Aug. 18, 1959 J. P. GREENE 2,900,108

SLAT FEEDING APPARATUS FOR BOX-MAKING MACHINES

Filed July 27, 1954

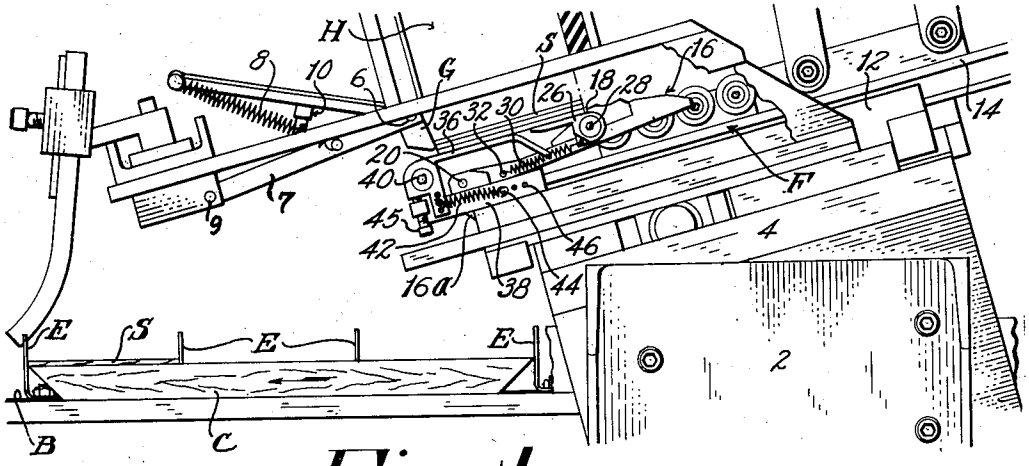


Fig. 1

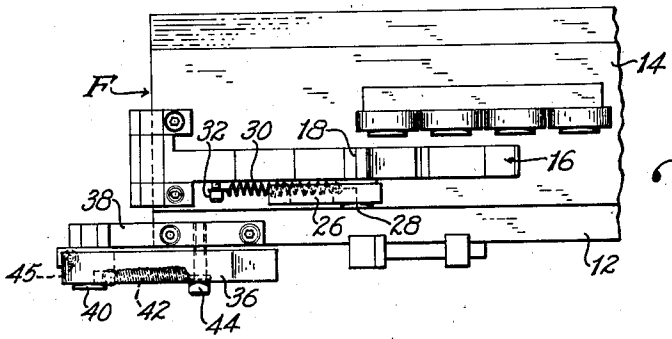


Fig. 2

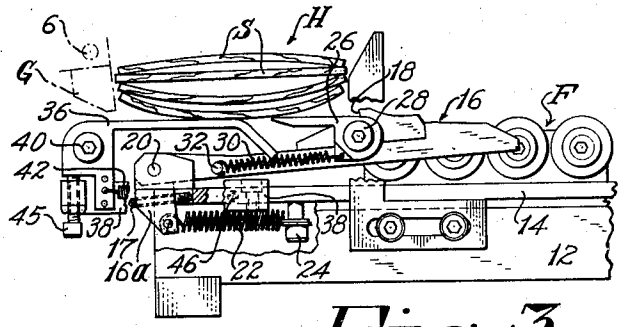
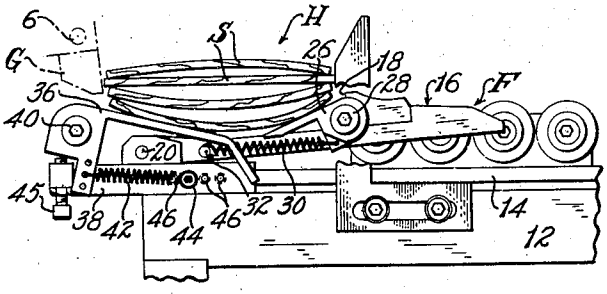


Fig. 3

Fig. 4



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SLAT FEEDING APPARATUS FOR BOX-MAKING MACHINES

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Application July 27, 1954, Serial No. 446,075

4 Claims. (Cl. 221—268)

This invention relates to apparatus for dispensing slats to wirebound box-making machines of the general type disclosed, for example, in U.S. Patent No. 2,304,510.

In such machines, properly assembled cleats and side material or slats are conveyed beneath a transverse bank of stapling units, by which they are stapled together to form box-part units or complete wirebound box or crate blanks. The cleats and slats are conveyed through the machine by means of conveyor bands having projecting push elements which engage the cleats and slats and maintain their properly assembled relationship.

In the abandoned application Serial No. 372,903, filed August 7, 1953, there is disclosed an apparatus for mechanically laying slats into proper position in the spaces between the push elements on the continuously moving conveyor bands of a wirebound box-making machine. This apparatus eliminates the need for manual labor in the laying of slats and enables substantial reductions in the cost of manufacture of wirebound boxes and crates.

As will be appreciated, any such mechanical slat dispensing apparatus, to be practical, must be reliable and relatively foolproof in operation. If the dispensing apparatus ceases to feed slats or feeds more than one slat at a time or feeds them improperly to the continuously operating box-making machine, improperly formed boxes will be produced unless the persons tending the machine are sufficiently alert to stop the machine immediately or sufficiently skilled to feed the slats manually (or to remove any surplus slats and position the remaining slats properly on the conveyor bands), while simultaneously restoring the dispensing apparatus to proper operating condition.

The necessary degree of reliability in the mechanical feeding of slats is difficult to achieve in view of the fact that the relatively thin wooden slats are often warped, twisted, split or broken, as well as being of improper dimensions. One of the most difficult types of slats to feed properly from dispensing apparatus of previous types is one which has upwardly curled leading and/or trailing edges.

In most types of slat feeders, the slats are held in a generally vertical stack and a pair of slat feeding hooks are movable across the bottom of the stack to engage the trailing edge of the bottom slat of the stack and push it individually out of the hopper. A pair of exit gates are provided on the hopper, the lower ends of these gates being positioned so as to engage and prevent movement from the hopper of all but the bottom slat. If the bottom slat is upwardly curled, the feed hooks tend to miss its trailing edge and slide ineffectually across the bottom of the slat. Even if the feed hooks engage the slat and start to feed it from the hopper, its upwardly curled leading edge tends to strike the exit gates and prevent the slat from moving out of the hopper, frequently causing slippage of the feed hooks and consequent non-feeding and sometimes resulting in breakage of the slat or even jamming of the dispensing apparatus.

Of course, if all of the slats were upwardly curled, reliable slat feeding could be obtained by some relatively simple expedient such as beveling the upper surface of the feeding member just ahead of the feed hook. But such an arrangement would be ill adapted for feeding other types of slats. For example, where the bottom slat was too narrow or was broken off along one edge, it could drop down on the beveled portion of the feed member and place the trailing edge of the next slat above in the path of the feed hook so that there would be a tendency to feed the two bottom slats simultaneously from the hopper on the next feeding stroke. It is thus the random nature of the variable in slat dimensions which makes the mechanical feeding of slats exceptionally difficult.

The present invention provides an improved construction of slat feeding apparatus which is capable of feeding reliably all types of slats, including those which are properly formed and those which are malformed in any of the usual respects to a degree which does not render them unfit for commercial use. The invention is shown as applied in a slat dispensing apparatus of the type disclosed in the aforementioned abandoned application Serial No. 372,903. The invention provides a novel means for supporting the stack of slats in the hopper of such an apparatus at variable levels depending upon the shape of the bottom slat in the stack. This supporting means includes two sets of pivotally mounted slat supporting arms, one set beneath the lower front corner of the stack and the other set beneath the lower rear corner. These arms extend at least partially across the bottom of the stack and are urged upwardly by springs or other yieldable means. The supporting arms are pivoted on axes which are so located that a flat or a downwardly curled bottom slat will engage them relatively close to their pivotal axes, while an upwardly curled bottom slat will engage them a substantially greater distance from their pivotal axes. The turning moment imposed on the supporting arms is therefore much greater where the bottom slat is upwardly curled than when it is flat. The resistance of springs is such that the turning moment imposed through an upwardly curled bottom slat is sufficient to depress the arms while the turning moment imposed by a flat or downwardly curled bottom slat is not. Thus, when there is an upwardly curled slat at the bottom of the stack, the stack is allowed to drop downwardly by a sufficient distance to permit the feed hooks to engage the trailing edge of the bottom slat and to permit its leading edge to pass beneath the exit gates.

In the drawings and specification of the present application, I have disclosed in detail only the specific improvement to which this application relates. For a more complete disclosure of the construction of the remaining portions of the apparatus, including the hopper and all its associated parts, and of the mounting of the apparatus relative to the box-making machine, reference may be had to the aforesaid abandoned application, Serial No. 372,903.

In the drawings:

Figure 1 is a fragmentary side elevational view of a slat feeding apparatus embodying features of the present invention, with the apparatus being shown in position above the conveyor bands of a box-making machine and with certain parts of the feeding apparatus being broken away to reveal its construction. This view is similar to Figure 1 of the aforementioned application Serial No. 372,903.

Figure 2 is a top plan view, at slightly enlarged scale, of one of the two identical slat feeding units of the apparatus.

Figure 3 is a fragmentary side elevational view at the scale of Figure 2, showing the apparatus at the com-

pletion of the return stroke of the slat feeding head, with an upwardly curled slat in the bottom position in the stack, but with the slat supporting arms in their upper position, to illustrate the potential difficulty in feeding such slats.

Figure 4 is a view similar to Figure 3, showing the slat supporting arms in a downward position, illustrating the manner in which the present invention overcomes the difficulties heretofore attendant upon the feeding of upwardly curled slats.

As may be seen in Figures 1 and 2, the slat feeding apparatus embodying the present invention is adapted to be mounted above the conveyor bands B of a wirebound box-making machine at a point adjacent the input end of the machine. The conveyor bands B are provided with upstanding slat engaging elements E which are adjustably spaced along the conveyor bands and are adapted to engage the slats S and convey them in properly assembled relation with respect to the cleats C beneath a transverse bank of stapling units (not shown) where they are stabled together to form wirebound crate blanks.

The dispensing apparatus is secured to and supported above the box-making machine by means of upstanding side plates **2** which are secured to the longitudinal framing members at either side of the box-making machine. Bolted to the upper ends of the side plates **2** and extending between them across the conveyor bands B is a base member **4** on which the various elements of the dispensing apparatus are mounted. These elements include a plurality of upstanding angular members which form the frame work of a hopper, generally designated H, which is adapted to support a generally vertical stack of slats S. The slats are oblong, with their ends or short edges being visible in Figures 1, 3 and 4.

A pair of exit gates G are pivotally mounted at **6** on links **7** which in turn are pivotally attached to the frame of the hopper H at **9**. The exit gates G are urged in a counterclockwise direction, as viewed in Figures 1, 3 and 4, by means of tension springs **8**, with their counterclockwise movement being limited by means of adjustable stops generally designated **10**. The lower ends of the gate members G are normally positioned, as shown in Figure 1, so as to permit the bottom slat in the stack to pass unimpeded out of the hopper H, while engaging and preventing movement from the hopper of all except the bottom slat. The pivotal arrangement of the gate members G allows them to be forced open in a clockwise direction against the resistance of the springs **8** to permit two or more slats to move simultaneously from the hopper and prevent jamming of the dispensing apparatus with possible breakage of the slats or even damage to the dispensing apparatus.

Also mounted on the base **4** are a pair of slat feeding units, generally indicated F, which are laterally spaced at adjustable positions on the base **4** and include longitudinally extending slideways **12** and carriages **14** mounted thereon for reciprocation through feeding and return strokes across the bottom of the hopper H.

Each of the carriages **14** has mounted thereon a composite slat feeding member, generally designated **16**, which has mounted at its upper surface a feed hook **18** having a vertical step which projects upwardly from the portions of the feed hook and feeding member directly ahead of it for a distance slightly less than the thickness of the slats so that on each feeding stroke of the carriage **14** (i.e., each leftward stroke as viewed in Figures 1, 3 and 4), it will engage the trailing edge of the bottom slat only and push it out of the hopper.

This composite slat feeding member **16** is pivoted on a pin **20** extending between a pair of brackets **21** projecting upwardly from the forward end of the carriage **14** and, as shown in Figure 3, is urged in a counterclockwise direction by means of a coil spring **22** tensioned between a downwardly extending portion **16***a* at the forward end of the slat feeding member **16** and a stud

24 projecting downwardly from the undersurface of the carriage **14**. A stop screw **17** threaded through the downwardly projecting portion **16***a* of the slat feeding member **16** and engaging the forward edge of the carriage **14** serves to limit the counterclockwise movement of the feeding member. The spring **22** exerts sufficient force on the slat feeding member **16** so that the slat feeding member is not pressed downwardly by the normal weight of the stack of slats S in the hopper H but yields downwardly when necessary to prevent jamming of the apparatus or possible damage to its component parts.

Each of the slat feeding members **16** also carries a slat supporting arm **26** which is pivotally mounted on an axis, indicated at **28**, which is approximately in line with the feed hook **18**, and which, when the slat feeding members are in their rearward position, as shown in Figures 1, 3 and 4, is approximately in the plane of the trailing edges of the stack of slats S in the hopper H, that is, in the plane of one of the broad faces of the stack.

The slat supporting arm **26** is urged in a clockwise direction, as viewed in Figures 1, 3 and 4, by means of a coil spring **30** which is tensioned between the lower portion of the hub of the arm **26** and a stud **32** projecting from the forward position of the slat feeding member **16**. The tension of this spring **30** is sufficient that, when there is a flat or a downwardly curled slat at the bottom of the hopper as shown in Figure 1, the weight of the stack of slats, which will therefore be imposed at the lower rear corner of the stack, approximately in line above the pivotal axis **28** of the supporting arm **26**, is insufficient to overcome the resistance of the spring **30** and press the slat supporting arm **26** downwardly. However, the spring **30** is sufficiently yielding that, when there is an upwardly curled slat at the bottom of the stack of slats S in the hopper, as shown in Figure 4, the weight of the stack of slats, which will thus be imposed at a point spaced a considerable distance forward of the pivotal axis **28** of the supporting arm **26**, and will therefore be subject to considerable mechanical advantage, will be sufficient to depress the supporting arm **26**, as illustrated in Figure 4. When the supporting arm **26** is in its normal upper position, generally parallel to the bottom of the stack of slats S, it is engaged by an upwardly curled bottom slat at its outer end—a distance forward of its pivot of the order of one-half the width or short-edge dimension of the slats. As the supporting arm **26** moves downwardly, the point at which the weight of the stack is imposed on the arm moves rearwardly, shortening the moment arm to the point where a balance is reached between the forces imposed on the arm **26** by the weight of the stack and by the spring **30**.

The depression of the supporting arm permits the rear corner of the stack of slats to drop downwardly so that the feed hook **18** of the slat feeding member **16** may engage the upwardly curled trailing edge of the bottom slat in the stack and feed it individually from the hopper H on the next feeding stroke of the carriage **14**. But for this arrangement, it may be seen in Figure 3, the feed hook **18** would miss the upwardly curled trailing edge of the bottom slat in the stack and slide ineffectually under the bottom face of this slat, thereby resulting in non-feeding of slats.

Beneath the forward side of the hopper H another pair of slat supporting arms **36** is provided. Each of these slat supporting arms **36** is pivotally mounted on a bracket **38** which extends from the forward end of the slideway **12**, the pivotal axis **40** of the arm **36** being located just forward of the plane of the leading edges of the slats S in the hopper H, and with the arm **36** extending rearwardly at least partially across the bottom of the hopper to support the lower front corner of the stack of slats S therein. The slat supporting arm **36** is urged in a counterclockwise direction as viewed in Figure 1 by means of a coil spring **42** which is tensioned between a downwardly

extending portion 36*a* of the arm 36 and a bolt 44 threaded into the bracket 38. The counterclockwise movement of the arm 36 is limited by means of a stop screw 45 threaded through the bracket 38 and engaging a downwardly facing flattened surface 36*b* on the hub of the arm 36 at a point forward of its pivotal axis 40.

The tension of the spring 42 is such that when a flat or downwardly curled slat is at the bottom of the stack of slats S in the hopper, as shown in Figure 1, the weight of the stack of slats which will thus be imposed in the plane of the leading edges of the slats in the hopper and not far from the pivotal axis 40 of the supporting arm 36, will not be sufficient to depress the arm. Thus, the supporting arm 36 will remain in its upper or counterclockwise position as illustrated in Figure 1. However, the spring 42 is sufficiently yielding that when an upwardly curled slat is at the bottom of the stack, as illustrated in Figures 3 and 4, the weight of the stack of slats, which is thus imposed near the end of the supporting arm 36 a substantial distance from its pivotal axis 40, will overcome the resistance of the spring 42 and press the supporting arm 36 downwardly, as illustrated in Figure 4. As may be seen from a study of Figure 3, but for this depression of the supporting arm 36, the leading edge of the bottom slat would strike the exit gate G as the slat started to move out of the hopper, thereby tending to prevent movement of the slat from the hopper and either resulting in non-feeding of slats or in opening of the exit gates G, which might allow the feeding of more than one slat from the hopper on a single feeding stroke. However, as is illustrated in Figure 4, the depression of the slat supporting arm 36 allows the lower front corner of the stack of slats S to drop downwardly so that the leading edge of the bottom slat in the stack can move out of the hopper beneath the bottom of the exit gate G on the ensuing feeding stroke of the carriage 14.

As the slat supporting arm 36 rotates in a clockwise direction toward the position as shown in Figure 4, the point of engagement between the bottom slat and the slat supporting arm 36 moves toward the pivotal axis 40 of the slat supporting arm 36 thereby shortening its moment arm to the point where the force imposed by the weight of the stack on the slat supporting arm 36 just balances the force imposed upon it by the spring 42. The tension of the spring 42 is so adjusted that this balance of force occurs when the supporting arm 36 reaches such an angle that the upwardly curled leading edge of the bottom slat will just clear the lower end of the exit gate G. To provide for adjustment of the spring 42, a series of tapped holes 46 is provided along the bracket 38 into which the bolt 44 may be threaded to vary the elongation of the spring 42.

From the foregoing description, it will be understood that the present invention provides a dispensing apparatus so constructed that the leading and trailing edges of the stack of slats in the hopper are positioned at varying heights depending upon the shape of the bottom slat in the stack, with the result that the slat feeding hooks will engage the trailing edge of the bottom slat only, while the leading edge of the bottom slat only will clear the exit gate G, regardless of the shape of the bottom slat. It will therefore be appreciated that the present invention provides apparatus for reliably dispensing slats to a box-making machine even where the slats are drastically warped, curled or of improper dimensions.

However, it should be emphasized that the apparatus shown and described herein is intended as merely illustrative and not as restrictive of the invention.

I claim:

1. In a slat feeding apparatus of the type having a hopper for holding a generally vertical stack of slats, a slat feeding member mounted at the bottom of said hopper for movement in a direction parallel to the bottom of the stack and perpendicular to its broad faces, said slat feeding member having a hook portion shaped and positioned at such level as to engage the trailing edge of the bottom slat only in the stack, an exit opening in said hopper opposite the leading edge of said bottom slat, said opening being high enough to permit the bottom slat only to be fed out of the hopper, and motor means for driving said slat feeding member across the bottom of said hopper in feeding and return strokes, means for supporting said stack of slats in said hopper with the bottom slat in said stack at proper vertical position despite the bowing of said bottom slat, said means comprising a pair of transversely spaced arms extending at least partially across the bottom of said hopper in a direction perpendicular to the broad faces of said stack, said arms being pivotally mounted on an axis generally parallel to and adjacent to the plane of one of the broad faces of said stack, and yieldable means urging said arms upwardly about their pivots, said yieldable means being sufficiently resistant to withstand the downward pressure of said stack of slats imposed in the plane of said broad face but sufficiently yielding to permit said arms to be pushed downwardly by the pressure of said stack of slats imposed at a distance from the plane of said broad face not exceeding one-half the width of said slats.

2. In a slat feeding apparatus of the type having a hopper for holding a generally vertical stack of slats, a slat feeding member mounted at the bottom of said hopper for movement in a direction parallel to the bottom of the stack and perpendicular to its broad faces, said slat feeding member having a hook portion shaped and positioned at such level as to engage the trailing edge of the bottom slat only in the stack, an exit opening in said hopper opposite the leading edge of said bottom slat, said opening being high enough to permit the bottom slat only to be fed out of the hopper, and motor means for driving said slat feeding member across the bottom of said hopper in feeding and return strokes, means for supporting said stack of slats in said hopper with the leading edge of the bottom slat in said stack in line with said exit opening whether or not said bottom slat is bowed, said means comprising a pair of transversely spaced arms extending at least partially across the bottom of said hopper in a direction perpendicular to the broad faces of said stack, said arms being pivotally mounted on an axis generally parallel to and adjacent the plane of the leading edges of the slats in said stack, and yieldable means urging said arms upwardly about their pivots, said yieldable means being sufficiently resistant to withstand the downward pressure of said stack of slats imposed in the plane of said leading edges but sufficiently yielding to permit said arms to be pushed downwardly by the pressure of said stack of slats imposed at a distance from the plane of said leading edges not exceeding one-half the width of said slats.

3. In a slat feeding apparatus of the type having a hopper for holding a generally vertical stack of slats, a pair of transversely spaced slat feeding members mounted at the bottom of said hopper for movement in a direction parallel to the bottom of the stack and perpendicular to its broad faces, each of said slat feeding members having a hook portion shaped and positioned at such level as to engage the trailing edge of the bottom slat only in the stack, an exit opening in said hopper opposite the leading edge of said bottom slat, said opening being high enough to permit the bottom slat only to be fed out of the hopper, and motor means for driving said slat feeding members across the bottom of said hopper in feeding and return strokes, means for supporting said stack of slats in said hopper with the leading edge of the bottom slat in said stack in the path of said hook portions regardless of bowing of said bottom slat, said means comprising an arm mounted on each of said slat feeding members for pivotal movement about a horizontal axis which is parallel to the broad faces of said stack and in approximately vertical alignment with said hook portions, said arms extending forwardly at least partially

across the bottom of said stack in a direction perpendicular to said broad faces, and the upper surfaces of said arms being positioned below the upper ends of said hook portions by a distance slightly less than the thickness of said slats, and springs urging said arms upwardly about their pivots, said springs being sufficiently strong to withstand without yielding the downward pressure of said stack of slats imposed on said arms at points immediately adjacent said hook portions but sufficiently yielding to permit said arms to bend downwardly under such pressure when imposed at points spaced forwardly thereof by distances not greater than one-half the width of said slats.

4. In a slat feeding apparatus of the type having a hopper for holding a generally vertical stack of slats, a pair of transversely spaced slat feeding members mounted at the bottom of said hopper for movement in a direction parallel to the bottom of the stack and perpendicular to its broad faces, each of said slat feeding members having a hook portion shaped and positioned at such level as to engage the trailing edge of the bottom slat only in the stack, an exit opening in said hopper opposite the leading edge of said bottom slat, said opening being high enough to permit the bottom slat only to be fed out of the hopper, and motor means for driving said slat feeding members across the bottom of said hopper in feeding and return strokes, means for supporting said stack of slats in said hopper with the trailing edge of the bottom slat in said stack in the path of said hook portions and with the leading edge of said bottom slat in line with

said exit opening, whether or not said bottom slat is bowed, said means comprising two pairs of transversely spaced arms extending at least partially across the bottom of said stack in a direction generally perpendicular to the broad faces of said stack, one pair of said arms being pivotally mounted on an axis generally parallel to and adjacent the plane of the leading edges of the slats in said stack, and the other pair being mounted on said slat feeding members for pivotal movement about axes generally parallel to the plane of the trailing edges of said slats and in approximate vertical alignment with said hook portions, and the upper faces of said arms being positioned below the upper ends of said hook portions by a distance slightly less than the thickness of said slats, and resilient means urging each of said arms upwardly about their respective axes, said resilient means being sufficiently resistant to withstand the downward pressure of said stack of slats imposed adjacent the respective axes, but sufficiently yielding to permit said arms to be pushed downwardly by the pressure of said stack imposed at distances from said axes not exceeding one-half the width of said slats.

References Cited in the file of this patent

UNITED STATES PATENTS

1,684,389	Ford	Sept. 18, 1928
1,728,454	Sterling	Sept. 17, 1929
2,560,327	Bergman	July 10, 1951