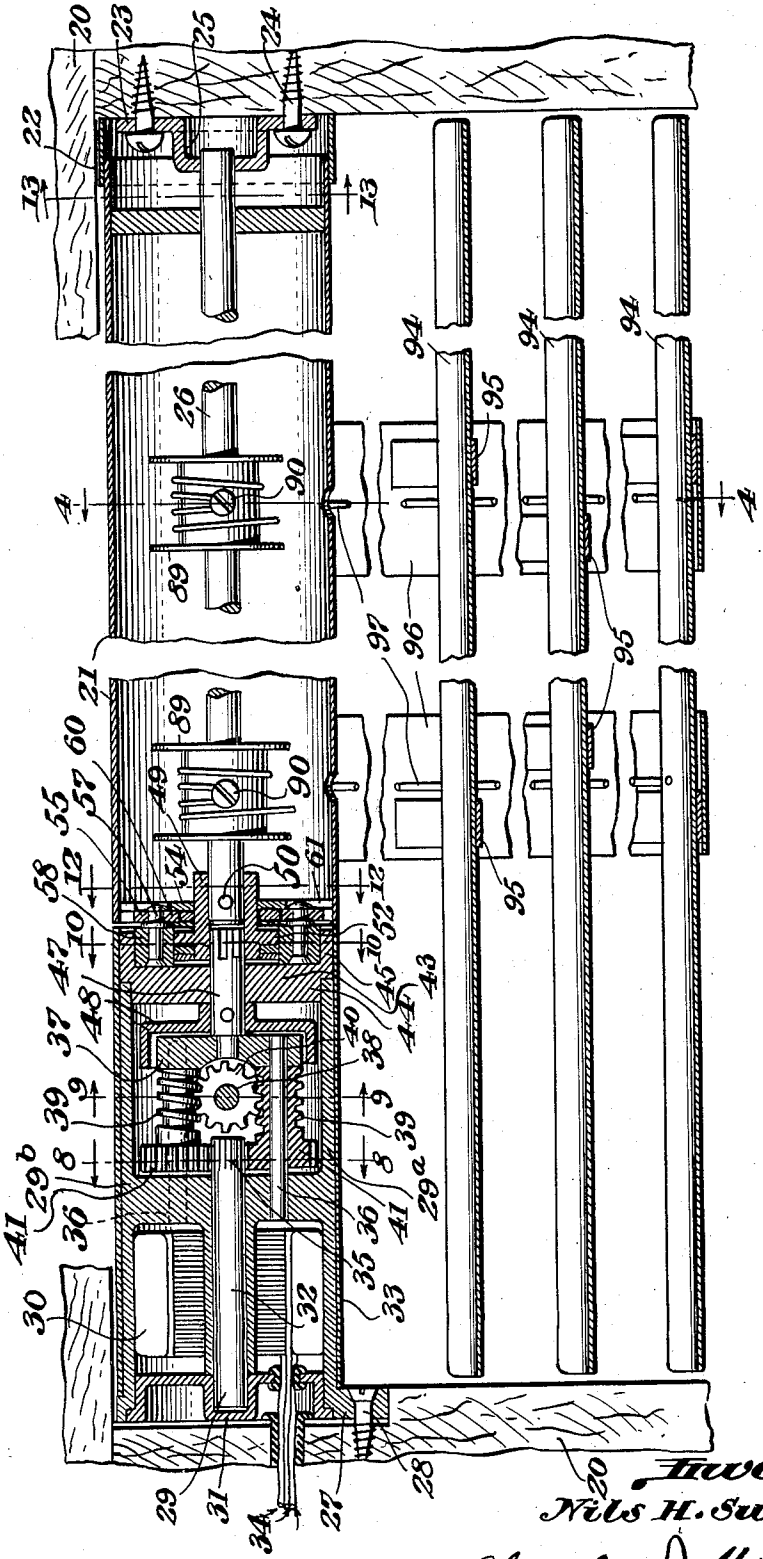


Fig. 3.

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VENETIAN BLIND AND OPERATING MECHANISM THEREFOR

Filed April 23, 1938 3 Sheets-Sheet 3

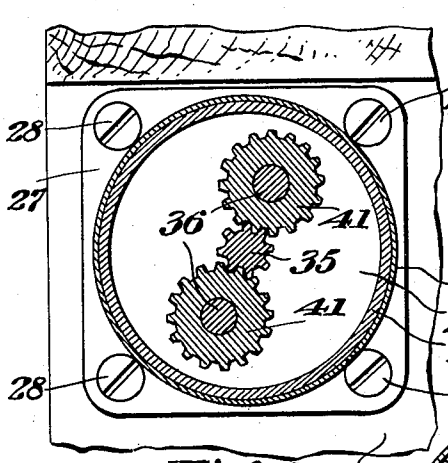


Fig. 8.

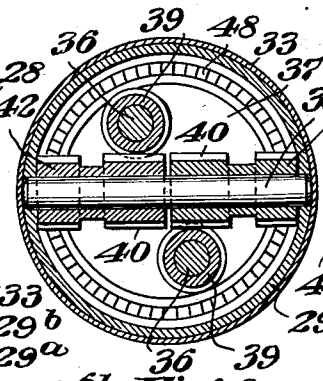


Fig. 9.

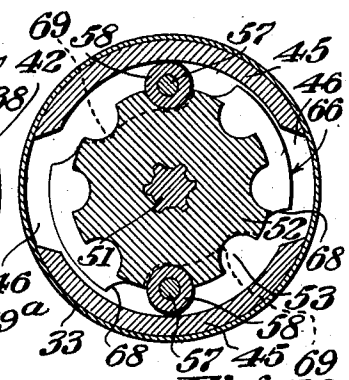


Fig. 10.

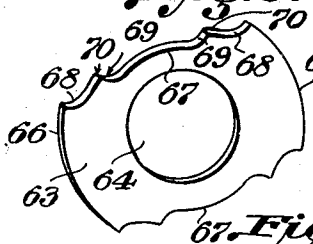


Fig. 11.

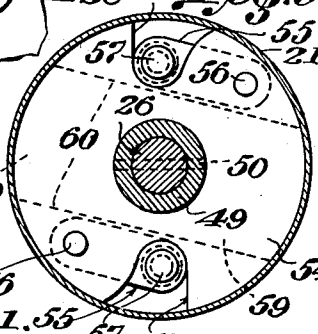


Fig. 12.

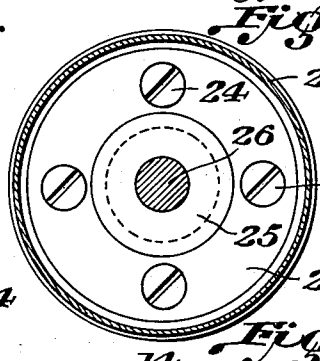


Fig. 13.

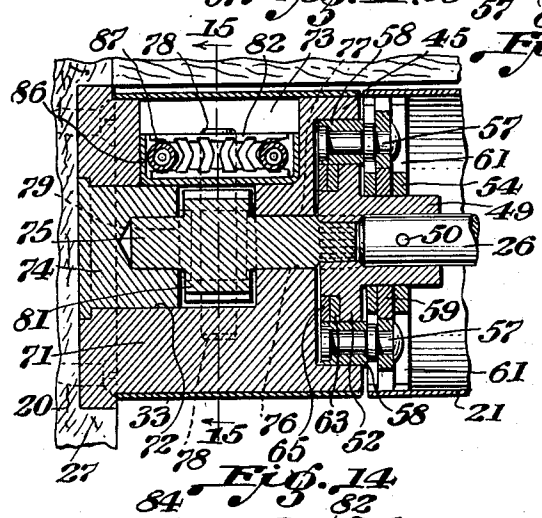


Fig. 14.

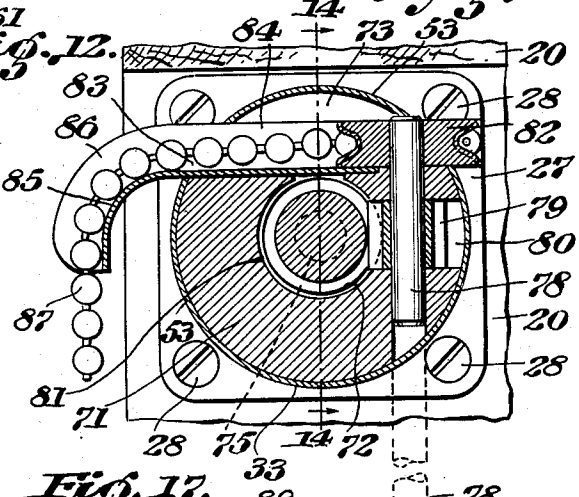


Fig. 17.

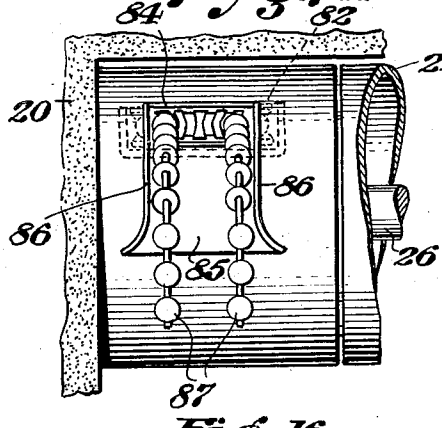


Fig. 16.

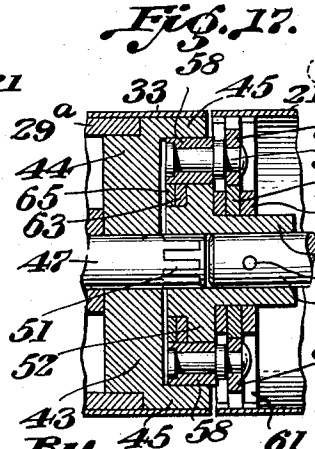


Fig. 15.

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Patented Feb. 11, 1941 2,231,778

UNITED STATES PATENT OFFICE

2,231,778

VENETIAN BLIND AND OPERATING MECHANISM THEREFOR

Nils H. Swanson, Chicago, Ill.

Application April 23, 1938, Serial No. 203,838

25 Claims. (Cl. 156—17)

This invention relates to Venetian blinds and the operating mechanisms therefor and has for its object a blind construction and operating mechanism whereby the blind may be adjusted as to raising, lowering, and tilting by a single unitary operating mechanism that can be controlled either manually, mechanically, or electrically.

With the above and other objects in view, as will be apparent, this invention consists in the construction, combination, and arrangement of parts all as hereinafter more fully described, claimed, and illustrated in the accompanying drawings, wherein:

Figure 1 is an elevation of the blind forming the subject matter of the present invention taken from the inside of a window with blind completely lowered and tilted closed as illustrated in position A of Figure 2;

Figure 2 is a diagrammatic series of end elevations of the blind showing the relative positions of the blind sections or slats and head bar during several successive stages of the operation thereof in being adjusted, raised or lowered, wherein: A shows the positions, the slats or sections assume when the blind is fully lowered and tilted closed; B illustrates the positions of the slats or sections when tilted or adjusted to be fully open; C discloses the positions of the slats or sections when tilted or adjusted to be fully closed but in the opposite direction to position A; D shows the positions of the slats or sections when partly raised; E discloses the positions of the slats or sections when fully raised and with the cluster thereof substantially horizontal; F shows the positions of the slats or sections when partly lowered; and G illustrates the positions the slats or sections may be adjusted to assume at any point during the raising or lowering thereof;

Figure 3 is a vertical longitudinal section through the blind and its tubular or cylindrical head bar to illustrate its construction and operating mechanism as well as electrical means for the control of its operation and adjustment;

Figure 4 is a vertical transverse section taken along line 4—4 of Figure 3 disclosing the cooperation between the operating and supporting cylindrical head bar, the slats or sections of the blind and the cords and tapes thereof;

Figure 5 is a fragmentary perspective view of the slats or sections of a blind and the cooperating tapes and cords together with the clip by which the tapes are secured to the cylindrical head bar;

Figure 6 is a fragmentary perspective view of the cylindrical head bar disclosing the elements and features thereof instrumental in attaching the tapes and cords of the blind for cooperation with the bar and the operating and controlling mechanism positioned therein;

Figure 7 is a perspective view of one of the clamps or covers by which the clip shown in Figure 5 for securing the tapes to the head bar is held in place;

Figure 8 is a vertical transverse section taken along line 8—8 of Figure 3;

Figure 9 is a similar view taken along line 9—9 of Figure 3;

Figure 10 is also a vertical transverse section being taken along line 10—10 of Figure 3;

Figure 11 is a perspective view of the locking plate forming a part of the mechanism disclosed in Figures 3 and 10;

Figure 12 is a vertical transverse section taken along line 12—12 of Figure 3;

Figure 13 is similarly a transverse vertical section taken along line 13—13 of Figure 3, showing the mounting for one end of the cylindrical head bar;

Figure 14 is a longitudinal vertical section taken along line 14—14 of Figure 15 through one end of the cylindrical head bar to disclose manual and mechanical means for the operation and control of the blind;

Figure 15 is a vertical transverse section taken along line 15—15 of Figure 14;

Figure 16 is a front elevation of one end of the cylindrical head bar provided with that form of the invention illustrated in Figures 14 and 15; and

Figure 17 is an enlarged vertical section of the connection between the driving mechanism and the operating shaft in that form of the invention disclosed in Figures 3 to 13, inclusive.

Heretofore Venetian blinds have generally employed two separate and distinct mechanisms for the control and operation thereof, viz. one for raising and lowering the blind and one for the tilting or adjustment of the slats or sections constituting the blind. Among its other purposes the present invention contemplates a Venetian blind employing a single unitary mechanism, either electrical, mechanical, or manual in its operation and control by which the blind may be raised and lowered and the slats or sections simultaneously adjusted angularly or tilted in either direction.

The invention furthermore has in view a Venetian blind construction wherein the blind slats

or sections may, for all practical purposes, be converted into a substantially solid sheet or wall when the slats or sections are fully tilted in either direction by the elimination of all apertures in said slats or sections and so constructing and arranging them that there is complete cooperation between the coacting portions thereof.

Reference being had more particularly to the drawings **20** designates a window opening and the frame thereof. Interposed between the vertical sides of the window frame **20** adjoining the top horizontal side thereof is a tubular and preferably cylindrical head bar **21** by or from which the entire blind is supported, operated and adjusted. This head bar may be constructed of any suitable material, preferably metal of appropriate thickness, and carries within it the mechanism by which the blind is raised, lowered, and adjusted.

At one of its ends, i. e. that end opposed to the end carrying the operating and control mechanism, the head bar is supported for oscillation with a relatively short sleeve **22** mounted on one vertical side of the window frame as close as convenient to the upper horizontal side of the frame. Within the short sleeve **22** is a bracket **23** secured to the adjacent vertical side of the frame **20** by the screws **24** which has a projecting bearing **25** for rotatably mounting one end of the operating shaft **26**. The head bar **21** may reciprocate slightly in the short sleeve **22** when the blind is being assembled in the window opening or when it is desired to disconnect the operating and controlling mechanism from said head bar **21** so that the latter and the elements carried thereby may be removed from the window opening for cleaning and repairing.

In all forms of the invention one end of the head bar **21** and of the shaft **26** are mounted as above described whereas the support for the opposite ends of these elements varies somewhat to meet the requirements of the respective operating or driving mechanisms employed. In that form of the invention disclosed in Figures 3 to 13, inclusive, and 17, a bracket plate **27** is secured by the screws **28** to the opposite vertical side of the frame **20** to the bracket **23** and in horizontal alinement therewith. The block **29** of a suitable electric motor **30** is attached to and may form a part of this plate **27**. A central bearing **31** for the outer end of the shaft **32** of said motor **30** is also mounted or pressed into the outer end of the motor block **29**. This motor **30**, of standard type, is reversible in its operation to be controlled by any desirable switches (not shown) operating through the leads **34** shown in Figure 3 as extending through the adjacent side of the frame **20** and the plate of the bearing **31**.

This motor **30**, its block **29** and associated mechanisms, as will be pointed out, are housed in a stationary supplemental casing or shell **33** of the same diameter as the head bar **21**, which when interposed between the adjacent end of said bar and the plate **27** constitutes an unbroken continuous extension of said bar as clearly indicated in Figures 1 and 3. In other words, the head bar **21** and the casing or shell **33** of the operating mechanism combine to constitute what in effect is a single unitary bar extending from one to the other of the vertical side walls of the frame **20**.

The block **29** of the motor **30** fits snugly in the casing or shell **33** at the end thereof adjoining the plate **27** and at its inner end has a hollow or tubular extension **29a** bearing against the inner surface of the casing or shell **33**. The inner end of the shaft **32** of the motor **30** projects into this extension **29a** and has a spur gear **35** thereon lying close to the partition **29b** between the motor **30** and said extension. A pair of parallel pins **36** are fixed in the partition **29b** on each side of the shaft **32** and extend toward the outer end of the extension **29a** where their extremities are engaged by a plate **37** that will prevent the pins **36** from becoming displaced from their relatively parallel positions.

Within the extension **29a** and fixed thereto is a pin **38** transverse to the pins **36** and positioned between them to approximately lie on a horizontal diameter of said extension. Each pin **36** has a worm **39** loosely mounted thereon and meshing with a worm gear **40** loosely mounted on the corresponding or adjacent end portion of the transverse horizontal pin **38**. Integral with each worm **39** and adjoining the partition **29b** is a spur gear **41**, the pair of spur gears **41** thus provided being opposed and situated on each side of the spur gear **35** of the motor shaft **32** with which they both mesh.

The worm gears **40** mounted loosely on the transverse pin **38** abut at the approximate center of the length of the pin and each is provided at its outer end with an integral spur gear **42**. Thus it is manifest that upon the rotation of the motor shaft **32** in either direction the gear **35** fixed thereto rotates the gears **41** and integral worms **39** in the same direction. This rotation being imparted to the worm gears **40** and the integral spur gears **42** which in turn rotate independently in opposite directions on the pin **38**. Each unit consisting of a worm gear **40** and its integral spur gear **42** occupies about one-half of the length of the pin **38**.

Fixed within the shell or casing **33** and abutting against the extremity of the extension **29a** of the motor block **29** is a substantially solid plate **43**, provided with a boss **44** on one surface having a friction fit within the extremity of the extension **29a** and a peripheral flange **45** on the opposed surface bearing against the inner surface of the shell or casing **33**, where it to all intents and purposes forms a part of said shell as well as a part of the motor block **29**. The outer terminal of the flange **45** lies in substantially the same plane as the end of the shell or casing **33**. The motor block **29**, its extension **29a** and the associated plate **43** are so mounted in the shell or casing **33** that they are immovable therein. Located at the ends of the horizontal diameter of the flange **45** are the opposed somewhat elongated slots or openings **46** formed through said flange to extend to the inner surface of the shell or casing **33**. Because of the fixed position of the plate **43** and flange **45** within the casing **33** the positions of the slots or openings **46** with respect to the shell or casing **33** and to the operating shaft **26** are also fixed.

An intermediate shaft **47** is mounted for rotation in the plate **43** and at its terminals projects beyond the limits of the plate. To that end of the intermediate shaft **47** projecting beyond the boss **44** is secured a crown gear **48** for rotation with said shaft. This crown gear **48** encompasses the plate **37** interposed between and holding the outer ends of the pins **36** and its teeth mesh with the teeth of the spur gears **42**, whereby the crown gear is rotated upon the rotation of said spur gears on the transverse pin **38** as above described.

The mechanism heretofore described as mount-

ed in the shell or casing 33 so transmits the rotary power originating in the motor 30 to the intermediate shaft 47 that the rotation of the motor in either direction correspondingly rotates said intermediate shaft in either direction. This rotation of the intermediate shaft 47 in either direction accomplishes two purposes, viz, the rotation of the operating shaft 26 within the cylindrical head bar 21 for raising or lowering the sections or slats of the blind and the tilting or adjustment of said sections or slats by or through the oscillation of the head bar 21 in either direction.

The operating shaft 26 is positioned concentrically within the head bar 21 and passes through substantially the entire length thereof from the bearing 25 at one end to the extremity of the intermediate shaft 47 at the opposite end. This operating shaft 26, the intermediate shaft 47 and the motor shaft 32 are coextensive and concentrically situated in the head bar 21 and the shell or casing 33 respectively.

The adjoining ends of the operating shaft 26 and the intermediate shaft 47 abut as illustrated in Figure 3. For the purpose of transmitting the rotation of the intermediate shaft 47 to the operating shaft 26 the latter has a collar 49 fixed thereto by the pin 50 piercing both the collar 49 and shaft 26. This collar 49 projects beyond the end of the shaft 26 to receive the end portion of the intermediate shaft 47 which extends into the projecting part of the collar 49 where it is splined to said collar, as at 51. Thus any rotation of the intermediate shaft 47 correspondingly rotates the operating shaft 26 through the medium of the collar 49 fixed to the abutting ends of both of said shafts.

Means are provided for operation in conjunction with the collar 49, flange 45 of the plate 43 and associated elements to oscillate the cylindrical head bar 21 to tilt or adjust the slats or sections of the blind. To that end the collar 49 is provided, between its ends and within the space defined by the flange 45 of the plate 43, with an integral outstanding disc 52, the periphery of which is indented by a series of spaced approximately semi-circular recesses 53. Loosely mounted on the end of the collar 49 extending into the terminal of the head bar 21 and adjoining the disc 52 is a driving plate 54. At its edge or periphery this plate 54 frictionally or otherwise so engages the inner surface of the head bar 21 that when the plate is rotated upon or with the collar 49 the head bar 21 will be rotated or moved similarly. That is to say, by provision of the driving plate 54 and its operative connection with the head bar 21, the latter will bodily rotate with the motor shaft 32, the intermediate shaft 47 and the operating shaft 26 whenever the plate 54 is connected to these elements for that purpose.

It is proposed to partly rotate the head bar 21 on the initiation of rotation in either direction of the operating shaft 26 and then only for a part of a revolution upon the completion of which the plate 54 and consequently the head bar 21 is disengaged from the power source to remain stationary. For this initial and periodic movement of the head bar 21 the driving plate 54 has a pair of diametrically opposed arms 55 pivoted thereto as at 56 to lie between the plate 54 and the plane of the disc 52. It is to be noted that the arms 55 are of substantially equal length and that the pivots 56 thereof are diametrically disposed on opposite sides of the collar 49. Furthermore these arms 55 rest close to, if not flush against, one face of the plate 54. At its free end each arm 55 has a laterally projecting pivot 57 upon which is freely mounted a roller 58. These rollers 58 rest at right angles to the ends of the arms 55 and to the plate 54 and project over the edge of the disc 52 for cooperation with the recesses 53 therein.

To prevent the arms 55 from being displaced or dropping, at points in the rotation of the plate 54 toward the collar 49, a separator 59 is loosely mounted on the collar between the plate 54 and the disc 52. This separator 59 has the opposed parallel sides 60 positioned facing the arms 55 and its ends are curved to coincide with the periphery of the plate 54. Inasmuch as the arms 55 are designed to swing about their pivots 56 toward and away from the straight sides 60 of the separator 59 and as the heads of the pins 57 project beyond the faces of said arms, the driving plate 54 is provided with the diametrically opposed apertures 61 in its edge portion in which the heads of the pins 57 are seated and operate.

Upon the rollers 58 engaging the recesses 53 of the disc 52 and being held therein by the portions of the flange 45 between the slots or openings 46, the driving plate 54 is thereby locked to said disc for rotation therewith and in turn rotates the head bar 21. When in the course of the rotation of the driving plate 54 and head bar 21 the rollers 58 reach and aline with the slots or openings 46 in the flange 45, which is always stationary, the rollers become disengaged from the engaged recesses 53 and enter said slots or openings, where they remain during the continued rotation of the shafts 26, 47, and 32 in the same direction. This disconnects the driving plate 54 from the disc 52 and collar 49 so that the rotary movement of the head bar is halted. Reversely, when the rollers are positioned in the slots or openings 46 and the direction of rotation of the shafts 32, 47, and 26 is reversed, the rollers 58 again become seated in recesses 53 of the disc 52 until they again aline with the slots or apertures 46 into which they move and where they stay during the continued rotation of the said shafts in such reverse direction and until said direction of rotation is again reversed.

This movement of the rollers 58 into and out of the recesses 53 and the slots or openings 46 is accomplished by allowing the arms 55 carrying said rollers to swing about their pivots. In Figure 11 is shown a lock for controlling the movement of the rollers 58 and for holding them in the slots or openings 46 thereby preventing them from dropping successively into the recesses 53 as the disc 52 continues its rotation. This lock comprises a plate 63 provided with a central opening 64 by which the lock is mounted on the collar 49 adjacent that face of the disc 52 remote from the driving plate 54. Between the lock 63 and the plate 43 is interposed a spring plate 65 to exert sufficient pressure on the lock to establish a friction connection between the disc 52 and the face of the lock remote from said spring. In this manner the lock 63 may rotate with the collar 49 and the disc 52 integral therewith.

As illustrated in Figure 11 the ends 66 of the lock 63 are curved to coincide with the curvature of the inner face of the flange 45. The sides 67 of the lock are comparatively speaking straight and parallel and each end of each side 67 is pro-

vided with an outer notch 68 and an inner notch 69 separated by the projection 70. One or the other of the sets of notches 68—69 of one side 67 cooperates with one of the rollers 58 when one or the other of the sets of notches 68—69 on the opposite side 67 of the lock 63 cooperates with the other roller 58. That is to say the rollers 58 simultaneously cooperate with one or the other of the sets of notches 68—69 at the ends of the opposed sides 67 of the lock 63.

When the rollers 58 engage the recesses 53 they rest in the inner notches 69 of the lock 63 and the lock rotates with the collar 49 and disc 52. Upon the rollers 58 reaching or alining with the slots or openings 46 in the flanges 45 during this rotation, they simultaneously enter the same, which action permits the projections 70 between each pair of notches 68—69 to pass under said rollers whereupon the rollers enter or are positioned to cooperate with the outer notches 68. The rotation of the lock 63 then ceases, as does also the rotation of the plate 54 and the head bar 21, and the rollers 58 are retained in the openings 46 by the outer notches 68, thereby preventing the rollers from successively dropping into the recesses 53 during the continued rotation of the collar 49 and disc 52 in the same direction. When the direction of rotation is reversed, the rollers 58 return to the inner notches 69 and there remain for the rotation of the plate 54 as described until the rollers again aline with openings 46.

From the foregoing it is apparent that the form of operating mechanism for the blind illustrated in Figures 3 to 13 and 17 is entirely housed in the stationary shell or casing 33 which so cooperates with and forms a continuation of the head bar 21 that a unitary head bar is created comprising the combined elements 21 and 33, one of which may be oscillated while the other is fixed against movement. It is furthermore manifest that upon the initiation of rotation in either direction of the operating shaft 26, the intermediate shaft 47 and the motor shaft 32, the head bar 21 will be moved or oscillated a part of a revolution usually between one-quarter and one-half of a revolution. It is to be understood that if the rotation of the several shafts has been started in one direction, as for instance to raise the blind, the halting and subsequent continuation of this rotation does not influence the position of the head bar 21 until the raising operation is completed or the rotation of the shafts is reversed prior to the completion of the raising operation.

In Figures 14, 15, and 16 is disclosed a modified form of the operating mechanism wherein is illustrated a mechanism for the manual or mechanical operation, control, and adjustment of the blind. This form of operating mechanism is also contained and mounted within the shell or casing 33 and may be substituted for that form shown in Figures 3 to 13 inclusive and 17 without any modification of the head bar 21 or any of the mechanism therein contained.

The plate 27 carries a projecting block 71 fixed against movement relative thereto or integral therewith, said block being cylindrical in cross section and adapted to have a friction fit in the shell or casing 33. A concentric passage 72 is created in the block 71, its upper portion opening into or communicating with a chamber 73 formed in the top part of the block 71 and housed or covered by the shell 33. Within the end of the passage 72 toward the window frame 20 is a bearing 74 in which is mounted for rotation one end of an intermediate shaft 75. The end of the passage 72 opposed to the bearing 74 is reduced, as at 76, to constitute a bearing for the opposite end of the intermediate shaft 75. This shaft 75 is positioned concentrically in the block 71 and extends and projects beyond the end of said block adjacent the head bar 21. The terminal of the block 71 adjoining or abutting the end of the head bar 21 is also provided with the outstanding flange 45 which operates and functions like the flange 45 in Figures 3 to 13, inclusive, and 17, and like it, is provided with the diametrically opposed elongated slots or openings 46.

The intermediate shaft 75 abuts against the extremity of the operating shaft 26 and is encircled by the projecting end of the collar 49 fixed by the pin 50 to the shaft 26, to which it is secured by the spline 77 or other suitable means. Manifestly when the shaft 75 is rotated in either direction the operating shaft 26 is similarly rotated and by the provision of the collar 49, the disc 52, rollers 58, driving plate 54 and associated parts and elements the head bar 21 will be shifted and oscillated as heretofore described.

For the rotation of the intermediate shaft 75 a driving shaft 78 is mounted in the block 71 to one side of the shaft 75 and occupying a plane at right angles to the plane of the shaft 75. This driving shaft 78 has a gear 79 keyed or otherwise centrally secured thereto and operating in a cavity 80 formed in the block to communicate with the passage 72. A similar gear 81 is formed on or keyed to the intermediate shaft 75, and meshes with the gear 79 on the driving shaft 78. Thus when the driving shaft 78 is rotated in either direction, this rotation is transmitted and imparted to the intermediate shaft 75 and to the operating shaft 26, disc 52 and associated elements.

This driving shaft 78 may be rotated either mechanically or manually for the adjustment and operation of the blind. To rotate the driving shaft 78 manually, one end thereof has affixed to it a grooved pulley 82. A chute or guide 83 located in the chamber 73 and leads from and is alined with the lower face of the pulley 82 to extend to the outer surface of the block 71. This chute 83 passes through an opening or slot 84 in the shell or casing 33 and is then bent downwardly, as at 85, to lie in a vertical plane at right angles to the body of the chute. Vertical transverse sides 86 are provided at the edges of the chute to prevent a displacement of the operating cord 87.

The operating cord 87, of any suitable type or construction and here shown as bead chain, is looped about the pulley 82 and seated in the groove thereof with its end portions extending forwardly in the chute 83 and bending to rest in the vertical part 85 thereof. A pull exerted on one end of the cord or chain 87 rotates the pulley 82, the driving shaft 78, the intermediate shaft 75, the collar 49 and operating shaft 26 in one direction while a pull on the opposite end of the cord 87 reverses this rotation. The effect of the rotation and the reversal of the direction of rotation of the shafts 26, 75, and 78 is the same as the effective rotation and reversal of rotation of the shafts 32, 77, and 26 of that form of the invention illustrated in Figures 3 to 13 and 17.

For the operation of the blind mechanically and without hanging or dangling cords, the pulley

82, chain or cord 87, and chute 83 may be eliminated from that form of the invention shown in Figures 14, 15, and 16. In this event the driving shaft 78 may be extended or elongated to any length as shown in dotted lines in Figure 15, and supplied with a crank 88 at its outer extremity for its rotation. By turning the block 71 through 90 degrees so that the shaft 78 lies horizontal, the blind and its controlling mechanism may be operated through the medium of the elongated or extended driving shaft 78 from a position remote from the blind as for instance a blind in a show window and a distance from the room operated from a crank positioned away from the blind or within the room.

From the foregoing it is apparent that the several forms of operating and controlling mechanisms disclosed herein and housed within the shell or casing 33 may be interchanged or assembled with the main head bar 21 without varying or changing the construction and operation of the latter or of its parts and cooperating elements, thereby making it possible to install the blind for either manual, mechanical, or electrical operation. Furthermore, it is evident that where the blind or blinds are electrically controlled and operated as disclosed in Figures 3 to 13, inclusive, and 17, a plurality thereof may be operated, controlled, and adjusted in unison and form a common point by the provision of suitable electrical connections and switches (not shown). Likewise, any individual blind may be operated and adjusted from any remote and convenient point.

The head bar 21 and operating mechanisms hereinbefore described cooperate with a new and novel blind construction for the control, operation and adjustment thereof, though it is to be understood that these elements and features may also be used to control, operate, and adjust any adaptable or standard blind construction.

Within the head bar 21 and fixed to the operating shaft 26 for rotation therewith are several reels 89 spaced one from the other longitudinally of said shaft. To hold these reels fixed in their respective positions on the shaft 26 they are pierced by the countersunk screws 90 threaded into the shaft 26, which may also be employed to secure the ends of the cords to the reels.

At the ends of a horizontal diameter of the cylindrical tubular head bar 21 in alinement with each reel 89, the body of the head bar 21 is bent inwardly as at 91, creating a depression open at its transverse ends. In the bottom of each depression 91 adjacent its lower edge is an opening or slot 92 to permit one of the blind cords 97 to pass to the interior of the head bar 21. On the interior of the head bar 21 and adjoining each slot or opening 92, a tongue is cut from the body of the head bar or fastened to the interior of said bar and formed into a roll 93 on and over which the cord 97 passing through said slot or opening operates. This construction provides a smooth, rounded surface over which the cord 97 passes.

Each blind comprises a series of slats or blind sections 94 approximately equal in length to the combined length of the head bar 21 and coacting shell or casing 33. These slats or sections 94 are preferably of metal and are curved transversely. The slats 94 rest freely on spaced transverse supporting tapes 95 interposed between ladder tapes 96 crossing the edges of said slats or sections when the latter are horizontal and extending from the head bar 21 to the bottom of the window opening when the blind is fully lowered.

The transverse supporting tapes 95 interposed between each pair of tapes 96 are comparatively narrow and are connected adjacent to alternate edges of the tapes 96. That is one tape 95 is interposed between and connected to one pair of corresponding edges of the spaced tapes 96 while the next tape 95 is interposed between and connected to the opposite pair of corresponding edges of the pair of tapes 96. This arrangement is clearly illustrated in Figures 3 and 5 and permits the cord 97 at the rear of each tape 96 to pass between the transverse tapes 95 of the assembly and does not require the slat or section 94 to be slotted for the passage of the cord.

At their lower ends the tapes 96 of each pair pass under the bottommost or lowest slat or section 94 and may there have their ends connected together; or alternatively, if desired, the tapes 96 may be formed from a single strip of material bent upon itself. The upper or free ends of each pair of tapes 96 are secured to a U-shaped clip 98 (Figures 4 and 5). The base of this clip 98 is curved outwardly to conform to the outer contour of the head bar 21 between the depressions 91 while the arms 99 are curved inwardly to follow the curvature of the bottoms of the depressions 91. To secure the tapes 96 to the clip 98, their extremities are placed flush against the outer faces of the arms 99 and the end portions 100 of said arms are bent outwardly and downwardly to lie against and clamp the extremities of the tapes. If desired, small rivets (not shown) may be employed to pierce the arms 99 of the clip, the end portions 100 thereof and the extremities of the tapes 96 thereby insuring their permanent engagement by said clip. Openings or slots 101 are provided in the base of the clip 98 where the arms 99 join it to permit passage of the cords 97 therethrough.

In operation the clip 98 spans the head bar 21 with its base flush against the outer surface of the bar and its arms 99 carrying the extremities of the tapes 96 seated in the depressions 91 flush against the bottoms thereof. The ends of the cords 97 are passed through the slots 101 in the clip 98 and then through the openings 92 in the bottoms of the depressions 91 to the interior of the head bar where they are secured to the cooperating reel 89 by the screw 90 or by any other suitable means.

A clamp or cover such as illustrated in Figure 7 is employed to hold each arm 99 of the clip 98 in its depression 91 and to fill the cavity of the curvature of said arm so that the outer face of the head bar 21 will present a smooth unbroken appearance and surface at each point where an arm 99 of a clip 98 engages it. This clamp or cover comprises a strip of metal wider than the length of a depression 91, bent upon itself elliptically to form an outer member 102 and inner member 103. The outer member 102 is curved or bulged outwardly to form a continuation of the outer curve of the head bar 21 while the inner member 103 is also curved or bulged outwardly to seat snugly in a curved rebent end portion 100 of an arm 99 of a clip 98. When the arms 99 of a clip 98 are seated in opposed depressions 91, a clamp or cover cooperates with each arm by being inserted under one transverse edge of the depression with the outer member 102 facing outwardly. The cover or clamp is then slid bodily toward and under the opposite transverse edge of the depression 91. Thus the arms 99 of each clip 98 are removably held in place not only by the spring action of the arms 99 of the clip, but also by the clamp or cover so cooperating with

each arm that the depression 91 is completely filled and the outer surface of the head bar 21 is smooth and unbroken.

The cords 97 operating on each side of the slats 94 and fixed at their lower or outer ends to the bottom slat upon the rotation of the operating shaft 26 in either direction, are wound upon and unwound from the reels 89. Thus if the shaft 26 is rotated in one direction and the slats 94 are fully lowered, the cords 97 will be wound upon the reels 89 until the slats 94 are entirely clustered adjoining the head bar 21 and the blind completely raised. Thereupon if the rotation of the shaft 26 is reversed, the cords 97 will unwind from the reels 89 until the blind is fully lowered and if rotation in this reverse direction is then continued, the cords 97 will again wind upon the reels 89 in the reverse direction again clustering the slats 94 adjoining the head bar 21. This describes the raising and lowering of the blind by the rotation of the shaft 26 and the cooperation of the cords 97 with the reels 89 fixed to said shaft for rotation therewith.

The oscillation of the head bar 21, as above described, tilts and adjusts the angles of the slats 94 through the medium of the tapes 96 and their coaction with said bar. Thus, if the slats 94 are substantially horizontal and the operating mechanism is rotated in one direction, the head bar 21 moves a part of a revolution in that direction correspondingly tilting the slats after which the continued rotation of the operating mechanism raises the blind to the determined height without any further movement on the part of the head bar. If it is then desired for the slats 94 to resume substantially horizontal positions, the rotation of the operating mechanism may be reversed for an instant and the initial movement thereof adjusts the angle of the slats 94 from completely closed on one side of a vertical plane to completely closed on the opposite side of this plane or to any intermediate position.

The several positions in Figure 2 are illustrative of the positions assumed by the slats 94 under the control of the operating mechanism of the present invention. When the slats 94 are in position A, i. e. fully closed and completely lowered, the origination of rotation of the operating mechanism causes the head bar 21 to oscillate tilting the slats 94 or until they assume position C. In being adjusted from position A to position C the slats pass through position B, i. e. maximum open tilted position and if the operation of the operating mechanism is halted during such initial movement, the slats will assume and remain in position B or any other adjusted position between position A and position C at which rotation of the operating mechanism is halted. If, however, the operating mechanism is allowed to continue its rotation in the same direction, the cords 97 will wind on the reels 89 and cluster the slats 94. Position D illustrates one of the positions assumed by the slats 94 during such raising of the blind. When the blind is fully raised and just prior to lowering, the slats 94 may assume position E by a reversal of the rotation of the operating mechanism for a duration just sufficient for the slats 94 to become horizontal. If this reverse rotation of the operating mechanism is permitted to continue after the slats 94 assume position E, they assume position F and the lowering process of blind continues until it is fully lowered. At any point in either the raising or lowering of the blind the slats may be made to assume position G or one like it by simply reversing the direction of rotation of the operating mechanism for an instant and then halting its operation.

In order to remove the blind for cleaning and repairing, the head bar 21 and all of the elements carried thereby may be moved relative to sleeve 22 in a direction away from the shell or casing 33. This movement disconnects the spline 51 or 77 and permits the removal of the head bar, the shell or casing 33, and its mechanism remaining fixed to the frame 20. Reversely the movement of the head bar 21 toward the shell or casing 33 in the opposite direction will reconnect the spline 51 or 77 and reassemble the head bar. To install the present blind the shell or casing 33 and its mechanism and the sleeve 22, bracket 23, and bearing 25 are fixed in alignment on opposite vertical sides of the frame 20. One end of the bar 21 is then seated in the sleeve 22 with the shaft 26 in the bearing 25, after which the bar 21 may be moved toward the shell or casing 33 and the spline 51 or 77 connected.

From the foregoing it is manifest that the several slats 94 are imperforate throughout their entire lengths. It is also apparent that by having the slats 94 curved transversely, the edge of one slat may contact and bear snugly against the body of the next slat, when the slats are fully tilted, thereby presenting a substantially solid and imperforate partition or sheet. Likewise slats so shaped are more easily manipulated and clustered and also act to reflect sun and heat rays.

What is claimed is:

1. The combination with a head bar, of a plurality of slats movably suspended therefrom, means for bodily raising and lowering said slats with respect to said head bar, means associated with said head bar for operating said raising and lowering means, and means including disengageable coupling means coacting with said operating means for tilting said slats.

2. The combination with an oscillatory head bar, of a plurality of movable slats suspended therefrom, means associated with said head bar for moving said slats bodily with respect to said head bar, means for operating said last means, and means including disengageable coupling means coacting with said operating means for oscillating said head bar to tilt said slats.

3. The combination with a tubular head bar mounted for oscillation in either direction, of a plurality of blind slats suspended from said head bar for bodily movement relative thereto, as well as for tilting movement, means within said head bar for movement in one of two directions to move said slats bodily, a unitary operating mechanism cooperating with said head bar, means whereby said operating mechanism drives the means for bodily moving said slats, and means whereby said operating mechanism oscillates said head bar to tilt said slats.

4. The combination with a tubular head bar mounted for oscillation, of a series of slats capable of being clustered adjacent said head bar and also of being tilted, a shaft mounted for rotation in either direction within said head bar, means whereby the rotation of said shaft clusters or distributes said slats, means for rotating said shaft in either direction, and means operable from said last said means for oscillating said head bar upon the initiation of rotation in either direction of said shaft to tilt said slats.

5. The combination with a tubular, oscillatory head bar, of a plurality of bodily movable and tiltable slats carried by said head bar, a shaft within

and coextensive with said head bar, means whereby the rotation of said shaft bodily moves said slats, means whereby the oscillation of said head bar tilts said slats, a unitary operating mechanism, a connection between said mechanism and said shaft for the rotation of the latter in either direction under the control of the former, and a connection between said operating mechanism and said head bar whereby the latter moves to correspond to the rotation of said shaft upon the initiation of rotation thereof in either direction.

6. The combination with a tubular oscillatory head bar, of a fixed casing forming a continuation of said head bar, a plurality of bodily movable and tiltable slats carried by said head bar, a coextensive shaft mounted for rotation in either direction in said head bar, means whereby the rotation of said shaft in either direction bodily moves said slats, means whereby the oscillation of said head bar tilts said slats, an operating mechanism mounted in said casing, and connections between said mechanism and shaft and said head bar for the rotation of the shaft in either direction and the corresponding oscillation of said head bar.

7. The combination with a tubular oscillatory head bar, of a fixed casing forming a continuation of said head bar, a plurality of bodily movable and tiltable slats carried by said head bar, a coextensive shaft mounted for rotation in either direction in said head bar, means whereby the rotation of said shaft in either direction bodily moves said slats, means whereby the oscillation of said head bar tilts said slats, an operating mechanism mounted in said casing, connections between said mechanism and said shaft and head bar for the rotation thereof in the same direction, and means whereby said head bar may be adjusted relative to said casing for breaking said connections.

8. The combination with a tubular oscillatory head bar, of a fixed casing forming a continuation of said head bar, a plurality of bodily movable and tiltable slats carried by said head bar, a coextensive shaft mounted for rotation in either direction in said head bar, means whereby the rotation of said shaft in either direction bodily moves said slats, means whereby the oscillation of said head bar tilts said slats, an operating mechanism mounted in said casing, connections between said mechanism and said shaft and head bar for the rotation thereof in the same direction, means whereby said head bar may be adjusted relative to said casing for breaking said connections, and the removal of said head bar from alignment with said casing.

9. The combination with a tubular oscillatory head bar, of a fixed casing forming a continuation of said head bar, a plurality of bodily movable and tiltable slats carried by said head bar, a coextensive shaft mounted for rotation in either direction in said head bar, means whereby the rotation of said shaft in either direction bodily moves said slats, means whereby the oscillation of said head bar tilts said slats, an operating mechanism mounted in said casing, a connection between said operating mechanism and said shaft for the rotation thereof in either direction, means under the control of said connection for oscillating said bar in either direction upon the initiation of rotation of said shaft in either direction, and means whereby said connection may be established and broken and said head placed in or removed from alignment with said casing.

10. The combination with a tubular head bar, of a rotary shaft mounted therein, an operating mechanism, means whereby said operating mechanism may rotate said shaft in either direction, means whereby said head bar may be oscillated in either direction from said operating mechanism, a series of slats movable bodily and rotatably with reference to said head bar, cords at the edges of said slats and connected only to the outermost slat for moving said slats bodily, reels on said shaft connected to said cords whereby the rotation of the shaft moves said slats bodily, tapes arranged in pairs for supporting said slats for rotatable movement, and removable connections between each pair of tapes and said head bar whereby the oscillation of the latter moves said slats rotatably in either direction.

11. The combination with a head bar, of a plurality of bodily and rotatably movable slats cooperating therewith, a pair of tapes combining to support said slats, opposed depressions in said head bar, and a clip comprising a base bent outwardly to span and follow the contour of said bar and having arms formed to be seated snugly in the depressions of said bar and secured to the extremities of the tapes of a pair.

12. The combination with a head bar having a pair of opposed depressions, of a plurality of bodily and rotatably movable slats cooperating therewith, a pair of tapes combining to support said slats, a U-shaped clip having its base formed to span and follow the contour of said bar between said depressions and the arms thereof secured to the extremities of the tapes and formed to be seated in said depressions to rest against the bottoms thereof, and a removable clamp coacting with each arm of the clip when seated in a depression for holding it therein and forming a continuation of the outer contour of said bar.

13. The combination with a tubular head bar, of a series of adjustable slats cooperating therewith, a shaft rotatably mounted within said head bar, and connected to said slats, ladder tapes cooperating with said slats and attached to said head bar, means for mounting said head bar and shaft, whereby the former may oscillate and the latter rotate in either direction in unison or independently, an operating mechanism adjoining one end of said head bar including a shaft, a connection between the shaft of the operating mechanism and the shaft within the head bar whereby the former rotates the latter in either direction, and means coacting with said connection for oscillating said head bar in either direction.

14. The combination with a tubular head bar, of a series of adjustable slats cooperating therewith, a shaft rotatably mounted within said head bar, and connected to said slats, ladder tapes cooperating with said slats and attached to said head bar, means for mounting said head bar and shaft, whereby the former may oscillate and the latter rotate in either direction in unison or independently, an operating mechanism adjoining one end of said head bar including a shaft, a collar fixed to the shaft within the head bar and connected to said driving shaft, a disc fixed to said collar and having a series of recesses in its edge, a driving plate having operative connection with the head bar, a connection carried by said plate for removable engagement with the recesses of said disc, and means for controlling said connection for periodic engagement with said recesses.

15. The combination with a tubular head bar, of a series of adjustable slats cooperating therewith, a shaft rotatably mounted within said head bar, and connected to said slats, ladder tapes cooperating with said slats and attached to said head bar, means for mounting said head bar and shaft, whereby the former may oscillate and the latter rotate in either direction in unison or independently, an operating mechanism adjoining one end of said head bar including a shaft, a collar fixed to the shaft within the head bar and connected to said driving shaft, an outstanding disc fixed to said collar for rotation therewith provided with a plurality of recesses in its edge, a driving plate having an operative connection with said head bar, a pivotally mounted connection between said disc and plate whereby the latter and the head bar may rotate in unison with said shafts and collar, and means for automatically rendering said connection inoperative after the head bar moves through part of a revolution in unison with said shafts.

16. The combination with a tubular head bar, of a shaft mounted for rotation in either direction in said head bar, means for mounting said head bar so that it may rotate in either direction in unison with said shaft, an operating mechanism adjoining one end of said head bar including a driving shaft, worms driven from said driving shaft, a transverse pin arranged adjacent said worms, independent worm gears mounted on said pin and meshing with said worms, a spur gear fixed to each worm gear for rotation therewith, an intermediate shaft, a crown gear secured to said intermediate shaft and meshing with the spur gears, a collar attached to and projecting beyond the end of the shaft within the head bar, a connection between the projecting end of said collar and said intermediate shaft, and an intermittently operable connection between the collar and the head bar whereby the latter may move in either direction for a part of a revolution in unison with its shaft.

17. The combination with a tubular head bar, of a shaft mounted for rotation in either direction in said head bar, means for mounting said head bar so that it may rotate in either direction in unison with said shaft, an operating mechanism adjoining one end of said head bar including a driving shaft, worms driven from said driving shaft, a transverse pin arranged adjacent said worms, independent worm gears mounted on said pin and meshing with said worms, a spur gear fixed to each worm gear for rotation therewith, an intermediate shaft, a crown gear secured to said intermediate shaft and meshing with the spur gears, a collar attached to and projecting beyond the end of the shaft within the head bar, a connection between the projecting end of said collar and said intermediate shaft, a disc secured to said collar for movement therewith having a series of recesses in its edge, a driving plate loosely mounted on said collar and having operative connection with said head bar, rollers movably mounted on said plate to engage the recesses of the disc and lock said plate and disc together for rotation in unison, and means whereby said rollers may be automatically removed from said recesses to release said plate from operation in unison with the disc and collar aforesaid.

18. The combination with a tubular head bar, of a shaft mounted for rotation in either direction in said head bar, means for mounting said head bar so that it may rotate in either direction in unison with said shaft, an operating mechanism adjoining one end of said head bar including an intermediate shaft coextensive with the shaft in said head bar, a collar fixed to and projecting beyond one end of said head bar shaft, a connection between the projecting end of said collar and the intermediate shaft, a driving shaft, meshing gears fixed to said driving shaft and said intermediate shaft whereby the latter is driven from the former, means for rotating said driving shaft, and an intermittently operable connection between the collar and the head bar whereby the latter may move in either direction for a part of a revolution in unison with said shaft.

19. The combination with a tubular head bar, of a shaft mounted for rotation in either direction in said head bar, means for mounting said head bar so that it may rotate in either direction in unison with said shaft, an operating mechanism adjoining one end of said head bar including an intermediate shaft coextensive with the shaft in said head bar, a collar fixed to and projecting beyond one end of said head bar shaft, a connection between the projecting end of said collar and the intermediate shaft, a driving shaft positioned transversely of said intermediate shaft, meshing gears fixed to said driving and to said intermediate shafts whereby the latter rotates from the former, means for rotating said driving shaft, a disc secured to said collar for rotation therewith having a series of recesses in its edge, a driving plate loosely mounted on said collar and having operative connection with the head bar, rollers movably mounted on said plate to engage the recesses of the disc and lock said plate and disc together for rotation in unison, and automatic means whereby said rollers may be disengaged from said recesses to release said plate from operation in unison with the disc and the collar aforesaid.

20. A Venetian blind construction comprising a head bar adapted to be located at a fixed position with respect to a window or the like, an operating member operatively mounted on the head bar, means for driving the operating member, a plurality of slats connected with said head bar, said head bar comprising means movable for tilting all of the slats and means for vertically shifting the slats with respect to the head bar, and means operatively connecting said operating member to both said tilting means and said vertically shifting means and arranged to tilt and vertically shift the slats from the same operating member.

21. A Venetian blind construction comprising a head bar, an operating member operatively mounted on the head bar, means for driving the operating member, a plurality of slats connected with said head bar, said head bar comprising means movable for tilting all of the slats and means for vertically shifting the slats with respect to the head bar, and means operatively connecting said operating member to both said tilting means and said vertically shifting means and arranged to tilt and vertically shift the slats from the same operating member.

22. A Venetian blind construction as defined in claim 20, wherein said connecting means is operative to shift the tilting means in a predetermined limited arcuate path only.

23. A Venetian blind construction as defined

in claim 20, wherein said driving means is selectively reversible.

24. A Venetian blind construction as defined in claim 20, wherein said tilting means comprises a tubular bar oppositely engaged by ladder tapes angularly movable to tilt the slats and wherein said vertical shifting means comprises a shaft interiorly of the tubular bar adapted to receive slat shifting cords in winding engagement.

25. A Venetian blind construction as defined in claim 21, wherein said operating member is disposed within said head bar.

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