

April 21, 1953

R. J. VODRA

2,635,333

AUTOMATIC VENETIAN BLIND ASSEMBLING MACHINE

Filed Nov. 17, 1949

4 Sheets-Sheet 1

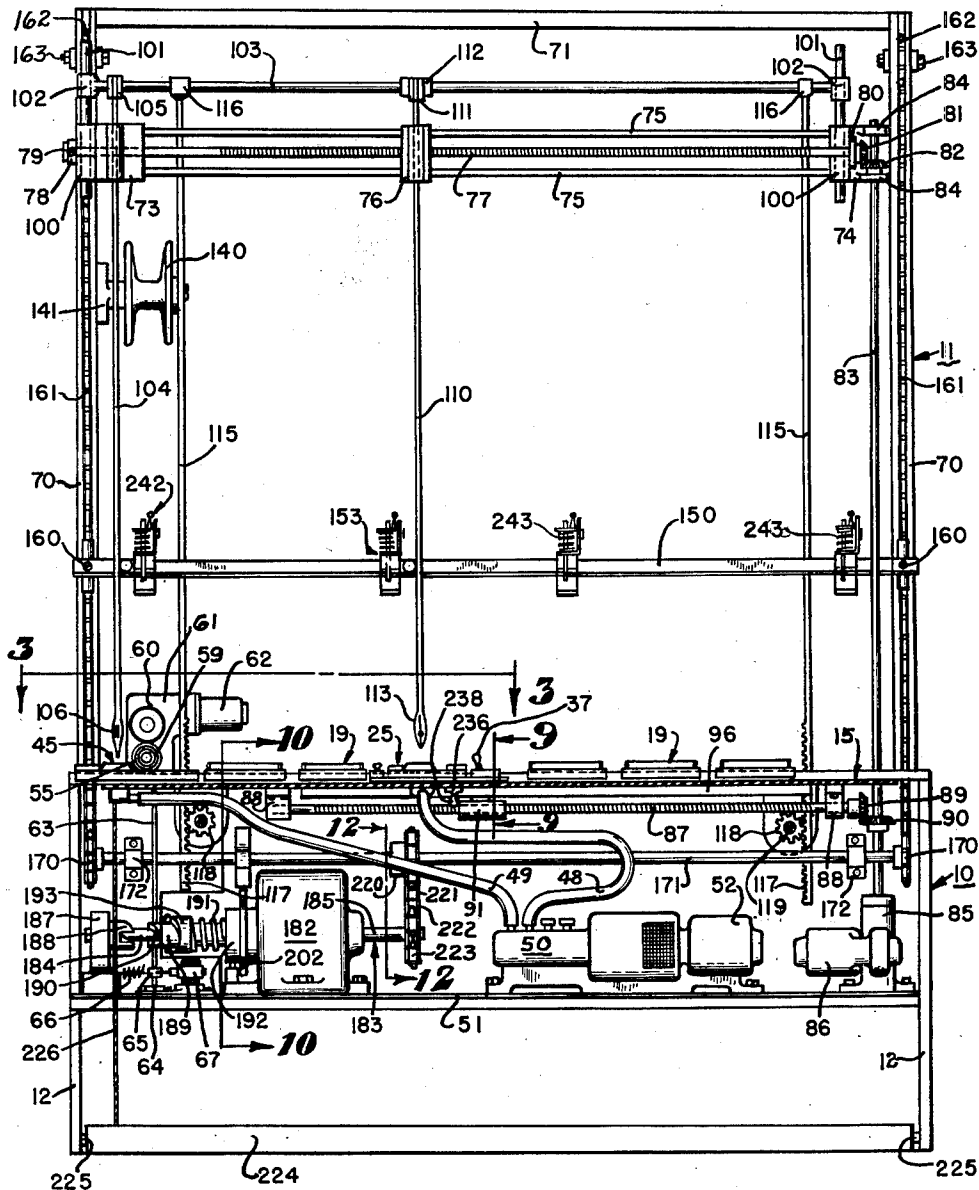


Fig. 1

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4 Sheets-Sheet 2

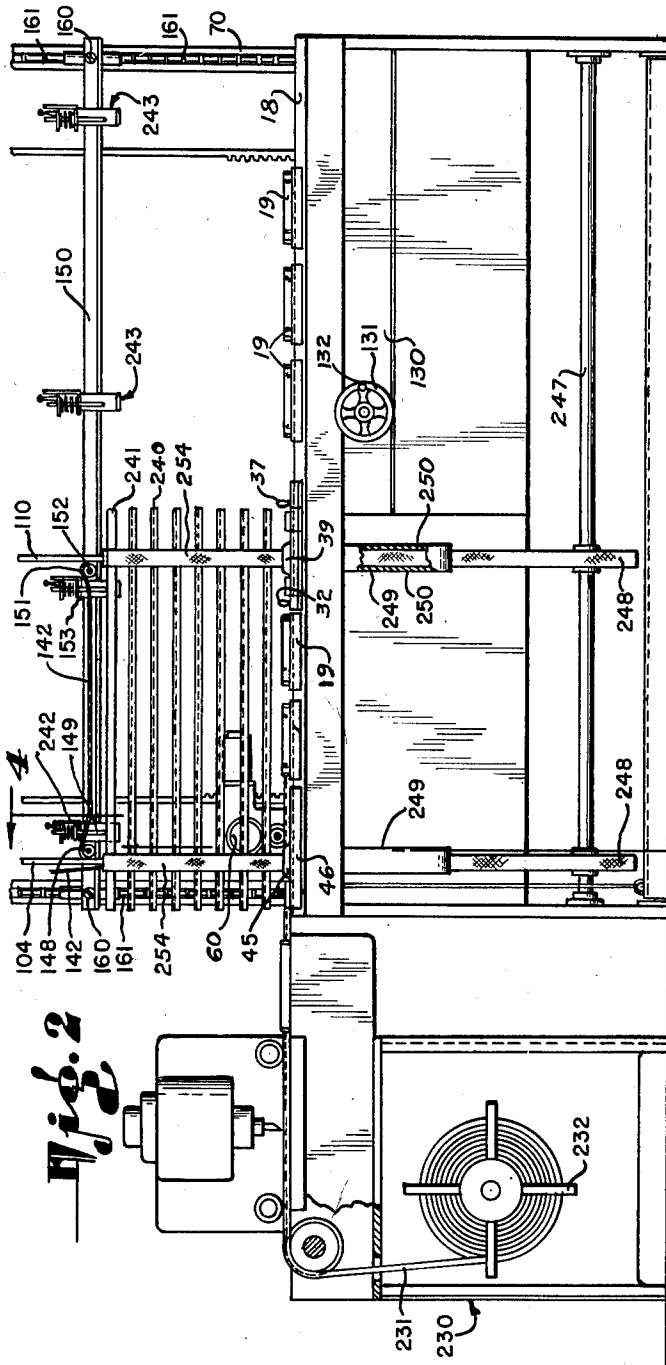


Fig. 2

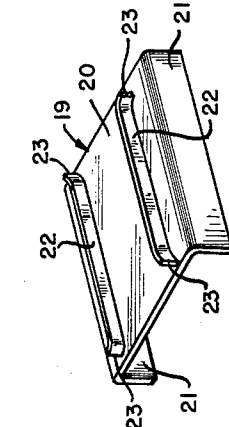


Fig. 6

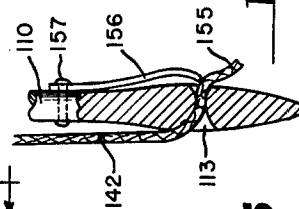


Fig. 5

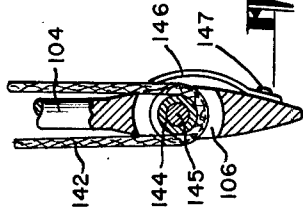


Fig. 3

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4 Sheets-Sheet 3

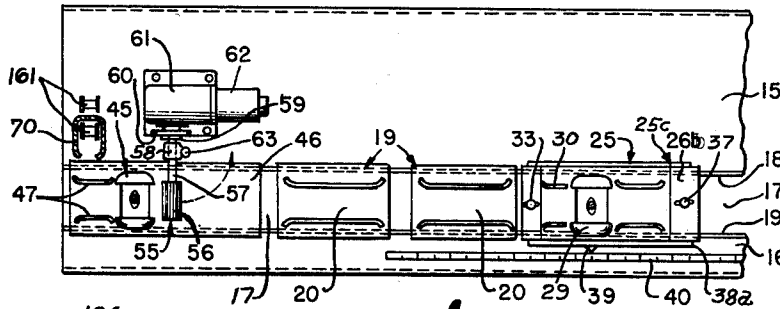


Fig. 3

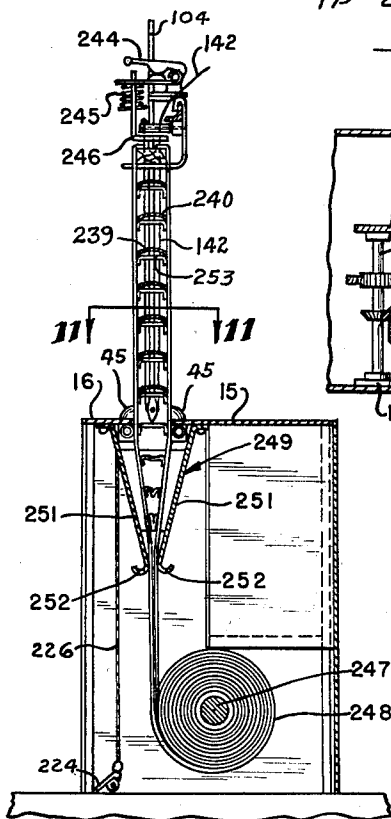


Fig. 4

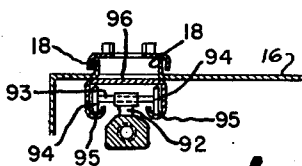


Fig. 5

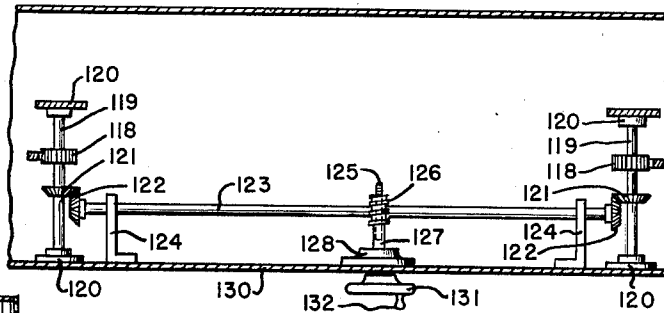


Fig. 8

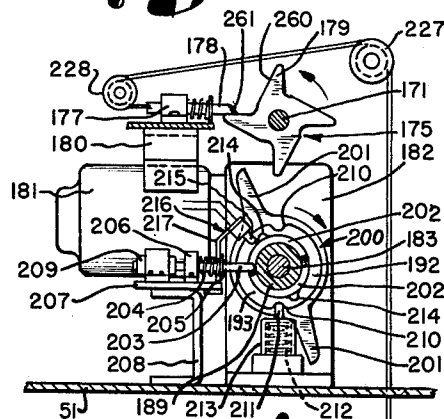


Fig. 10

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4 Sheets-Sheet 4

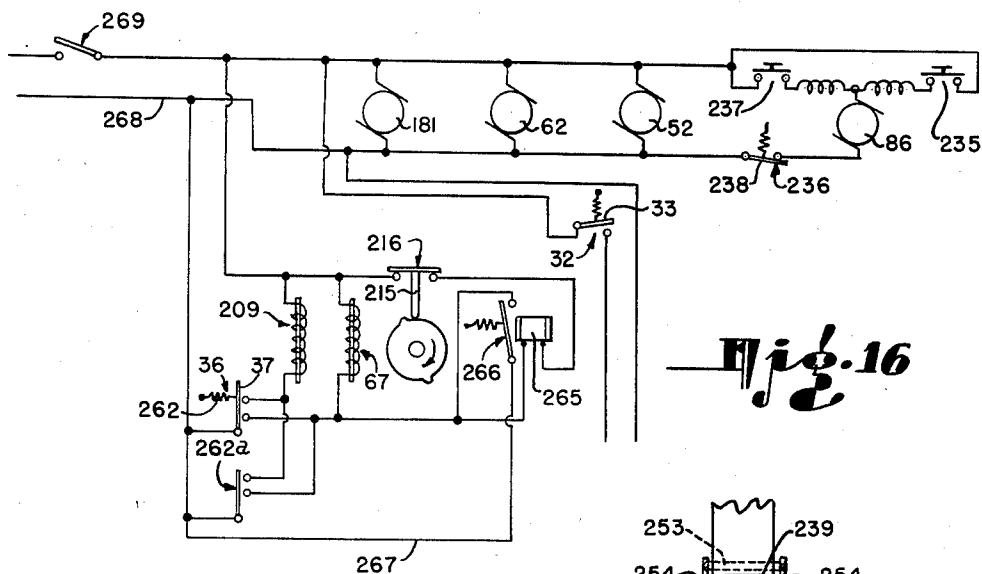


Fig. 16

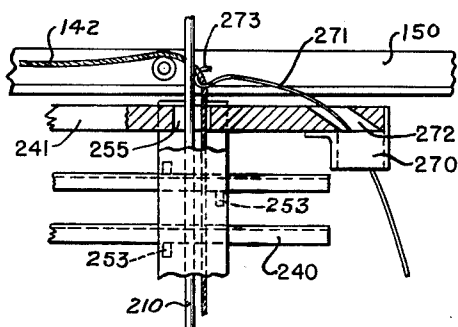


Fig. 13

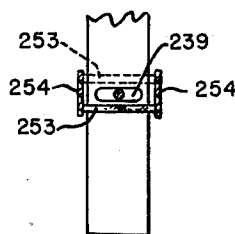


Fig. 11

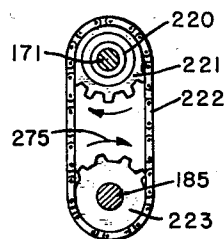


Fig. 12

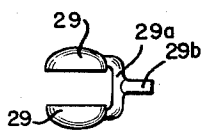


Fig. 15

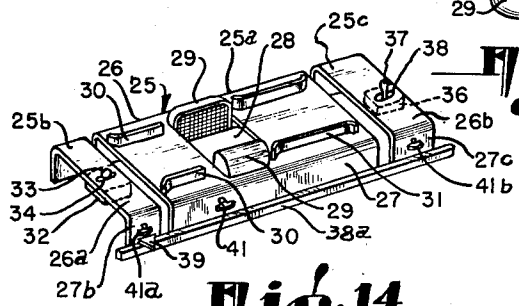


Fig. 14

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UNITED STATES PATENT OFFICE

2,635,333

AUTOMATIC VENETIAN BLIND ASSEMBLING MACHINE

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Application November 17, 1949, Serial No. 127,929

9 Claims. (Cl. 29—241)

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This invention relates generally to blind making machines and relates more particularly to machines for making Venetian blinds and the like.

Heretofore Venetian blinds were generally assembled by hand which is a relatively slow procedure.

It is an object of the present invention to provide a machine which will automatically assemble various component parts of Venetian blinds and the like.

Another object of the invention is to provide a machine of this character which will automatically feed the slats into position in the tapes.

Still another object of the invention is to provide a machine of this character which will automatically feed the cord or ropes through the openings provided therefor in the slats.

A further object of the invention is to provide a machine of this character which may be easily and quickly adjusted for manufacturing blinds of various widths.

Still another object of the invention is to provide a machine of this character which will manufacture blinds of various lengths.

A still further object of the invention is to provide a machine of this character which will receive slats from a cutting machine and position them between the strips of tape.

Another object of the invention is to provide a device of this character wherein the side pieces of the respective tapes are automatically separated and held in proper position for reception of the slats.

Still another object of the invention is to provide a machine of this character which will allow the complete blind to descend gently.

Further objects and advantages of the invention will appear in the following part of the specification.

Referring to the drawings which are for illustrative purposes only:

Fig. 1 is a front elevation with certain of the panels removed to show the operating mechanism.

Fig. 2 is a front elevation with the upper part of the machine not shown but showing an automatic slat machine positioned for supplying slats.

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

Fig. 4 is a sectional view taken on line 4—4 of Fig. 2.

Fig. 5 is a fragmentary view, partially in section, of one of the needles.

Fig. 6 is a fragmentary view, partially in section, of the other needle.

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Fig. 7 is a perspective view of one of the slat guides.

Fig. 8 is a fragmentary view of the needle adjusting mechanism.

Fig. 9 is a sectional view taken on line 9—9 of Fig. 1.

Fig. 10 is a sectional view taken on line 10—10 of Fig. 1.

Fig. 11 is a sectional view taken on line 11—11 of Fig. 4.

Fig. 12 is a sectional view taken on line 12—12 of Fig. 1.

Fig. 13 is a fragmentary view, partially in section, showing means for drawing the cord through the end lock.

Fig. 14 is a perspective view of a slat guide embodying a suction nozzle and control switches.

Fig. 15 is a plan view of one of the suction nozzles per se.

Fig. 16 is a wiring diagram.

The type of Venetian blind, the components of which the present invention is adapted to assemble, comprises at least two ladder tapes, one adjacent each side of the blind. Each ladder tape has a pair of longitudinal strips of tape forming sides or side walls, with cross tapes therebetween in longitudinally spaced relation. Also the cross tapes are staggered. The cross tapes and longitudinal side strips define a series of compartments in which the slats are received, said slats being supported by the respective cross strips. Each of the slats is provided with an opening adjacent each end which is so aligned with the tapes as to receive a cord which extends the length of the blind, at each end and between the staggered cross pieces. Such cords are for raising and lowering the blind and have portions which extend through the end lock and tapered along one side of the blind.

Referring to Fig. 1 the machine is shown as having a lower part 10 and an upper part 11. The lower part comprises a frame which includes upright angle pieces or legs 12 at the corner, suitable reinforcing members which extend longitudinally and laterally, and a flat top, including a relatively wide part 15 and a narrower part 16 spaced from the part 15 to leave a longitudinally extending opening 17 adjacent the front of the machine. The adjacent edge portions of the parts 15 and 16 are turned upwardly at 18 to form a pair of flanges or rails on which may be placed slat guiding means, indicated generally at 19. Such a slat guiding means is best shown in Fig. 7 and comprises a channel having the closed side 20 uppermost and of such size

that the side flanges 21 are disposed on the outer sides of the rails 18. A pair of laterally spaced guide members 22 are secured to the top 20 and are provided with outwardly turned end portions 23 which facilitate entrance of the slats between said guide members 22. As many as are necessary of the guide means for the slats may be used, depending upon the width of the blind being assembled. Such guide means are used in conjunction with a control unit, indicated generally at 25 (best shown in Fig. 14), comprising a channel-shaped mid-section or member 25a having a top 26 and depending flanges 27 along the sides, said member 25a being mounted on the rails 18 in the same manner that the slat guide means are mounted. The control member 25a has an opening 28 therein, intermediate the ends of said member, for reception of laterally spaced nozzles 29 which are connected together by a conduit 29a, Fig. 15, said conduit 29a having a nipple 29b for connection with a vacuum line, as will be more fully described hereinafter. At each end of the nozzles 29 are upright slat guide rails 30 and 31. At the forward or leading end of the member 25a is a channel-shaped cutoff control section or member 25b, having a switch 32 with an actuating member 33 extending upwardly through a slot 34 in the top 26a, said member 25b having flanges 27b. At the opposite end of the member 25a is control member 25c carrying a switch 36 having an actuating lever 37 extending through a slot 38 in the top 26b thereof. The section or member 25c also has side flanges 27c. The front flanges 27b and 27c have longitudinal slots for reception of pins or screws (the slots and pins not being shown), which are secured in a bar 38a to which the flange 27 is secured, said bar extending longitudinally of the flanges and tying the members of the unit 25 together, but permits adjustment of said members relative to each other. At the front side of the front flange 27b is secured a pointer 39 which cooperates with a scale 40 (Fig. 3) secured to the top member 16. The control unit 25 is adjustable longitudinally on the rails 18 and the pointer 39 is set for the length of blind to be assembled, as indicated on the scale 40, the members 25b and 25c are set in accordance with the location at the openings in the slats relative to the ends of said slats. Means for securing or locking the control members in their adjusted positions provided and, as shown, comprise winged screws 41, 41a and 41b, threadably received in openings provided therefor in front flanges of the control unit, as best shown in Fig. 14.

A second suction nozzle, indicated generally at 45, Figs. 1, 2 and 3, is provided and is received in an opening provided therefor in a fixed plate 46. The plate 46 is located at the slat entering end of the machine and is provided with a pair of spaced slat guides 47 disposed outwardly of the suction device 45.

The suction device 45 is of the same construction as the one hereinabove described, and both of said devices are connected by conduits 48 and 49 respectively, to a suction pump 50, which is attached to a shelf 51 spaced below the top 15. The suction pump 50 is operated by an electric motor 52, which is also secured to the shelf 51.

Means for moving the slats into position is provided and comprises a rotor 55 which is provided with a corrugated cover 56 of rubber or other suitable material. The rotor is attached to a shaft 57 rotatably mounted in a journal 58. There is a friction wheel 59 mounted on the

shaft on the side of the journal opposite the rotor, said friction wheel being driven by a friction disc 60 driven through a gear reduction mechanism 61 which, in turn, is operated by an electric motor 62.

The journal 58 is attached to the upper end of a shaft 63 which is mounted for oscillating or swinging movement, as will be more particularly described hereinafter. The shaft 63 has its lower end received in a bearing 64 and is provided with an arm 65 which is urged in one direction by a spring 66, and is adapted to be actuated in the opposite direction by a solenoid 67. The rotor is normally positioned as shown in Figs. 1, 2 and 3, and is adapted to be swung in a counter-clockwise direction, as seen in Fig. 3, by the solenoid 67 shown in Fig. 1.

The upper frame portion 11 comprises a pair of upright channel members 70, said channel members being generally U-shaped in cross-section but with the free ends of the arms turned slightly, as best shown in Fig. 3. A cross brace 71 connects and reinforces the upper ends of the channel members 70. A bracket 73 is secured to one of the channel members 70, and a bracket 74 is secured to the other member 70. A pair of horizontal guide rods 75 have their respective ends secured to the brackets 73 and 74, said guides 75 being laterally spaced apart in parallel relationship to each other, and are adapted to slidably receive a travelling member 76. The travelling member 76 is provided with a threaded opening which threadably receives a screw shaft 77 which extends between the brackets 73 and 74 and is disposed between the guides 75. The screw shaft 77 has its ends journaled in the brackets 73 and 74, and one end of said shaft 77 is provided with retaining means, such as a collar 78, which is secured to the shaft by a pin 79. The collar 78 holds the shaft against longitudinal movement toward the right. The opposite end of the shaft 77 is provided with a collar 80, and outwardly of the collar 80 is a bevelled gear 81 which is meshed with a bevelled gear 82 on a shaft 83 which has its upper end journaled in a pair of spaced ears 84 and which extends downwardly to a reduction gear box 85, the gears of which are actuated by an electric motor 86.

A second screw shaft 87 is journaled adjacent its ends in bearings 88 secured to the under side of the portion 16 of the table top. The end of the shaft 87 carries a bevelled gear 89 meshed with a gear 90 secured to the shaft 83. The shafts 77 and 87 are adapted to operate at the same speed, and the shaft 87 is adapted to operate a screw member 91 which has a bearing 92 attached at the upper side and in which a shaft 93 is adapted to rotate. The ends of the shaft 93 are provided with rollers 94 which travel in concave guides 95 formed at the lower ends of the side flanges of a channel member 96 secured to the under side of the table top member 16.

The brackets 73 and 74 are provided with vertically extending sleeves 100, in which are fixed shafts 101. The shafts 101 extend upwardly of the brackets 73 and 74 and slidably receive members 102 carried by the end portions of a horizontal support 103.

A needle 104 is secured at its upper end 105 to the support member 103, said needle depending vertically and having an eye 106 formed at the lower end. The needle 104 is held in fixed relation with respect to horizontal movement, and the eye portion is disposed above the opening in which the suction nozzle 45 is secured.

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A second needle 110 is provided and has its upper end 111 secured in a member 112, slidably received on the support 103. The needle 110 is of the same length as the needle 104 and is provided with an eye 113 adjacent the lower end. Needle 110 is also slidably received in the traveling member 76, so that said needle may slide longitudinally in said member.

Means to raise and lower the needles 104 and 110 comprises a pair of rods 115 having their upper ends secured to clamps 116, which in turn are secured to the support member 103 adjacent the ends thereof. The rods 115 extend downwardly from the support 103 and are provided with racks 117 adjacent their lower ends. The respective racks are meshed with gears 118, mounted on shafts 119, having their respective ends journaled in bearings 120, and fixed to the lower frame. The shafts 119 are also provided with bevelled gears 121, meshed with gears 122 at the respective ends of a shaft 123, journaled in brackets 124, secured to the frame. The shaft 123 is provided with a worm gear 125, meshed with a worm 126 on a shaft 127, rotatable in a bearing 128. The bearing 128 is also secured to the lower frame and the outer end of the shaft 127 extends outwardly of a panel 130, and has attached thereto an actuating wheel 131, which may be provided with a crank handle 132.

It is to be noted that the racks 117 have their teeth facing each other, and the gears 118 are on the inner sides of said racks, so that when the wheel 131 is rotated, thereby rotating shafts 123 and 119, the rods 115 will be lowered or raised simultaneously to thereby raise and lower the needles 104 and 110. Thus, vertical adjustment of the needles is effected.

Horizontal adjustment of the needle 110 is provided by the screw shaft 77 and the driving mechanism therefor.

The cord for raising and lowering the blind is put in by means of the needles 104 and 110, said cord being taken from a spool 140 rotatably mounted on a bracket 141, attached to the upright frame member 70 adjacent the fixed needle 104. The cord, indicated at 142, extends downwardly adjacent the fixed needle 104, and is passed through the eye 106 within which is a pulley-like roller 144 on a shaft 145. The eye 106 is of sufficient size to permit the cord to move readily therethrough, and a spring 146 is secured at one end to the lower end portion of the needle 104, a rivet 147, or the like, being used to secure the spring. The upper free end of the spring engages the cord, which has passed through the eye 106, said spring permitting the cord to move upwardly, but holding said cord against reverse movement. The upwardly extending portion of the cord is passed over a small pulley 148, rotatably mounted on a blind support 150 by means of a pin 149. The pulley 148 is located adjacent the needle 104 and the cord is passed over a second pulley 151 rotatable on a pivot 152 which is secured to a clamp 153 adjustable on the blind support 150, longitudinally thereof. The clamp 153 is adapted to be disposed adjacent the needle 110 so that the cord may be brought downwardly of the needle 110, and the end of said cord passed through the eye 113 of said needle 110. The eye 113 is merely of sufficient size to receive the cord therein, and the free end 155 of the cord is prevented from coming out of the eye 113 by means of a spring 156, having one end secured to the needle 110 by means of a rivet 157 or the like.

The blind support 150 is shown as comprising

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an angle iron, and the ends of said support 150 are attached, at 160, to endless chains 161.

The upper ends of the chains 161 are passed over respective sprockets 162, mounted on shafts 163 secured to the frame members 70 adjacent the upper ends thereof. The front parts of the chains 161 are received within the channeled frame members 70, and the other parts are disposed immediately at the rear of the closed end wall of said members 70, and the blind support 150 is attached to the first mentioned part of said chains. The lower ends of the chains are received on sprockets 170, attached to a drive shaft 171, adjacent the respective ends of said shaft. The shaft extends lengthwise of the lower frame portion between the top thereof and the shelf 51, said shaft 171 being mounted in bearings 172 suitably secured to the frame. Rotation of shaft 171 in one direction will cause the blind support 150 to be raised, and means for effecting such movement of the shaft 171 is provided and includes a star wheel, indicated generally at 175, said star wheel having four points, as best shown in Fig. 10.

A spring urged latch 177 has a latching bar 178 adapted to engage the teeth 179 of the star wheel 175 for holding same against clockwise rotation. The latch 177 is secured to a support 180 mounted on a motor 181 attached to a gear reduction box 182. The gear box 182 has a shaft, indicated generally at 183. One end, 184, of the shaft extends outwardly at one side, and an end, 185, extends outwardly on the other side, said shaft being in parallel relationship with the shaft 171. The outer end of the shaft portion 184 rotates in a bearing 187. Adjacent the bearing 187 is a notched clutch member 188 which is secured to the shaft portion 184.

A sleeve 189 is slidable longitudinally on said shaft portion 184 but is held against rotation relative to said shaft portion by suitable means such as a key, not shown. The sleeve 189 is provided with a notch 190 adapted to cooperate with the notches of the clutch member 188, and said sleeve is urged in a direction for clutch engagement by a spring 191 which reacts against a collar 192 adjacent the housing 182, and a cam collar 193 which is secured to said sleeve. The sleeve 189 is also slidable within the collar 192 but the parts are held against rotation relative to each other by a key, not shown.

The collar 192 has an actuating member, indicated generally at 200, with a pair of oppositely disposed generally radially extending arms 201. The collar 193 is provided with a cam face including a pair of oppositely disposed cam surfaces 202 engageable by a plunger 203, urged toward the sleeve 189 by a spring 204 which reacts between the washer 205 secured to the plunger 203 and a bracket 206 secured to a base 207, which, in turn, is attached to a support 208 secured by any suitable means to the shelf 51. The plunger is adapted to slide in a bracket 206 and is actuated by a solenoid 209.

The collar 192 is provided with oppositely disposed notches 210 in the periphery thereof, for reception of a plunger 211 which is urged toward the collar 192 by a spring 212 mounted in a housing 213 attached to the shelf 51.

The cam collar 193 is provided with oppositely disposed projections 214, adapted to actuate a movable switch member 215 of a switch indicated generally at 216, and mounted to the base 207 by means of a bracket 217.

Means for lowering an assembled blind com-

prises a one-way clutch 220, having a sprocket 221, driven by a chain 222 which is engaged with a sprocket 223 on the shaft end 185.

Release means for the latch 177 includes a pedal member 224 pivoted at its ends 225 to the frame 10 adjacent the front thereof and at the bottom, so that said pedal may be operated by the operator's foot. The pedal is operably connected with the plunger 178 of said latch 177 by means of a cord 226 which is passed over pulleys 227 and 228, secured to the frame in any suitable manner.

Slats are delivered to the assembly machine by a slat machine, indicated generally at 230. The slat machine 230 may be of any suitable type and the metal slats are cut and punched in the well-known manner from strip material 231, which is provided on spools 232.

When using the present machine for assembling blind components the control unit 25 is placed on the guides 18 and 19 and adjusted so that the pointer 39 indicates or points to the scale 40 for the length of blind to be assembled. The other sections of the unit are also adjusted and the members of said unit 25 are then secured in position by means of the lock screws 41, 41a and 41b. It is to be assumed that at this time the needle 110 is in a position to the right of the unit 25. This position having been effected by the closing of a push button switch, indicated generally at 235 (Fig. 16), the closing of switch 235 causes operation of motor 86 which effects rotation of the screw shafts 77 and 87 to move the needle 110 and the member 91 to the right, as shown in Fig. 1. When the needle 110 and member 91 have been moved a sufficient distance, the switch 235 is released and the motor stops. At this time switch 236, Figs 1 and 16, is closed.

The closing of the push button switch 237 (Fig 16) causes a reverse operation of the motor 86 until the member 91 engages a movable switch member 238 and effects opening of the switch 236, whereupon motor 86 stops operating. When the member 91 has opened switch 236 the needle 110 is disposed over the opening 28 in the control member 25a so that said needle is in the proper position to thread the cord through openings 239 in the adjacent end of the slats 240. The needle 104 is fixed and is always in the proper position to thread the cord through the openings in said slats at the opposite ends thereof.

A tilt rail 241 is clamped to the blind support 150 by means of clamp 153 and a clamp 242. The clamp 153, being adjustable lengthwise of the member or support 150, is positioned so that the roller 151 is disposed adjacent the needle 110. Clamps 243 are disposed on the blind support 150 and are slidable thereon for use in the assembly of wide blinds.

The clamps may be of any desired type, but as shown, include a lever 244 having a cam part which compresses a spring 245 provided for one of the clamping jaws 246 so as to clamp the tilt rail to the blind support under spring tension.

The ladder tapes may be fed to the machine in any suitable manner, said tapes being shown as disposed on a shaft 247, there being rolls 248 of said ladder tapes provided.

The free end of each roll of ladder tape is brought through guide means, indicated generally at 249, and through the opening between the vacuum nozzles 29 and 45 respectively. The free ends of each of the longitudinally extending side pieces 254 of the respective ladder tapes are then

secured to the tilt rail by stapling or any other conventional means.

It is to be noted that a guide means 249 is provided for each of the vacuum nozzle arrangements and comprises side walls 250 which prevent the ladder tape from lateral displacement. In other words, the tape is maintained in alignment with the vacuum nozzles. The side walls 250 are generally triangular in shape, with the small end at the bottom, and there are edge walls 251 connecting the side walls. The edge walls 251 depend below the side walls 250 and are provided with outwardly curved portions 252 so that the ladder tape will slide smoothly through the opening between the curved end portions 252 which are spaced apart sufficiently to admit the tape. In Fig. 4 the guide means 249, for the fixed vacuum nozzle 45, has its upper end secured to the top members 15 and 16. The guide for the adjustable nozzle of the control unit 25 is secured to the member 25a by any suitable means, not shown.

A sufficient number of slat guides 19 are disposed on the rails or guides 18 and 19 to fill in the space between the part 46 and the control device 25 so that the slats will be properly guided as they enter the machine.

The tilt rail, at the beginning of the automatic assembly of the blind, is disposed above the slat guiding parts sufficiently to permit a slat to enter the machine. The adjacent cross tapes 253 of the ladder tapes are positioned below the plane of the member 46, the tops 20 of the slat guides 19, and the tops of the members of the control unit 25, so that a slat which moves over these surfaces will not engage said cross tapes. The longitudinal or side strips of the ladder tape are drawn apart by the suction nozzles 29 and 45, so that the entering slats will not strike said strips.

Further, the needles are lowered by means of the wheel 131 to a position whereat the lower free ends are disposed a short distance above the above referred to surfaces, the needles projecting through openings 255 provided in the tilt rail 241 adjacent the ends of said tilt rail, said openings 255 being in alignment with the respective openings of the slats in the assembled line. It will be noted that the rotor 55 is disposed between the tilt rail and the above referred to surfaces and in a position to engage the upper surface of slats entering the machine so as to cause said slats to move to the left, as shown in the drawings, by the rotor.

The slat machine 230 is positioned adjacent the receiving end of the present machine, as shown in Fig. 2, so as to deliver slats into said end and between the slat guide members 47. The cutting and punching mechanism of the machine 230 is controlled by the switch 32, and as the slat enters the guides 47 and passes beyond the nozzle 45, the rotor 55 engages the top surface of the slat and moves it along to the right, as shown in the drawings. When the forward or leading end of the slat strikes the lever 33 of the switch 32 the cutting and punching mechanism of the machine 230 is operated to cut off the slat at the proper length. The machine 230 need not be stopped at this time as the rotor 55 moves the slat ahead much faster than said machine 230.

The rotor 55 continues to move the slat through the guides until the leading edge of the slat strikes the switch member 37 of the microswitch 36, whereupon the solenoid 67 is energized so as to actuate the lever 65 and rotate shaft 63 ap-

proximately ninety degrees, thereby causing the rotor 55 to be swung in a counter-clockwise direction, as shown in Fig. 3, to a position whereat it is out of the way of the slat which has just been positioned in the machine. Simultaneously, the solenoid 209 is energized to move the plunger 203, Fig. 10, to the left and out of engagement with the cam surface 202 with which it is normally engaged. Such movement of the plunger 203 allows the sleeve 189, Fig. 1, to be urged by spring 191 to the left, so that the clutch parts engage. The projecting parts of the longitudinally movable clutch member enter the notches of the clutch member 188 so that the sleeve is then rotated. The sleeve 189 is then rotated and simultaneously causes the actuating member 200 to rotate in a clockwise direction, as shown in Fig. 10. One of the arms 201 of the actuating member 200 engages the adjacent arm 179 of the star wheel 175, causing said star wheel to rotate in a counter-clockwise direction. The star wheel is rotated a quarter of a turn and the inclined leading side 260 of the arm opposite that engaged by the arm 201 of the actuating member, engages the inclined end portion 262 of the latch member 178, thereby causing said latch member to yield and allow the free end of said arm to pass. Immediately the spring of the latch moves the latch member 178 into latching position so as to prevent counter rotation of the star wheel 175.

The quarter of a turn or rotation of the shaft 171 causes the chains to which the blind support 150 is connected, to move so as to raise the support 150 to a position whereat the next slat may be positioned into the succeeding compartments formed by the side walls and cross tapes of the ladder tapes.

As the first position slat is raised the end of said slat which engages the switch member 37 of the switch 36 passes upwardly beyond the free end of said member 37 and permits said switch to open, there being a spring 262 urging said switch member 37 in the opening direction.

When the switch 36 opens, the solenoid 209 is deenergized, permitting the plunger 203 to move to the right, Fig. 10, so that the point engages the sleeve 189 and positions said plunger so that the end portion is in engagement with the adjacent cam surface of the cam 193. It is to be noted that the plunger, when released by the solenoid 209, is returned to its normal position by the spring 204, said plunger enters the adjacent deepened portion of the cam 193 due to the fact that said cam has been rotated throughout a portion of its movement. Thereafter the plunger end portion is in engagement with the adjacent cam surface 202 which is curved to the left, as shown in Fig. 1. As the cam is further rotated, the contouring of the cam surface 202, above referred to, reacts against the plunger 203 and causes the cam and sleeve 189 to move to the right against the force of spring 191 until the clutch part 190 is at a position whereat a very slight additional movement of the sleeve to the right will effect full disengagement. At this point of operation the spring urged plunger 211 is just entering the adjacent notch 210 in the collar 192, and the force of spring 212 is sufficient to urge the plunger 211 into said notch 210 and effect sufficient rotation of the sleeve to cause complete disengagement of the clutch.

Referring to the wiring diagram of Fig. 16, it will be seen that when the switch 36 is closed by the slat end striking the switch member 37, a

relay 265 is energized simultaneously with the energization of the solenoids 67 and 209. Energization of relay 265 effects closing of a switch 266 which is connected to a wire 267 leading to one of the main wires 268 coming from a source of power, not shown. Thereafter, when the switch 36 opens by reason of disengagement of the slat and the switch member 37, the relay 265 and the solenoid 67 remain energized until switch 216 is opened. Opening of switch 216 is effected by the projection 214 opposite switch 216 being carried around and into engagement with the switch member 215 of the switch 216. The momentary opening of switch 216 causes deenergization of the relay 265 and opening of switch 266, so that when said projection 214 has passed just beyond the switch opening position and has allowed the switch 216 to close again, both the relay 265 and solenoid 67 remain deenergized. The deenergization of solenoid 67 occurs after the last positioned slat is raised a distance greater than the top of the rotor 55 so that when the solenoid 67 is deenergized the rotor is returned to its original position by the spring 66 without striking the above referred to slat. The mechanism is then ready for reception of the next slat which is delivered by the slat machine 230.

As the support member 150 moves upwardly, as hereinabove described, the free ends of the needles 104 and 110 enter the cord receiving holes of the adjacent slat, and with each succeeding upward movement of the support 150 the cords are threaded into the blind until the slats are all assembled. At this time the master switch 269, Fig. 16, is opened to stop the further operation of the machine.

It is to be noted that as the support 150 raises the portion of the blind which has been assembled, the needles thread the cord openings of the slats in the space between the spaced planes of the inner edges of the staggered cross tapes.

After the proper length of line has been assembled and the machine stopped, the tapes are cut and attached to the bottom rail.

Means for drawing a sufficient looped length of cord through the end lock 270 is provided, and of such means comprises a hook 271, Fig. 13, which is inserted through the end lock and the cord opening 272 of the tilt rail. The hook portion 273 of the hook 271 is disposed so that the cord 142 is within the hook end 273. The positioning of the hook 271 may be made at the beginning of the assembly operation, and after the blind components are assembled and the machine stopped, the hook 271 is pulled through the opening 272 and the end lock, thereby drawing through the end lock a sufficient length of the cord for raising and lowering the blind when installed.

The cord 142 is then severed adjacent the eye 106 of the needle 104 and on the right hand side of said needle, as shown in Fig. 5. The depending severed end is then passed through an opening provided in the bottom rail and secured in the usual manner, as by knotting or the like. The end 155 of the cord which extends through the eye 113 of the needle 110, is removed from said eye 113 by releasing the spring 156. The end 155 is then passed through the opening provided therefor in the bottom rail, and said end is secured to the bottom rail by knotting or other suitable means.

The blind is then lowered or collapsed by actuating the foot pedal 224, such actuation effecting movement of the latch member 178 out of

engagement with the star wheel 175. However, in order to prevent too rapid dropping or collapsing of the blind, there is means to slow down such movement. This means comprises the clutch 220 which is connected to the shaft end 185 by means of the chain 222.

Referring more particularly to Fig. 12, the sprocket 223 is rotated clockwise, as shown by arrow 275, which results in rotation of the sprocket 221 and clutch 220 in the same direction. The clutch is so constructed and arranged as to rotate freely on the shaft 171 when said shaft is stationary or is rotated in counter-clockwise direction as viewed in Fig. 12. The shaft 171 is rotated in such counter-clockwise direction when actuated through the actuating member 200 and star wheel 175 for raising the blind support 150. When the foot pedal 224 is actuated to release the star wheel 175 the weight of the blind will cause the shaft 171 to rotate in the clockwise direction, and said shaft 171 will tend to rotate faster in said clockwise direction than the rate at which the clutch 220 is rotated. The clutch will therefore engage the shaft 171 so that said shaft will rotate at the slower rate of the clutch 220. The blind will therefore descend at a moderate rate of speed.

When the blind has been lowered the needles 104 and 110 are raised by means of the end wheel 131 to a point where their free lower ends clear the collapsed line which is then removed from the machine.

The cord end remaining in the eye of the needle 104 is then drawn through said eye, passed over the pulleys 148 and 151, and threaded into the eye 113 of the needle 110, so that it is held therein, as shown in Fig. 6.

Another tilt rail is clamped to the support 150, the tapes attached thereto, and the needles lowered to the position required for assembling the components of the next blind. If desired, a manually operated switch 262a, Fig. 16, for controlling the circuit to the relay 265 and the solenoids 67 and 209 may be incorporated. The switch 262a is of similar character to switch 36, and closing and opening of said switch 262a will cause the mechanism to function in a manner similar to that effected by closing and opening switch 36.

The present apparatus or mechanism will assemble blind components in a small fraction of the time required by the present methods of which I have knowledge.

I claim:

1. Apparatus for assembling components of Venetian blinds, comprising: blind support means for attachment of one of the end pieces of a blind having ladder tapes attached thereto in longitudinally spaced relation and with the compartments between the cross pieces of said ladder tapes aligned; a pair of suction nozzles for each ladder tape, each pair of suction nozzles being spaced apart and adapted to draw the side strips of the ladder tape therebetween a greater distance than the width of the slats; means for applying suction to said nozzles; slat feeding means for successively feeding slats between the respective tape strips and into the compartments of the ladder tapes; and means for intermittently raising the blind support means a limited distance each time a slat is fed into one set of compartments of the ladder tapes so as to position the succeeding set of aligned tape compartments into position for reception of the succeeding slat.

2. The invention defined by claim 1, including means for guiding each tape into the respective suction nozzles and maintaining said tapes in proper alignment.

3. Apparatus for assembling components of Venetian blinds, comprising: blind support means extending horizontally and including clamps for clamping a tilt rail to said support means; horizontally arranged laterally spaced parallel rails; slat guides on said rails; a control member adjustably mounted on said rails and including means for locking said support member to said rails in adjusted positions; a vacuum nozzle attached to said control member, said vacuum nozzle including a pair of nozzle members spaced laterally apart; a normally closed control switch on said control member and including an upstanding lever in the path of a slat fed through the slat guides and on the side of the nozzle opposite that from which slats enter; a suction nozzle adjacent the entrance of the slat guides and inwardly of the entrance end of said guides; suction motor means for said suction nozzles; a rotor having its axis extending transversely of the slat guides and disposed closely above the bottom of said guides for engagement with slats in said guides and feeding same therethrough; electric motor means for operating said rotor; electrical means for swinging said rotor from the above mentioned position to a position at substantially right angles thereto; a pair of needles extending vertically and spaced laterally apart for disposition over the spaces between said vacuum nozzles, each of said needles having an eye and means for permitting a cord threaded through said eyes to move in one direction but not in the opposite direction; means for raising and lowering said needles; automatic means for adjusting the position of one of said needles laterally relative to the other of said needles, said adjusting means including a reversible electric motor, a normally closed switch mounted on the control member and a member movable at the same rate as said laterally adjustable needle for engagement with said last mentioned switch for opening said switch when said needle is disposed above the nozzles of said control member; a star wheel having four generally radially extending arms spaced equidistantly apart; means connecting said star wheel with the blind support; an actuating member having a pair of diametrically arranged generally radially extending arms engageable with the arms of the star wheel; electric motor means for operating said actuating member; a clutch between said electric motor means and said actuating member; electrical means for effecting engagement of said clutch; means for effecting disengagement of said clutch when the actuating member has moved through one increment of movement covering approximately 180 degrees of rotation; means for retaining the star wheel against rotation in one direction when said star wheel has been actuated through one increment of movement by a corresponding movement of the actuating member, the last mentioned electric motor means and the electrical means for effecting clutch engagement being connected to the first mentioned switch for energization when said switch is closed by a slat in the guides striking said switch, said switch also being connected with the electrical means for moving the rotor to the above mentioned right angle position; a relay in the circuit of the last mentioned electrical means for maintaining said electrical

means energized after the first mentioned switch opens; a normally closed electric switch controlling the relay; and means for opening said switch momentarily when the actuating member approaches the end of an increment of movement.

4. The invention defined by claim 3, including means connecting the last mentioned electric motor with the star wheel, said connecting means including a clutch and controlling the rate of reverse movement of said star wheel when the latter is released.

5. Apparatus for assembling components of Venetian blinds, comprising: blind support means for attachment of one of the end pieces of a blind having ladder tapes attached thereto in longitudinally spaced relation and with the compartments between the cross pieces of said ladder tapes aligned, the corresponding compartments of the respective tapes constituting sets of compartments; means for separating the longitudinal side strips of each ladder tape sufficiently to receive a slat in the aligned compartments thereof; slat feeding means for successively feeding slats between the respective tape strips and into the compartments of the ladder tapes; and means for intermittently raising the blind support means a limited distance each time a slat is fed into one set of compartments of the ladder tapes so as to position the succeeding set of aligned tape compartments into position for reception of the succeeding slat, said last mentioned means including a motor; a shaft driven by said motor at a reduced speed; a star wheel having a plurality of arms; means for connecting said star wheel with the blind support means; an actuator for actuating said star wheel through one increment of movement for a predetermined increment of movement of said actuator; clutch means for connecting said shaft with said actuator; and means for automatically disengaging said clutch when said actuator has moved through said one increment of movement.

6. Apparatus for assembling components of Venetian blinds, comprising: a frame, means for attaching ladder tapes to said frame in longitudinally spaced relation and with the compartments between the cross pieces of said ladder tapes aligned; a pair of suction nozzles for each ladder tape, each pair of suction nozzles being spaced apart and adapted to draw the side strips of the ladder tape therebetween; means for applying suction to said nozzles; slat feeding means for successively feeding perforated slats between the respective tape strips and into the compartments of the ladder tapes; means for intermittently moving successive sets of aligned compartments into position to receive slats from said slat feeding means, and means for threading cord into the perforations of the slats as the blind components are assembled, said means comprising a pair of vertical needles operably connected to said frame and spaced laterally apart for disposition over the spaces between said vacuum nozzles, each of said needles having an eye and means for permitting a cord threaded through said eyes to move in one direction but not in the opposite direction, and said needles being received in the perforations of the slats as the sets of aligned compartments are moved.

7. Apparatus for assembling components of Venetian blinds, comprising: a frame, means for attaching ladder tapes to said frame in longitudinally spaced relation and with the compartments between the cross pieces of said ladder tapes aligned; a pair of suction nozzles for each

ladder tape, each pair of suction nozzles being spaced apart and adapted to draw the side strips of the ladder tape therebetween; means for applying suction to said nozzles; slat feeding means for successively feeding apertured slats between the respective tape strips and into the compartments of the ladder tapes; means for intermittently raising said ladder tape attaching means a limited distance each time a slat is fed into one set of compartments of the ladder tapes so as to position the succeeding set of aligned tape compartments into position for reception of the succeeding slat; and means for threading cord into the perforations of the slats as the blind components are assembled, said means comprising a pair of vertical needles supported on said frame adjacent the upper ends thereof, each of said needles having an eye adjacent the lower free end thereof, said needles being positioned to be received in the perforations of the slats as the ladder tape attaching means is raised.

8. Apparatus for assembling components of Venetian blinds, comprising: a frame, means for attaching ladder tapes to said frame in longitudinally spaced relation and with the compartments between the cross pieces of said ladder tapes aligned; a pair of suction nozzles for each ladder tape, each pair of suction nozzles being spaced apart and adapted to draw the side strips of the ladder tape therebetween; means for applying suction to said nozzles; slat feeding means for successively feeding apertured slats between the respective tape strips and into the compartments of the ladder tapes; means for intermittently raising said ladder tape attaching means a limited distance each time a slat is fed into one set of compartments of the ladder tapes so as to position the succeeding set of aligned tape compartments into position for reception of the succeeding slat; and means for threading cord into the perforations of the slats as the blind components are assembled, said means comprising a pair of vertical needles supported on said frame adjacent the upper ends thereof, each of said needles having an eye adjacent the lower free end thereof, said needles being positioned to be received in the perforations of the slats as the ladder tape attaching means is raised, and the length of said needles being greater than the vertical dimension of the finished blind.

9. Apparatus for assembling components of Venetian blinds, comprising: a frame, means for attaching ladder tapes to said frame in longitudinally spaced relation and with the compartments between the cross pieces of said ladder tapes aligned; means for separating the longitudinal side strips of each ladder tape sufficiently to receive a slat in the aligned compartments thereof; slat feeding means for successively feeding apertured slats between the respective tape strips and into the compartments of the ladder tapes; means for intermittently raising said ladder tape attaching means a limited distance each time a slat is fed into one set of compartments of the ladder tapes so as to position the succeeding set of aligned tape compartments into position for reception of the succeeding slat; and means for threading cord into the perforations of the slats as the blind components are assembled, said means comprising a pair of vertical needles supported on said frame adjacent the upper ends thereof, each of said needles having an eye adjacent the lower free end thereof, one of said needles being provided with cord retaining means adjacent the eye thereof, and the other of said

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needles being provided with a pulley journaled therein within the eye of said needle and spring means on said latter needle permitting a cord threaded through said eye to move in only one direction, said needles being positioned to be received in the perforations of the slats as the ladder tape attaching means is raised, and the length of said needles being greater than the vertical dimension of the finished blind.

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