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(54) APPARATUS FOR PRODUCING VENETIAN BLINDS

(71) We, HUNTER DOUGLAS INDUSTRIES B.V., a Dutch Body Corporate of Piekstraat 2, Rotterdam, Netherlands do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates to an apparatus for producing venetian blinds having slats with vertically aligned holes for passage of a lifting member, and at least two suspension members each in the form of a ladder consisting of two stringer cords and rung cords connecting them, each rung holding and supporting a slat near one of said holes.

One type of apparatus for producing such blinds comprises a needle for passing the lifting member through the holes and the ladder in such manner that successive rungs shall lie alternately on opposite sides of the lifting member, and having a ladder guide actuable by lifting the ladder step by step and serving to deflect the free end of the ladder, with each successive rung not yet engaged by the lifting member and the needle, alternately into different oblique positions relative to the needle held vertical.

When the successive rungs thus alternately rest against the lifting member on either side, the slats and the ladders are secured in the horizontal direction in relation to each other, so that the slats cannot slip laterally out of the ladder.

In order to arrange the rungs of a ladder appropriately in relation to the lifting member, which in most cases will also be a cord, but may alternatively consist for example of a chain, it is known that use may be made of a device having two pivoted gripping arms alternately resting against successive rungs on either side of the ladder in a more or less horizontal direction. The arms are of such

shape that in this rest position, they deflect the ladder somewhat out of the vertical position, and, relative to the ladder, in an oblique position so that the portion of the ladder located between two successive rungs is in oblique position prior to each stepwise lifting of the ladder, underneath the opening for passage of the lifting member in the next slat above. The guiding member, in most cases is a needle, to which the lifting member may already be attached at the beginning of this assembly operation. Since the position of the successive rungs, in each case, is fixed by the presence of the needle, the lifting member need not be attached to the needle until all rungs of the ladder have been passed alternately on either side of the needle by the lifting of the slats.

When the ladder is lifted, one rung at a time will pass the tip of the needle, the arm located on one side of the ladder releasing the rung hitherto held by it, while the arm on the other side of the ladder can make contact with the next rung. The latter thus draws the ladder into the other oblique position, so that the next rung can now pass on the other side of the needle. In order for the arms to return to the horizontal position quickly enough after the lift, appropriately acting springs are provided. So that the rungs of the ladder will be drawn at least more or less straight prior to this assembly, a stationary spreading means is arranged below the arms.

This apparatus has the disadvantage of being comparatively expensive to construct. Also, the design of the arms and the dimensioning of the springs are critical, especially in reasonably fast operation, if the process is to run smoothly. Furthermore, the arms to be arranged transverse to the plane of the ladder require considerable additional space, which is further increased by the space required for the spreading means.

According to the present invention, we

provide apparatus for producing venetian blinds having slats with holes vertically aligned for the passage of a lifting member, and having at least two suspension members each in the form of a ladder consisting of two stringer cords and rung cords connecting them, each rung holding and supporting a slat in the vicinity of one of said holes, such apparatus comprising at least one surface defining an insertion plane for the slats, a vertical needle for threading the lifting member through the holes and the ladder, a flap pivotable on a horizontal axis, the pivoted flap being located beneath the needle and the plane of insertion of the slats, the flap carrying a ladder guide above the level of the axis of the flap and being alternatively rockable in opposite directions by stepwise lifting of the ladder and serving to deflect the free end of the ladder with each successive rung not yet engaged by the needle into different oblique positions in relation to the needle, in such manner that successive rungs shall lie on opposite sides of the lifting member.

We have found that such an arrangement enables the alternating oblique positioning of the ladder in opposed directions to be accomplished by simpler means and even more dependably.

With the apparatus of the invention, when the ladder is in one of its two oblique positions in its guide on the flap, then upon lifting of the ladder there will regularly be a certain amount of friction between the ladder on the one hand and the guide and/or the flap on the other hand. This friction is sufficient to bring the flap into its top dead centre position through the stepwise lifting of the ladder. The flap is thus supplied with a certain kinetic energy quite sufficient to move the flap past top dead centre into the other oblique position, with the further assistance, once top dead centre has been passed, of the dead weight of the flap. The two extreme positions of the flap may be fixed at suitable points by means of stops of suitable limitation of rotation of the pivot.

The proposed construction of the invention may be embodied at little technical outlay. There are no difficulties in the dimensioning and design of any restoring forces, lever arms or the like. On the contrary, the speed or swing of the flap will of its own accord adapt itself to the speed at which the ladder is lifted, for if the ladder is lifted faster, the flap will swing faster also. Furthermore, the apparatus can provide absolute dependability in the alternation of the oblique positions of the ladder. Preferably, the centre of gravity of the flap is above the pivot.

In further refinement of the invention, it is proposed that the flap itself shall have

two guiding members, one associated with each stringer of the ladder and arranged at a distance from each other corresponding to the length of a rung. It thus becomes superfluous to provide a similar spreading means with guiding members elsewhere, which would otherwise require additional cost and additional space. The guide members may consist of two plates with rails diverging upwardly. The spreading of the stringers, as usually required, to a more or less horizontal and straight position of the rungs, may thus be achieved by simple means and with minimum space requirement. To this is added the advantage that the simultaneous spreading of the ladder increases the friction between it and the guiding and/or spreading members, so that a correspondingly greater component of force can be transmitted to the flap when the ladder is lifted. Thus any further measures to obtain adequate friction are superfluous. Proper design will even eliminate the need of limiting the extreme swing of the flap with stops or by other means.

In further refinement of the invention, it is proposed that a guiding member be arranged above the flap, against which the ladder will be urged horizontally by the flap. Since the ladder is already spread above the flap, the guiding member may suitably be so fashioned that it may simultaneously perform a guiding function for the several slats as they are inserted.

The guiding member may advantageously include a central cut-out, the width of the cut-out determining the horizontal range of deflection of the ladder. The ladder will thus alternately come to rest at one of two opposed interior sides of the cut-out, while in one of the remaining sides, a slit may appropriately be provided, through which the ladder can be slipped in and out.

Further, it is proposed that the guiding member shall have a projection between each pair of points of contact for the stringers of the ladder, to serve as a hold-down for the ladder. This permits insertion of the slats along the top side of the guiding member, without danger that so much as a portion of the rung will protrude above this plane of insertion. By this construction of the guiding member, incidentally, the maximum friction required to hold the ladder, which friction must be developed by the guide members, on the flap is diminished.

In order that the invention may more readily be understood, the following description is given merely by way of example, reference being made to the accompanying drawings in which:—

Figure 1 is a schematic elevation of a portion of a general arrangement in which a machine for making the slats is joined directly to an assembly device including

one embodiment of apparatus according to the invention, for making up the packs of slats of a venetian blind;

Figure 2 is a side elevation to a larger scale, showing a portion of the apparatus shown in Figure 1 in more detail;

Figure 3 is a perspective view, to a still larger scale, showing part of the portion represented in Figure 2;

Figure 4 is an end view of the flap of Figure 3 showing the ladder spreading means; and

Figure 5 is a section taken along the line V-V in Figure 4.

The apparatus shown in Figure 1 comprises a machine platform 10 and an assembly rack 11. On the platform 10 is mounted a supply reel 12 of coiled sheet metal which is passed by way of rollers 13 to a first pair of rolls 14 driven by motor 15. The strip of sheet metal then passes through a fixture 16 in which it is straightened and formed. Also in fixture 16, the holes required for threading a lifting member are punched and the strips of sheet metal are trimmed to the particular desired length, thus completing the several slats 17. The parts directly associated with the machine platform 10, however, do not form part of the present invention.

The assembly rack 11 has two vertical U-shaped suspension members 18, the width of the inside spacing of the arms of which is so dimensioned as just to match the width of a slat 17. On the inner sides of the suspension members 18 there are spring stops 19 to be pressed into the suspension members 18 against spring action so that slats 17 can be lifted upward past the stops 19. When the stops 19 once more emerge from the suspension members 18, they may then serve as supports for the slats 17 which have been lifted upward.

In the upper part of the assembly rack 11, a fixture 20 is arranged for holding and guiding a needle 21 in the vertical direction. The slats 17 are each so inserted in the suspension members 18 that their holes 17a, punched on the machine platform 10 for threading a lifting member, lie exactly beneath the needle 21. The lifting member is a cord, not shown here, which may be attached to the tip 21a of the needle 21 when all the slats 17 required for one louvre pack have been properly assembled with the ladder 23. As a conceivable modification, however, the needle 21 may have a lengthwise recess 22 in which a cord to serve as the lifting member may already be contained before assembly is begun.

The several slats 17 of the blind are held by a ladder cord 23. If the length of the louver is not great, two ladders 23 may be sufficient; alternatively, however, three or more ladders 23 might be provided, more

or less evenly spaced over the slat length. The assembly rack 11 may therefore comprise a corresponding number of unit arrangements as represented singly in Figures 2 and 3.

Each ladder 23 consists of two stringer cords 23a and rung cords 23b connecting them and arranged at uniform intervals between the stringers 23a; these intervals determine the height of the several slats 17 one above another when the blind is lowered.

Beneath the needle 21, a flap 24 is arranged, connected to the assembly rack 11 and pivoting on a horizontal axis 25 parallel to the plane of the ladder 23. The flap 24 is provided on one face with two guide plates 26 flanged at the sides, which are so shaped and mounted on the flap 24 that the stringers 23a of the ladder 23 can slide between the flap 24 and the plate 26. On their facing sides, the plates 26 have guide rails 26a bent towards the flap 24, not touching the flap 24, however, but leaving enough clearance so that the rungs 23b can pass between the ends of the rails 26a and the flap 24. This distance may be adjusted by any suitable means (not shown). The stringers 23a are nevertheless held by the rails 26a, being of greater diameter than the rungs 23b. The rails 26a diverge upwardly, so that they can spread the stringers 23a of the ladder 23 so far that the rungs 23b will assume a straight and more or less horizontal position.

Above the flap 24, approximately at the level of the joining webs of the suspension members 18, a guiding member in the form of a frame 27 is provided, a central cut-out 27a of which is accessible from the outside through a slit 27b. On two opposed inner sides of the frame 27, notches 27c are provided at a spacing corresponding to the width of the ladder 23, forming the actual points of contact for the stringers 23a, while in between two notches 27c there is a projection 27a holding down one rung 23b at a time when the stringers 23a of the ladder 23 are in contact with one or the other side of the cut-out 27a inside the notches 27c, therein

The slats 17 are lifted by a known lifting means, not forming part of the present invention, by means of which the slats 17 may be lifted to a point above the spring stops 19. None of this lifting means is shown in the drawings, except vertical rods 28 in slide bearings 29 with pins 30 to pick up the slats 17.

The mode of operation of the arrangement described is as follows.

The cord serving as a lifting member is secured by its lower end to the tip 21a of the needle 21 or otherwise held in any suitable manner. The upper end of the ladder 23 is secured to the top bar (not shown) of the

blind, or to one of the slats 17, as indicated in Figure 3. The ladder is slipped under the guide plates 26 of the flap 24 the position of each plate 26 in relation to the flap 24 being
 5 presettable by means of spring action and a suitable screw adjustment. A free rung 23b is thus located as indicated in Figure 3 below the loft projection 27d of frame 27, since the last rung 23b as yet held at the lower end
 10 of the needle by the latter is in contact on the righthand side of the needle. Between these two rungs 23b there is another, intermediate rung 23b deflected to the left in relation to the lengthwise axis of the needle
 15 21.

By suitable control and actuation of devices associated with the machine platform 10, one slat 17 at a time of proper length is inserted in the assembly rack 11, each set of openings 17a becoming located exactly beneath a needle 21. Furthermore, the ladder 23 assumes the oblique position to be seen in Figures 2 and 3, owing to the position of the flap 24.

25 The flap 24 is in the same position in each of Figures 2 and 3; in Figure 2, however, several slats 17 are shown already assembled, so that the positions of the rungs 23b may be seen at this stage of assembly also.

30 In Figures 2 and 3, the bottommost slat 17 lies in an insertion plane designated by reference numeral 31. Before a new slat 17 is supplied, however, first the lifting pins 30 must be lowered into their lowermost
 35 position underneath the insertion plane 31.

If after insertion of a new slat 17 the lifting pins 30 are then lifted, such lifting will remain without effect on the ladder 23 until the slat 17 has engaged the next rung 40 23b above from below. Only then will the ladder 23 be lifted. Upon further lifting, this rung 23b will pass the tip 21a of the needle 21 on the left side of the needle, thereby fixing the correct position in relation to the elevating member to be afterwards brought in with the needle 21. At the same time, the flap 24 is carried along by the ladder 23 towards top dead centre by virtue of the friction between the two. The flap 24
 50 thereby gains a certain kinetic energy and a certain angular velocity. When the bottommost slat 17 has been lifted so far that it is secured against dropping back downward by the spring stops 19, the lifting pins 30
 55 are arrested. The flap 24 continues its swinging motion by virtue of its kinetic energy, and after passing top dead centre drops into its righthand position. Thus the stringers 23a of ladder 23 come to rest in the notches 60 27c of frame 27 on the righthand side of cut-out 27a. That rung 23b which ran along underneath the lefthand projection 27d before the lift is now on the righthand side of the lengthwise axis of the needle and about
 65 midway between the slat 17 just lifted and

the next rung 23b below, running along underneath the righthand projection 27d.

The lifting pins 30 are now lowered again into their extreme bottom position. Assembly of the next slat 17 may be repeated, 70 whereupon the flap 24 is returned from its righthand to its lefthand position. The lifting of each lowermost slat 17 takes place in each instance by an amount corresponding to the distance between two rungs 23b. 75

This lifting is accomplished mechanically, optionally including the control of corresponding movements in the control of the systems associated with the machine platform 10. Alternatively, of course, the programme 80 of the several movements in the area of each of the ladders 23 present in any distance may be included in a common control.

WHAT WE CLAIM IS:—

1. Apparatus for producing venetian 85 blinds having slats with holes vertically aligned for the passage of a lifting member, and having at least two suspension members each in the form of a ladder consisting of two stringer cords and rung cords connecting 90 them, each rung holding and supporting a slat in the vicinity of one of said holes, such apparatus comprising at least one surface defining an insertion plane for the slats, a vertical needle for threading the lifting 95 member through the holes and the ladder, a flap pivotable on a horizontal axis, the pivoted flap being located beneath the needle and the plane of insertion of the slats, the flap carrying a ladder guide above the 100 level of the axis of the flap and being alternately rockable in opposite directions by stepwise lifting of the ladder and serving to deflect the free end of the ladder with each successive rung not yet engaged by the 105 needle into different oblique positions in relation to the needle, in such manner that successive rungs shall lie on opposite sides of the lifting member.

2. Apparatus according to claim 1, where- 110 in the centre of gravity of the flap is located above said horizontal axis.

3. Apparatus according to claim 1 or 2, wherein the flap has two guide members, one associated with each stringer cord of 115 the ladder and arranged at a distance from each other corresponding to the length of a rung cord.

4. Apparatus according to claim 3, wherein the guide members at the same time serve as spreading means and comprises two guide 120 plates having guide rails diverging upwardly.

5. Apparatus according to any of the preceding claims, wherein above the flap a guiding member is arranged against which 125 the ladder is urged horizontally by the flap.

6. Apparatus according to claim 5, wherein said guide member has a central cut-out, the width of the cut-out determining the amount of horizontal deflection of the 130

ladder.

7. Apparatus according to claim 5 or 6,
wherein the said guide member or frame
has a projection between each set of points
5 of contact for the stringers of the ladder to
serve as hold-down for a ladder rung.

8. Apparatus for producing venetian

blinds substantially as hereinbefore de-
scribed, with reference to and as illustrated
in the accompanying drawings.

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FIG. 1

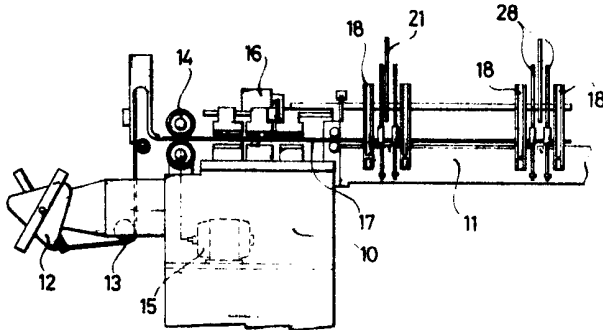


FIG. 2

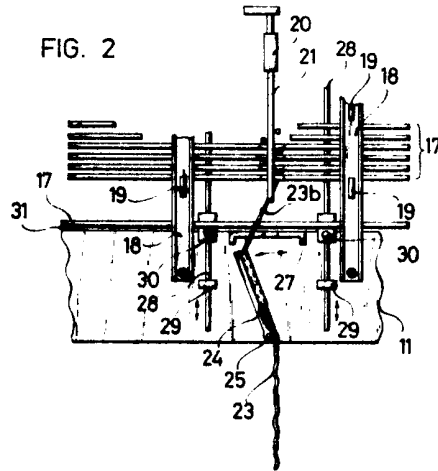


FIG. 3

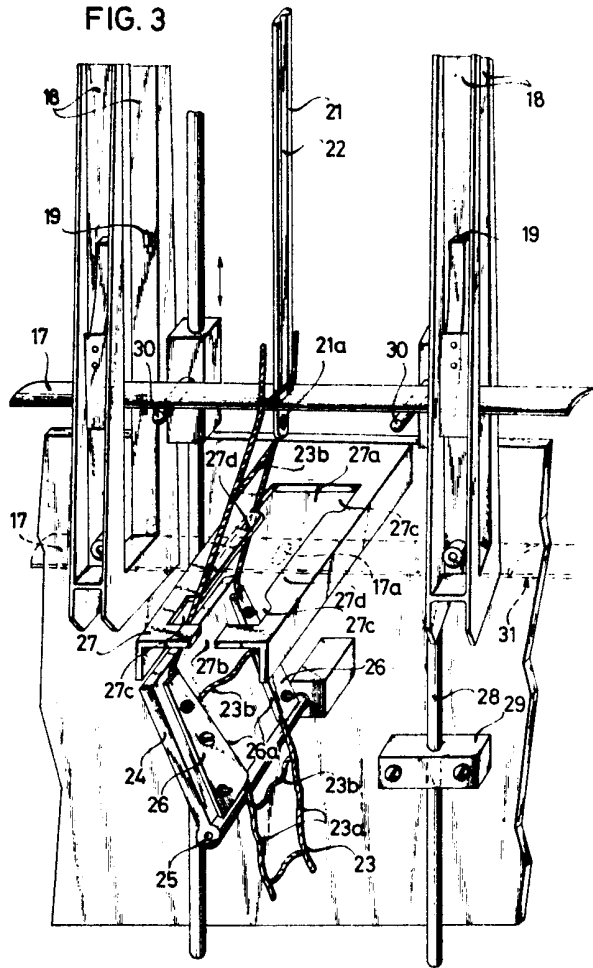


FIG. 4

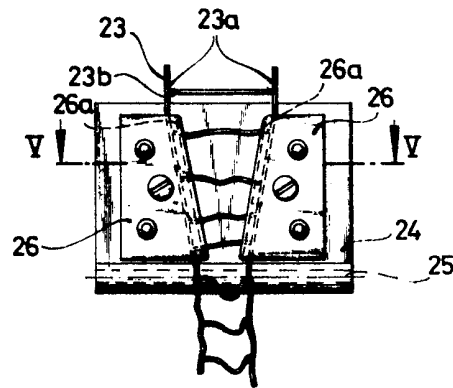


FIG. 5

