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**United States Patent  
Stone****8,341,887  
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Plantation fan top window shutter

**Abstract**

A plantation window shutter comprises a frame and a plurality of shutter blades pivotably supported by the frame in a fan configuration. The frame comprises a front surface and a rear surface. The rear surface has a plurality of upper grooves and a plurality of lower grooves, each upper groove being axially aligned with a respective lower groove. Each of the shutter blades has a longitudinal pivotal axis and a top pivot and a bottom pivot aligned along the axis, the top pivot and the bottom pivot being received in respective upper groove and the lower groove for pivotal motion therein. At least one member is attached to the rear surface disposed to bridge over the upper grooves and the lower grooves, thereby to capture the top and bottom pivots within respective the upper grooves and the lower grooves.

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9. A plantation window shutter as in claim 8, wherein said attachment portion and said correspondingly shaped slot is T-shaped in cross-section.
10. A plantation window shutter as in claim 8, wherein said attachment portion includes a flange portion disposed over said correspondingly shaped slot when said attachment portion is received within said correspondingly shaped slot.
11. A plantation window shutter as in claim 1, wherein: a) each of said shutter blades includes left and right longitudinal edges, one of said edges includes a lower recess and the other of said edges includes an upper recess; and b) said shutter blades are secured to said frame such that an interior shutter blade has its left and right edges overlap, respectively, an adjacent shutter blade right edge and another adjacent shutter blade right edge.
12. A plantation window shutter as in claim wherein each of said upper pivots includes a spacer washer.
13. A plantation window shutter as in claim 1, wherein: a) each of said bottom pivots includes a gear fixedly attached thereto; b) a rotatable plate having a gear track in meshing engagement with each gear; and c) said plate includes a knob disposed outside said at least one member such that turning said knob causes rotation of each gear, thereby to open or close said shutter blades.
14. A plantation shutter as in claim 1, wherein said upper portion is arcuate.
15. A plantation shutter as in claim 1, wherein said upper portion is angular.
16. A plantation window shutter, comprising: a) a frame and a plurality of shutter blades pivotably supported by said frame in a fan configuration; b) said frame comprising a first member and a second member attached together, said first member and said second member being substantially identical in shape; c) said first member having a rear surface and said second member having a front surface facing said rear surface; d) one of said rear and front surfaces having a plurality of upper grooves and a plurality of lower grooves, each upper groove being axially aligned with a respective lower groove; and e) each of said shutter blades having a longitudinal pivotal axis and a top pivot and a bottom pivot aligned along said axis, said top pivot and said bottom pivot being received in respective upper groove and said lower groove for pivotal motion therein.
17. A plantation window shutter as in claim 16, wherein: a) each of said top and bottom pivots includes an attachment portion and a pivot portion; and b) said attachment portion is received in a correspondingly shaped slot in a respective shutter blade.
18. A plantation window shutter as in claim 17, wherein said attachment portion and said correspondingly shaped slot is T-shaped in cross-section.

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### *Description*

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#### FIELD OF THE INVENTION

The present invention relates generally to a window shutter and a method of making the same and particularly to an indoor plantation fan top window shutter.

#### BACKGROUND OF THE INVENTION

Plantation fan top window shutters are currently built by hand by trained craftsmen. Manufacturers of window shutters use a variety of wood working hand tools, complex formulas and highly trained expensive craftsmen. The present invention provides additional ways for manufacturing plantation top window shutters that reduce costs, improve quality, and reduce dramatically the time it takes to build them.

#### SUMMARY OF THE INVENTION

The present invention provides a plantation window shutter, comprising a frame and a plurality of shutter blades pivotably supported by the frame in a fan configuration. The frame comprises a front surface and a rear surface. The rear surface has a plurality of upper grooves and a plurality of lower grooves, each upper groove being axially aligned with a respective lower groove. Each of the shutter blades has a longitudinal pivotal axis and a top pivot and a bottom pivot aligned along the axis, the top pivot and the bottom pivot being received in respective upper groove and the lower groove for pivotal motion therein. At least one member is attached to the rear surface disposed to bridge over the upper grooves and the lower grooves, thereby to capture the top and bottom pivots within respective the upper grooves and the lower grooves.

The present invention also provides a method for manufacturing a plantation window shutter comprising a frame made of two substantially identical members attached together and a plurality of shutter blades pivotably supported by said frame, the method comprising the steps of providing shutter blade pivots with shaft portions and attachment portions; providing at least one sheet material; cutting the at least one sheet material with a CNC router machine to the shape of the frame members and the shutter blades; cutting grooves in one of the frame members with the CNC router machine to receive the shaft portions; cutting slots at each end of the shutter blades with the CNC router machine to receive the attachment portions; and assembling the frame members and the shutter blades.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front perspective view of window shutter embodying the present invention.

FIG. 2 is rear perspective view of FIG. 1.

FIG. 3 is an assembly view of the shutter shown in FIG. 1.

FIG. 4 is a rear view of the front member of the frame shown in FIG. 3.

FIG. 5 is a cross-sectional view taken along line 5-5 in FIG. 4.

FIG. 6 is a perspective assembly view of a shutter blade.

FIG. 7 is a cross-sectional taken along line 7-7 in FIG. 6.

FIG. 8 is a cross-sectional view taken along line 8-8 in FIG. 2.

FIG. 9 is a cross-sectional view of an alternate embodiment taken along line 9-9 in FIG. 2.

FIG. 10 is a cross-sectional view taken along 10-10 in FIG. 2.

FIG. 11 is a front perspective of another embodiment of the shutter shown in FIG. 1.

FIG. 12 is a front view of the shutter of FIG. 11.

FIG. 13 is a cross-sectional view taken along line 13-13.

FIG. 14 is a perspective schematic view of a CNC router machine used in making the shutter of FIG. 1.

FIG. 15 is a functional block diagram of a system used in making the shutter of FIG. 1.

FIG. 16 is a flowchart of a system used in making the shutter of FIG. 1.

FIGS. 17(a)-17(i) show the various exemplary input displays for entering window measurements.

FIGS. 18(a)-18(b) illustrate matching the width of a rectangular window shutter blade with the outer width of a shutter blade of FIG. 1.







the measurement provided at step 88.

Examples of the various shutter drawings generated and provided to the operator to show the shutter configuration based on the input at step 88 is shown in FIGS. 21(a)-21(k). The drawings advantageously provides a visual confirmation for the operator of the correct type of shutter ordered before cutting the component parts from the board.

The G-code machine file 94 is standard G-code software used for motion control of the cutting tool of the router machine 76 that does the actual work. The G-code machine file 94 includes router tool selection, machine feed rates, tool speeds, tool paths and cutting depths. The G-codes direct the machine actions, such as rapid move; controlled feed move in a straight line or arc; series of controlled feed moves for boring holes; cutting a workpiece to a specific dimension; cutting a decorative profile shape to the edge of a workpiece; change tool; etc. The generation of G-codes for driving the router machine 76 are well known in the art. The G-codes may be generated using a standard drawing software package, such as AUTOCAD, available from Autodesk, Inc., 111 McInnis Parkway, San Rafael, Calif. 94903 and a standard G-code generating software package, such as ALPHACAM, available from Planit Solutions, Inc., 3800 Palisades Drive, Tuscaloosa, Ala. 35405. For example, referring to FIGS. 22(b)-22(g) and FIGS. 23(a)-23(f), each figure is generated by the drawing software, which is then converted by the G-code generating software into a G-coded machine file that will drive the router machine 76 to cut the various pieces for the shutter. The G-coded machine file is sent to the router machine computer 78 using standard connections, such as the Internet or other network connections.

The generation of the G-coded machine file 94 may also be automated by storing a database of G-code files that would be used in cutting any type and size of shutter for which the system is designed. These G-code files include all the necessary machine operations, such as the tool path, tool selection, depth of cut, tool rpm, feed speed, etc. for cutting the parts for any type and size of shutter stored in the system. Data on the dimensions of the ordered shutter, including the number of shutter blades, the hub portion size and any frame deduction generate a drawing file comprising several layered views. Each view is then associated with the appropriate G-code files already stored in the system. All the selected G-code files for all the views are then sent to the router machine computer 78 via the internet or other network connections.

The cutting process will now be described with reference to a half-circle shutter generally shown in FIG. 21(a). The various reference numerals used in describing the shutter 2, which is a half-circle with legs, will also be used for the same parts in describing the process for the half-circle shutter. The shutter in this example has 16 shutter blades and will require two 4 ft..times.8 ft..times.1/2 in. PVC boards.

The first board will provide the front member 6 of the frame 4 and eight shutter blades 10. Referring to FIGS. 22(a)-22(g), a 4 ft..times.8 ft. PVC board 128 is placed on the table surface 77 of the CNC router machine 76. Referring to FIG. 22(b), a V-cutting tool is used to make a decorative groove 130, typically 1/8 in. deep. At a different depth less than the thickness of the board, for example 1/4 in., the cutting tool cuts the inner edge 132 (see FIG. 3) of the front member 6 with a bevel chamfer cut. Referring to FIG. 22(c), a straight cutting tool is used to cut the top recesses 58 of the shutter blades 10 at 1/4 in. deep, which is half the thickness of the board. The same tool is used to drill four indexing holes 134. Referring to FIG. 22(d), using a T-shaped cutting tool, the slots 40 at the top portion 16 and the bottom portion 18 of the shutter blades 10 are cut.

Referring to FIG. 22(e), the board 128 is then turned over and secured to the indexing pins 82 through the indexing holes 134. The surface of the board does not show any cuts, since the cuts done on the previous steps were only made partway through the thickness of the board. A straight cutting tool is used to cut the recesses 60 on the respective opposite edge of the shutter blades 10 at 1/4 in. deep. The groove 34 (see FIG. 3) is also cut, typically at 1/16 in. deep for a 1/2 in..times.1/2 in. washer 50. Referring to FIG. 22(g), using the same straight cutting tool, the ledge 32 (see FIG. 3) is cut. The cutting tool then goes through the thickness of the board, cutting around the inner edge 132, the outer edge 136 (see FIG. 3), and the outer edges of the shutter blades 10. This final cut separates the various components from the board 128.

Referring to FIGS. 23(a)-23(g), a second board is used to make the 8 shutter blades 10 and the rear member 8 of the frame 4. Referring to FIG. 23(a), using a V cutting tool, the inner edge 140 (see FIG. 3) is cut partway through the thickness of the board, typically at 1/4 in. deep. A decorative bead groove, for example

at 1/8 in. deep, is also cut with the same tool. Referring to FIG. 23(b), a straight cutting tool is used to cut the top recesses 58 of the shutter blades 10 to a depth half the thickness of the board, in this case, 1/4 in. deep. The same tool is used to drill four indexing holes 144. Referring to FIG. 23(c), using a T-shaped cutting tool, the slots 40 at the top portion 16 and the bottom portion 18 of the shutter blade 10 are cut.

Referring to FIG. 23(d), the board 138 is then turned over and secured to the indexing pins 82 through the indexing holes 144. The surface of the board does not show any cuts, since the cuts done on the previous steps were made only partway through the thickness of the board. Referring to FIG. 23(e), a straight cutting tool is now used to cut the recesses 60 on the respective opposite edge of the shutter blades 10 at the same depth as the recesses 58. The upper grooves 24 and lower grooves 26 are also cut with the same tool, for example at 1/4 in. and 5/16 in. deep, respectively, for 1/4 in. shaft portions 42. The slots 28 for the washers 50 are also cut, for example 5/16 in. deep. The various tool paths are programmed at different depths as appropriate. Referring to FIG. 23(f), the same straight cutting tool cuts through the thickness of the board, cutting around the inner edge 132, the outer edge 146 (see FIG. 3), and the outer edges of the shutter blades 10. This final cut separates the various components from the board 138.

The various parts are then assembled, as shown in FIG. 3.

Referring to FIGS. 24(a)-24(f), another example of a cutting process for making a shutter embodying the present invention is disclosed. The shutter of this example has the upper grooves 24 and the lower grooves 26 disposed on both the front member 6 and the rear member 8. For a 1/4 in. diameter shaft portion 42, the depth of the grooves 24 and 26 would be about 1/8 in. In this example, the shutter 2 is small enough so that a single board would be sufficient to provide all the components. The shutter of the example has 12 shutter blades.

Referring to FIGS. 24(a) and 24(b), a board 148 is placed on the table 77 of the CNC router machine 76. Decorative bead grooves 150 are cut on the front member 6 and the rear member 8 with a V-cutting tool. The inner edge 132 of the front member 6 and the inner edge 140 of the rear member 8 are cut to a depth less than the thickness of the board, which in this example is 1/4 in. deep for a 1/2 in. thick board. The V-cutting tool used provides a chamfer edge to the edges. The recesses 60 of the shutter blades 10 are then cut with a straight cutting tool.

Referring to FIG. 24(c), the slots 40 at the top portion 16 and the bottom portion 18 of each shutter blade 10 are cut with a T-shaped cutting tool. The recess 58 for each shutter blade 10 is cut with straight cutting tool to a depth of 1/4 in., which is half the thickness of the board in this example. Referring to FIG. 24(d), the upper grooves 24 and the lower grooves 26 are cut. The upper grooves 24 are cut to a depth of 1/4 in. for a shaft portion 42 of 1/4 in. diameter. The lower grooves 26 are cut to a depth of 5/16 in. to provide clearance for the shaft portion 42 when the washer 50 is compressed within the slot 28. Referring to FIG. 24(e), the slots 28 for the washers 50 are cut to a depth of 7/16 in. for a square washer about 1/2 in. times 1/2 in. outside dimension. The groove 34 is also cut to a depth of 1/16 in. The groove 34 lines up with the slots 28 to provide a total depth of 1/2 in. to the washers 50 and allow for a compression fit. Referring to FIG. 24(f), the shutter blades 10 are cut through along their outer edges. The front member 6 and the rear member 8 are also cut through along their outer and inner edges. The separated components are then assembled.

Referring to FIG. 25, the individual slots 28 may be cut into one continuous slot 160. Referring to FIG. 26, the individual washers 50 may be made a from a longitudinal member 162 having a linear series of holes 164, each being hole spaced apart to accommodate the respective shaft portions 42 of the bottom pivots 20. The continuous slot 160 may also be used with the individual washers 40.

Referring to FIG. 27, another embodiment of a frame 166 for the shutter 2 is disclosed. The frame 166 consists of a member 168 and cover members 170 and 172. The member 168 includes the upper grooves 24, the lower grooves 26 and the slots 28. The member 168 has recesses 174 and 176 configured to receive the cover members 170 and 172, respectively, and be attached thereto by standard means, such with glue or screws, thereby bridging over the grooves. The thickness of the cover members 170 and 172 is sized to the depth of the recesses 174 and 176 for a flush fit. The cover member 170 and 172 are used to capture the shaft portions 42 disposed within the grooves 24 and 26.

While this invention has been described as having preferred design, it is understood that it is capable of

further modification, uses and/or adaptations following in general the principle of the invention and including such departures from the present disclosure as come within known or customary practice in the art to which the invention pertains, and as may be applied to the essential features set forth, and fall within the scope of the invention or the limits of the appended claims.

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