United States Patent

Murdoch et al.

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[45] **Oct. 10, 1972**

[54] **LUMBER BIN SORTER WITH GUIDE SLING AND TILTABLE BIN FLOOR**

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[52] **U.S. Cl.** .....**214/16 B,** 209/74, 214/6 H

[51] **Int. Cl.**.....**A24f 27/14,** B65g 47/18

[58] **Field of Search** .....214/16 B, 16 R, 6 H, 6 DK, 214/6 D, 8; 209/74, 125; 298/28, 27; 198/52, 53, 54

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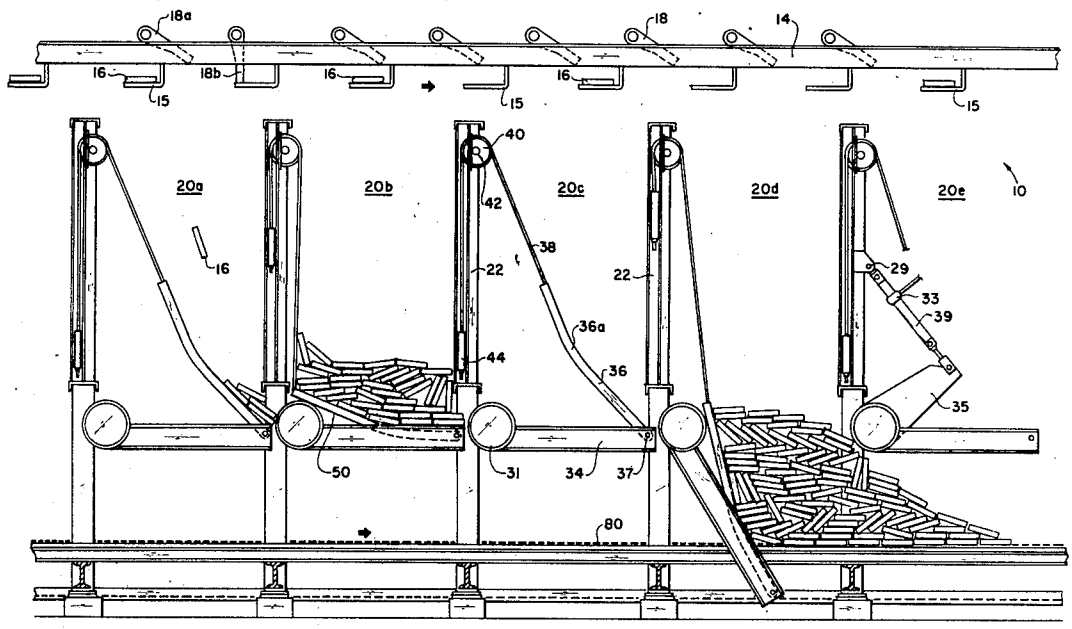
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[57] **ABSTRACT**

A lumber bin sorter, of the type having a multiplicity of bins to which graded lumber is carried by an overhead conveyor and ejected into designated bin locations, wherein each of the bins is provided with a rotatable torque tube member positioned at the bottom of the bin stall adjacent to and extending laterally of a bin wall. Projecting out horizontally from the periphery of the tube member are a plurality of laterally spaced girders bridging the space between adjacent bin walls and serving as a floor for the bin. At the extended end of certain of the floor girders is pivotally connected a counterweighted sling arm which angles upwards and serves to cushion the impact and guide the positioning of the initial boards dropping into an empty bin. The bin floor is held stationary in a horizontal position by a hydraulic latch securing in a retracted position a hydraulic actuator connected between the floor structure and the bin frame. As the bin fills up, the weight of the collected lumber pulls against the counterweight to gradually drop the sling arm in a vertical arc until eventually it assumes a substantially horizontal position resting against the tube member. When it is desired to empty a filled bin, the floor is allowed to start downward by the release of the latch on the actuator which in turn extends and allows the tube member to rotate about its axis, and pivot the floor downward, so as to form a bottom opening in the bin for gently depositing its contents onto a conveyor traveling underneath.

6 Claims, 3 Drawing Figures



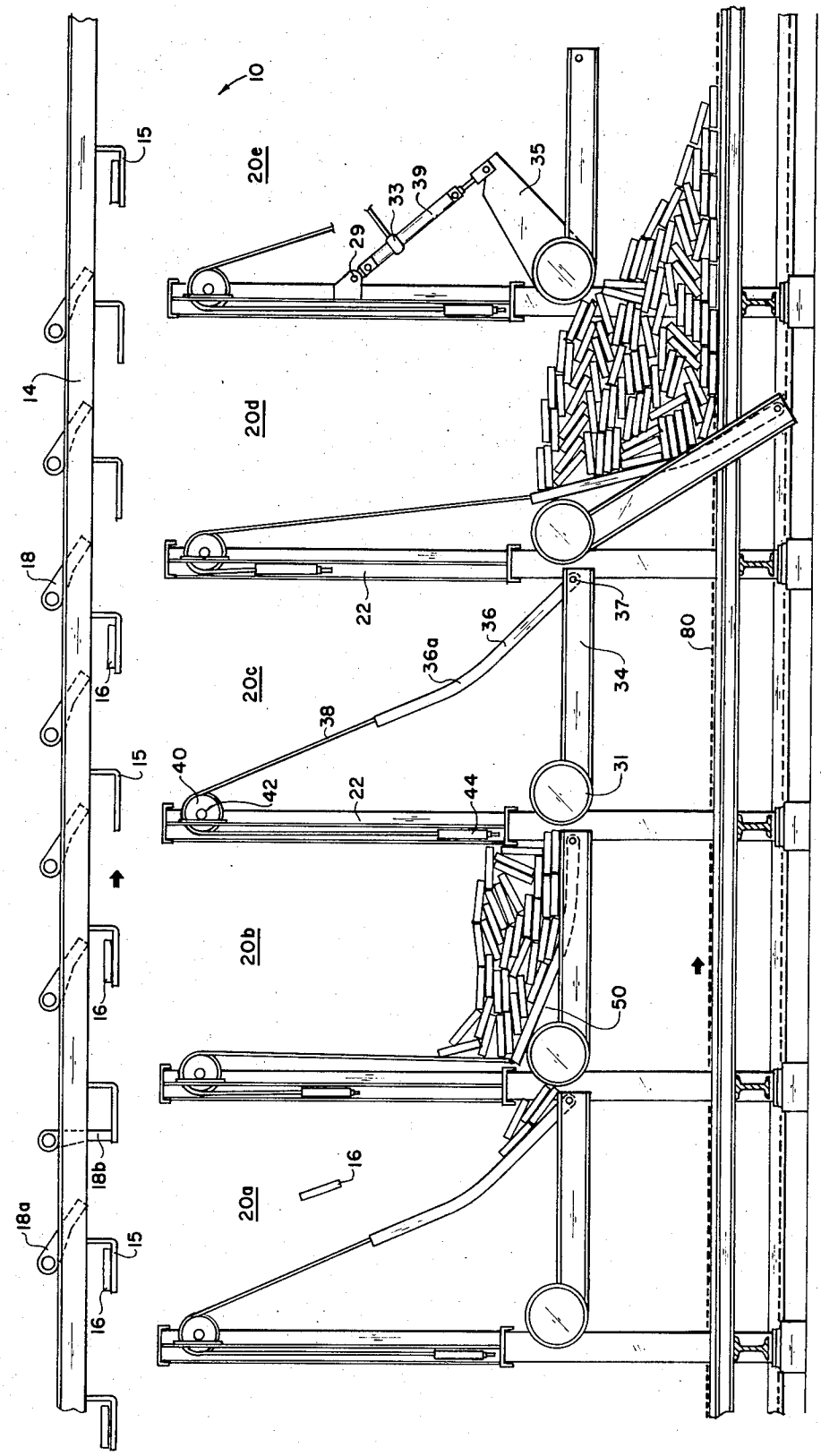

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20d
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FIG. 1

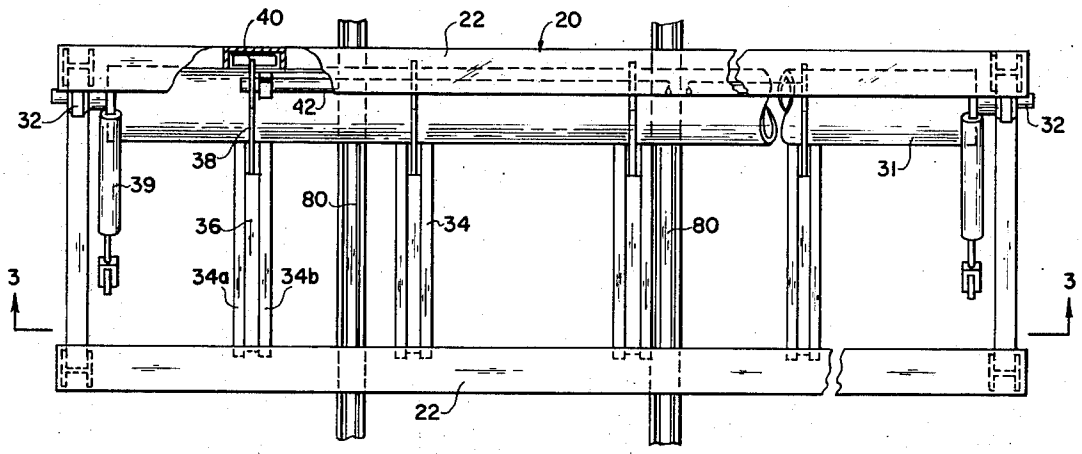

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34a
34b
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FIG. 2

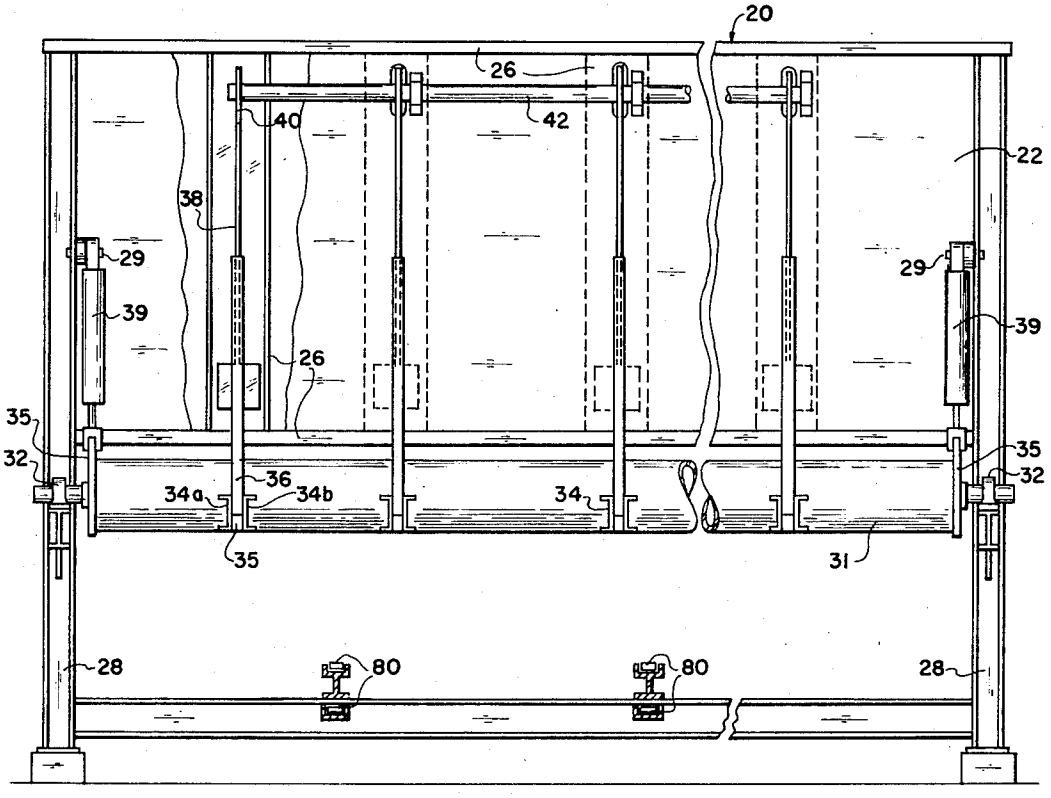

20
26
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80
80
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FIG. 3

LUMBER BIN SORTER WITH GUIDE SLING AND TILTABLE BIN FLOOR

BACKGROUND OF THE INVENTION

This invention relates to improvements in a bin sorter for lumber of the type wherein similar graded lumber is conveyed and dropped into a designated one of a multiplicity of bin storage locations. More specifically, the invention relates to a bin sorter of the type described wherein the individual bins are provided with a guide sling mechanism for cushioning the impact of the initial group of boards dropping into a bin so as to minimize damage to the lumber and for guiding the build-up of the lumber pile into a more uniform and compact formation, together with means for tilting the floor member of a filled bin so as to empty its contents through its bottom onto an underlying conveyor for removal to another location.

In lumber bin sorters of the type known to the art and shown for example in Boyle U.S. Pat. No. 3,254,764 and Rambo U.S. Pat. Nos. 2,902,150 and 2,998,133, assorted green lumber is conveyed on a horizontal path by an overhead conveyor and ejected, at the appropriate moment, to fall downward into a predetermined one of a plurality of receiving bins or bin locations assigned to a particular grade and dimension of lumber. Since the variations of lumber width, length, thickness, moisture content, specie, grade, and the combinations thereof, are considerable, a typical such sorter would possess a large multiplicity of bin locations, perhaps 20 to 50.

In conventional bin sorters of the type described, the first sticks of lumber dropped into an empty bin location typically fall through a distance of 7 to 8 feet onto a flat, hard floor of a trolley or buggy car, and consequently these initial boards frequently are damaged and degraded. Furthermore, because of the lengthy fall distance as the bin is initially filled, and the inevitably asynchronous operation of the ejection means which causes one end of the lumber to be dropped ahead of the other from the conveyor into the bin, the boards tend to randomly align or jackstraw so that the lumber pile does not build up uniformly and compactly in the bin. Finally, in lumber bin sorters of the conventional type employing buggy cars, emptying of the bin contents and their removal to another work station is a time-consuming process involving several workers to minimize downtime and expedite the operation, since it is required that the filled buggy originally positioned in the bin location be wheeled out, moved over the next station and the contents emptied, a second buggy wheeled in underneath the sorter to replace it, and a third buggy made ready for standby.

Accordingly, a real need exists in the industry for lumber drop sorter apparatus of economical and rugged construction which will overcome the aforementioned disadvantages of prior art devices.

SUMMARY OF THE PRESENT INVENTION

The present invention is directed to a bin sorter apparatus of the general type described in which each of the holding bins is provided with a floor support member which is normally maintained in the horizontal position but which can be tilted downward so as to form an opening in the bottom of the bin for emptying of its contents onto an underlying conveyor. Further,

each of the bin locations is provided with a counterweighted guide sling mechanism which cushions the impact of the initial group of boards falling into the bin so as to minimize the possibility of lumber damage or degrade, and which also serves to align the boards into a more uniform and properly oriented formation, resulting in a more compact filling of the bin.

The floor support member for the bin is comprised of a torque tube which is positioned at the bottom of the bin stall adjacent to and extending laterally of a bin wall and from which projects out horizontally a plurality of laterally spaced girders bridging the space between adjacent bin walls and serving as a floor for the bin. At the extended end of certain of the floor girders is pivotally connected a counterweighted sling arm which in the unloaded condition angles upward toward the opposite bin wall to serve as a cushion and guide for the initial group of boards dropping into an empty bin. As the bin loads up with boards, the weight of the collected lumber pulls against the counterweight, gradually dropping the sling into a vertical arc until eventually the sling arm assumes a substantially horizontal position with its distal end resting against the torque tube member. The action of the sling, in addition to cushioning the impact of the first boards dropped into the bin, serves also to guide them into proper and uniform alignment, i.e., parallel to the bin wall. Thereafter, with the sling arm dropped down to its fully-loaded horizontal position, there will then be a sufficient amount of lumber in the bin so that succeeding boards dropped onto the pile will automatically align properly with minimal tendency to assume a random or jackstraw arrangement.

Unloading of a filled bin is accomplished by first releasing a latching mechanism on a hydraulic actuator holding the floor girders in a horizontal position and then energizing the actuator element which, as it extends, causes the torque tube member to rotate about its longitudinal axis, thereby tilting the horizontal floor girders downward and gently dumping the bin contents onto an underlying conveyor where the sorted lumber can then be carried directly without intervention, to a stacker station for unscrambling, stacking and thereafter setting up into packages. The utilization of a conveyor to carry off the bin contents, rather than a buggy or trolley car as conventional, enables the individual bins of the sorter apparatus to be emptied and quickly replaced into service ready for refilling.

It is therefore a principal objective of the present invention to provide a new and improved bin sorter for lumber and like material which minimizes the possibility of damage or degrade of the material in the sorting process, builds up a more compact, uniform and aligned pile in the bin, and provides means for more rapidly emptying the filled bin, removing its contents to a subsequent work station and replacing the emptied bin back into operation with considerably less manpower required than with prior art drop sorter systems.

It is a principal feature of the present invention to provide a bin sorter of the type described wherein each of the bins is provided with a support floor which may be tilted downward to provide an opening in the bottom of the bin for dumping its contents onto a conveyor traveling underneath for removal to a remote work station.

It is a further feature of the present invention to provide means in a bin sorter of the type described for cushioning the impact of the initial group of boards dropped into a bin, so as to minimize damage and degrade of the material, and to guide the initial group of boards so that the pile builds up in the bin in a more uniform, properly oriented and compact formation.

The foregoing and other objectives, features and advantages of the present invention will be more readily understood upon consideration of the following detailed description of the invention, taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front sectional view depicting an illustrative embodiment of the lumber bin sorter apparatus of the present invention and showing several individual holding bins at different stages of operation.

FIG. **2** is a top plan view of an individual holding bin, exemplary of the multiplicity of such bins provided in the sorter apparatus of the present invention, with the overhead conveyor mechanism removed for purposes of clarity.

FIG. **3** is an end sectional view of an individual holding bin, taken along the line **3—3** in FIG. **2**.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1** initially, the bin sorter, designated generally as **10**, comprises an overhead conveyor mechanism **14** for delivering individual pieces of graded lumber to a point above a designated bin location and thereafter ejecting the lumber piece into its assigned bin **20**. In the fragmentary drawing of FIG. **1**, only five bin locations **20***a* . . . **20***e* are shown, but this is intended to be representative of a large multiplicity of such bin locations in a typical sorter embodiment. Upon emptying of a particular bin, for example bin **20***d*, the contents are dumped onto a conveyor **80** traveling underneath and thereafter carried to a remote work station for stacking or other operation.

Considering more particularly the major components of the bin sorter system, the overhead conveyor **14** is conventional and formed of a plurality of endless conveyor chains, from which are suspended sets of spaced carrier elements or J-bars **15** supporting individual boards **16** aligned transversely to the direction of travel of the conveyor (left to right in FIG. **1**). When a given board **16** is directly above its designated bin location, pivotal diverter elements **18** are caused to rotate down so as to be interposed in the path of the board travel (as shown at bin location **20***a*) and cause the board to slide off its associated carrier bar **15** as the conveyor continues its travel, thus ejecting the board into the assigned bin location. The operation of the respective diverter elements **18** at the appropriate moment to cause the boards to fall into their designated bin locations, so that an individual bin location contains only boards of similar type, is controlled by visual categorization by the operator as to species and grade and by appropriate sensors for automatically determining wood dimension and moisture content located at the infeed of the conveyor, together with associated memory and logic circuitry. Means for effecting the automatic operation of the diverter elements so as to eject boards into their designated bin locations are well known to the art, as shown for example in Davies U.S. Pat. No. 3,495,707, and form no part of the present invention. In the illustrative embodiment of the invention shown, two sets of diverter elements **18***a*, **18***b* are provided at each bin location, one near the front wall of the bin and the other toward the rear, and their actuation alternated so that successive boards are ejected from the conveyor first near one wall, then near the other wall, so as to improve the uniform buildup of the pile in the bin.

Referring now to FIGS. **2** and **3** in addition to FIG. **1**, an individual bin location **20** is in the form of a stall having spaced front and rear walls **22** mounted on a skeletal frame **26** and carried on support stanchions **28**. The bottom edge of each wall **22** is elevated above ground to provide adequate clearance for a loaded chain conveyor **80** passing underneath.

A structural torque tube member **31** extending the full width of the bin stall is pivotably supported on both ends on bearings **32** mounted on the stationary frame of the assembly. Welded to the periphery of the tube member **31** and projecting out therefrom are a plurality of girders **34** bridging across the space between adjacent bin walls **22**. The girders are spaced, typically on 4-foot centers, along the width of the tube with perhaps four to six girder elements per bin depending upon the maximum length of the boards being handled. A pair of hydraulic actuators **39** are pivotably connected at **29** to the vertical support stanchions **28** and have their free ends respectively connected to a pair of radial lever arms **35** attached at each axial end of the torque tube member **31**. A hydraulic latch **33** is provided on each of the actuators for restraining them in the retracted position so as to maintain the floor girders **34** in a horizontal position supporting the weight of the lumber load. Upon release of the latching mechanism and actuation of the normally retracted cylinder of each of the actuators **39**, through the medium of appropriate hydraulic flow lines, their respective rod portions extend, causing the associated lever arm **35** to pivot the torque tube member **31** and consequently cause the floor girders mounted thereon to drop gradually downward. The actuators **39** may be of the variable rate type so that the speed of descent of the tilting bin floor is a function of the weight of the accumulated lumber, thereby ensuring the gentle deposit of the bin contents onto the underlying conveyor without damage to the product.

In the following description, reference will be made to the construction and operation of a single floor girder **31** and its associated sling, it being understood that in each bin stall there are a plurality of such girders which operate in unison. The girder is preferably formed from a pair of channel elements **34***a*, **34***b* welded to the tube wall with their backs together and slightly spaced from each other to form an approximate H-shaped cross section with a longitudinally extending opening **35** formed between the opposed backs of each channel pair. The opening **35** between the channel pairs **34***a*, **34***b* forming the floor girder provides clearance for a rod arm **36** which is pivotably connected by pin **37** to the extremity of the girder. The distal end of the rod arm **36** connects with a roller chain **38**, forming a sling, which is fed over a sprocket gear **40** mounted on a shaft **42** (mounted near the top

of the bin wall and common to all of the girder slings in a bin stall so as to maintain them in uniform alignment), and then to an associated counterweight **44**.

In the unloaded position, with no weight of lumber on the sling formed by the rod arm **36** and the associated chain **38**, the sling is pulled upward by its counterweight **44** so as to assume the maximum raised position depicted at bin location **20***c*. As the first lumber boards are dropped into the bin, they impact against the yieldable sling elements, associated with the girders forming the floor of the bin stall, which cushion their contact so as to minimize the likelihood of damage to the boards. After contacting the set of slings, the boards slide downwardly along the rod arm **36** to the crevice formed between the near end of the rod arm and the adjacent bin wall **22**, as depicted at bin location **20**a. In addition to the cushioning effect provided by the sling formed of the rod arm **36** and its associated roller chain **38**, the sling arrangement also serves the important function of guiding these first boards into the crevice so as to assume the desired alignment with the boards' long dimensions oriented uniformly in a parallel position, thereby preventing the random scattering or jackstraw pile buildup which might otherwise occur.

As the sling commenced to load up with boards, the weight of the collected lumber pulls against the counterweight **44** gradually dropping the sling in a vertical arc under each succeeding board until eventually the weight of the counterweight is fully overcome and the rod arm's distal end rests against the torque tube member **31**, as depicted at bin location **20***b*.

A crook or angled bend **36***a* is preferably provided proximate the center of the rod arm **36** thereby permitting the near portion of the arm to assume a substantially horizontal position when the lumber load builds up to the point where the distal end of the rod rests against the periphery of the torque tube, thus maximizing the utilization of the area of the bin stall for lumber storage. With a crooked arm configuration for the rod arm, only the relatively small triangular region, indicated as **50** at bin location **20***b*, is unavailable for storage; in contrast, with a straight rod arm a much greater triangular area above the plane formed by the horizontal floor girders would be rendered unavailable for lumber storage.

At the point in the loading process when the rod arm drops down under the weight of the boards to rest against the torque tube member there is then a sufficient amount of lumber in the bin stall so that succeeding boards dropped onto the pile will automatically orient properly with a minimal tendency to misalign. Thereafter succeeding boards dropped onto the pile build up in height until the bin approaches a fully loaded condition.

When the bin is full, as determined by a counter mechanism of conventional design counting the individual pieces of lumber falling into each bin, the bin is then ready for dumping upon the receipt of an actuating "bin dump" signal supplied by an operator. In unloading a filled bin, the actuators **39** are energized so as to cause the cylinder rod to extend against the lever arm **35**, serving to rotate the torque tube member **31** and cause the floor girders **34** to tilt gradually downward to the dumping position depicted at bin location **20**d. As the floor girders lower slowly downward under control of the hydraulic actuator mechanism **39**, the lumber boards resting thereon are gently dumped onto the horizontal chain conveyor **80** traveling beneath the bin stall. (The floor girders **34** are interdigitally spaced between the series of chains forming the outfeed conveyor **80** so as to permit the girders to pass beneath the plane of the conveyor.) The boards are quickly carried off by the conveyor away from the bin stall and onward to a subsequent station. Thereafter, with the contents of the bin now emptied, the action of the hydraulic actuator **39** is reversed to cause the piston arm to retract, thereby rotating the torque tube member **31** in the reverse direction so as to restore the floor girders to the horizontal position ready to receive a new supply of boards in the next cycle of bin filling. By virtue of the unique drive mechanism for tilting the bin floor operating in conjunction with the outfeed conveyor arrangement, the dumping and removal of the bin contents and the restoration of the bin ready for refilling is carried out extremely quickly and may be effected automatically following the initiation by the operator of the "bin dump" signal.

The terms and expressions which have been employed in the foregoing abstract and specification are used therein as terms of description and not of limitation, and there is no intention, in the use of such terms and expression, of excluding equivalents of the features shown and described, or portions thereof, it being recognized that the scope of the invention is defined and limited only by the claims which follow.

What is claimed is:

1. A lumber bin sorter apparatus comprising: an overhead conveyor carrying individual pieces of graded lumber and ejecting pieces of like character into a designated one of a multiplicity of bin storage locations, certain of said bin storage locations being formed by a pair of spaced walls together with a floor member for supporting lumber pieces dropping into said bin location, said floor member having yieldable sling means positioned thereabove for cushioning the impact of the initial group of boards dropping into the bin, said sling means being comprised of a spaced plurality of rigid arm members each pivotably connected at one end to said floor member and whose respective other end is connected by cable means to a counterweight, whereupon the position of said arm members at any given stage during the filling of said bin is determined by the opposing forces of said counterweight and the weight of the lumber then resting on said arm members.

2. A lumber bin sorter apparatus comprising: an overhead conveyor carrying individual pieces of graded lumber and ejecting pieces of like character into a designated one of a multiplicity of bin storage locations, certain of said bin storage locations being formed by a pair of spaced walls together with a floor member for supporting lumber pieces dropping into said bin location, said floor member being formed of a plurality of girders projecting out in cantilever fashion from and axially spaced along a torque tube member mounted for rotation about its longitudinal axis, and aligned parallel and adjacent to one of said pair of bin walls, said torque tube member being substantially the sole means of attachment and support for said girders; actuator means coupled to said torque tube member by

radially extending lever arm and in the quiescent condition maintaining said torque tube member in a position wherein said girders are substantially in a horizontal position but upon energization of said actuator means said torque tube member rotates at a controlled rate causing said floor member to tilt downward at a gradual rate of descent in a vertical arc forming an opening at the bottom of said bin for gently discharging the contents thereof onto an underlying surface.

3. A lumber bin sorter apparatus comprising: an overhead conveyor carrying individual pieces of graded lumber and ejecting pieces of like character into a designated one of a multiplicity of bin storage locations, certain of said bin storage locations being formed by a pair of spaced walls together with a floor member for supporting lumber pieces dropping into said bin location, said floor member being formed of a plurality of girders projecting out from and axially spaced along a torque tube member aligned parallel and adjacent to one of said pair of bin walls with certain of said girders being provided with sling means in the form of a rod arm pivotally connected at one end to the extremity of said girder and whose other end is connected by cable means to a counter weight which urges said rod arm to assume an upwardly angled position, said torque tube member being mounted for rotation about its longitudinal axis and coupled to actuator means, said actuator means in the quiescent condition maintaining said torque tube member in a position wherein said girders are substantially in a horizontal position but upon energization of said actuator said torque tube member rotates causing said floor member to tilt downward in a vertical arc forming an opening at the bottom of said bin for discharging the contents thereof.

4. The sorter apparatus of claim 3 wherein said counterweight is selected so that said rod arm gradually pivots downward under the increasing weight of successive boards dropped into said bin until it comes to rest with its free end bearing against said torque tube member.

5. The sorter apparatus of claim 4 further characterized in that said rod arm is of crooked configuration such that when its free end comes to rest against said torque tube member the major portion of its length is co-planar with or beneath the upper surface of its respective girder.

6. The sorter apparatus of claim 3 further characterized in that said floor girders are formed respectively of a pair of longitudinal channel members spaced slightly apart between which the pivot end of said rod arm is sandwiched at the extremity of the girder.

* * * * *