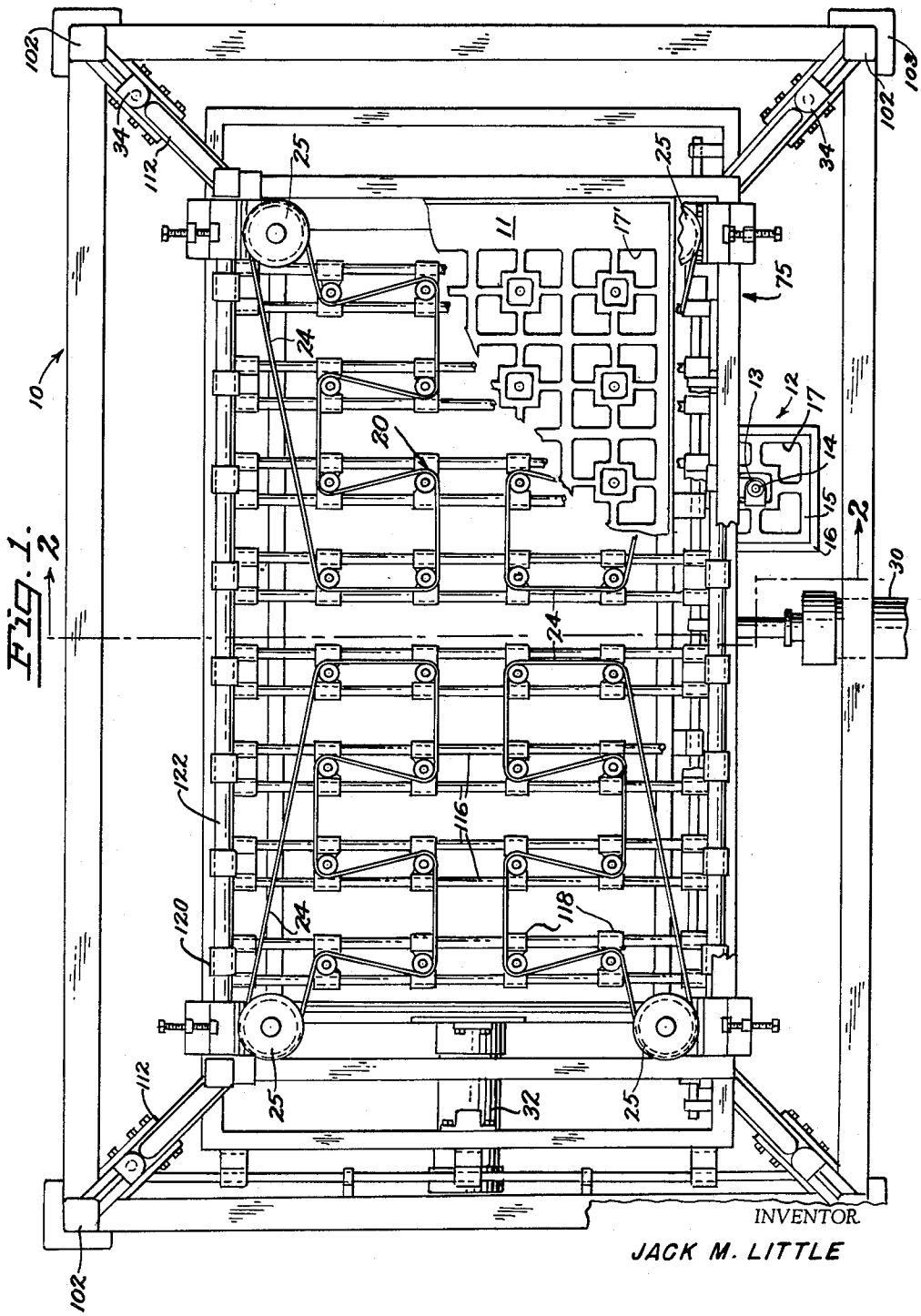
May 18, 1965 J. M. LITTLE 3,183,780

DECORATIVE DESIGN CARVING MACHINE

Filed Sept. 23, 1963 5 Sheets-Sheet 1



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DECORATIVE DESIGN CARVING MACHINE

Filed Sept. 23, 1963 5 Sheets-Sheet 2

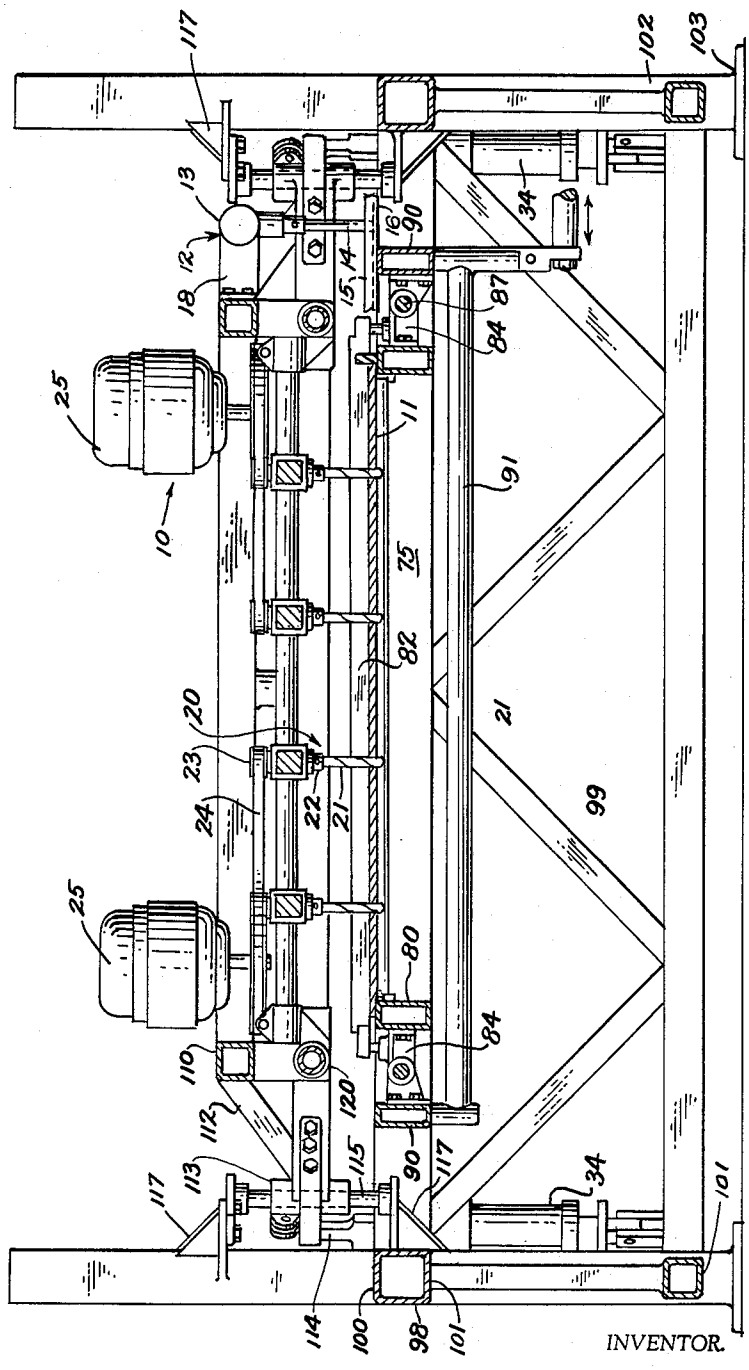


Fig. 2.

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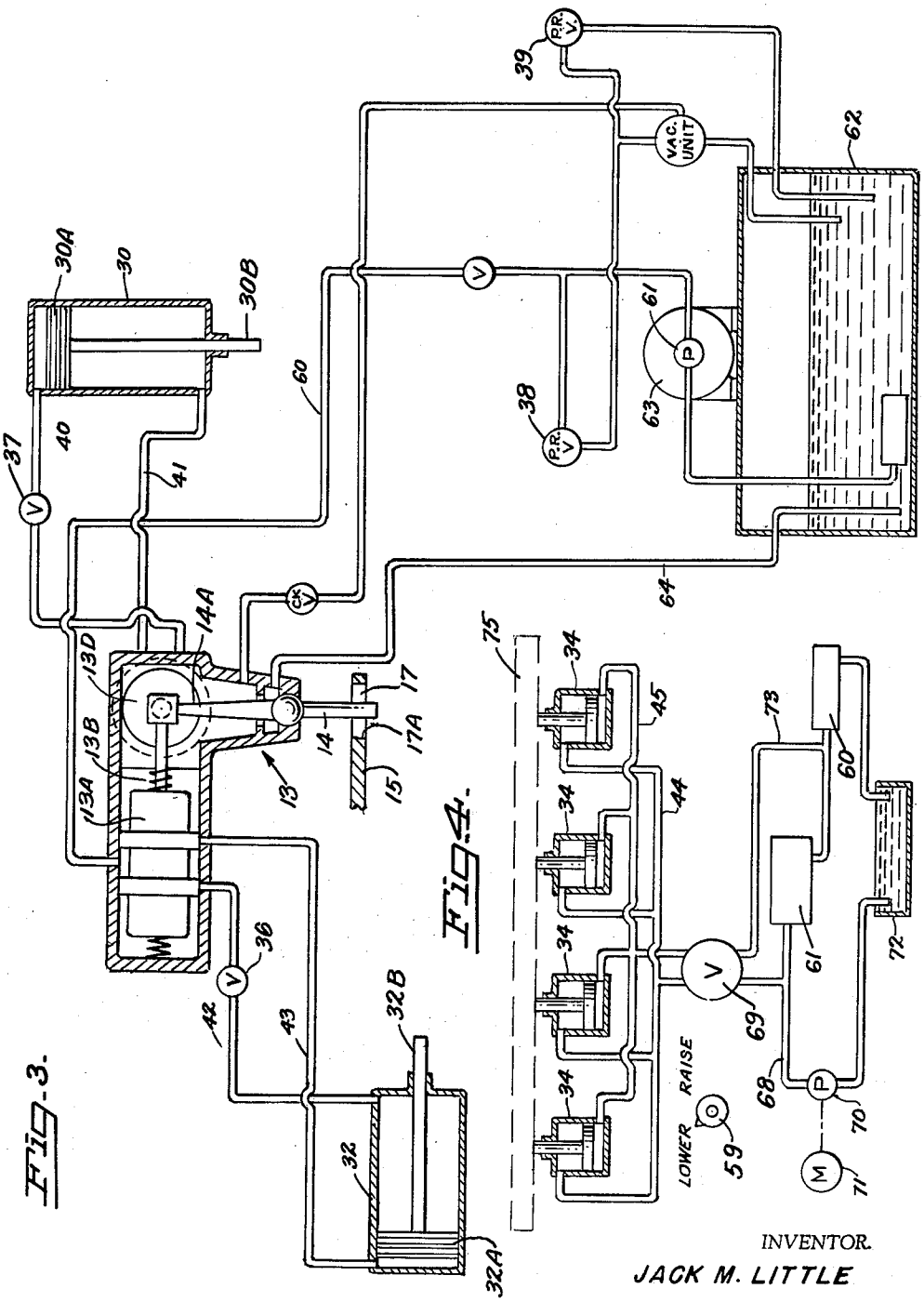


Fig. 3.

Fig. 4.

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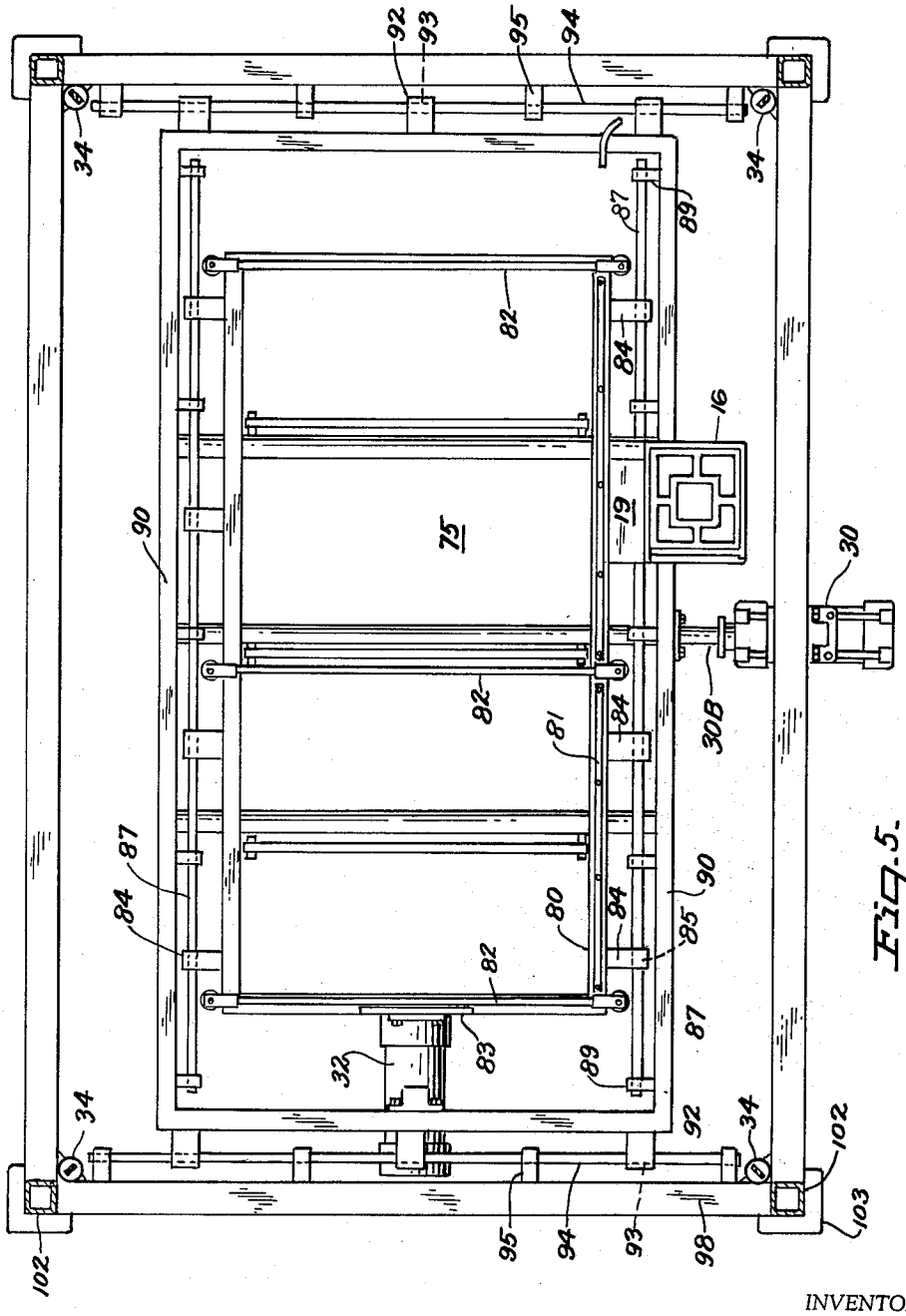


Fig. 5.

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Fig. 6

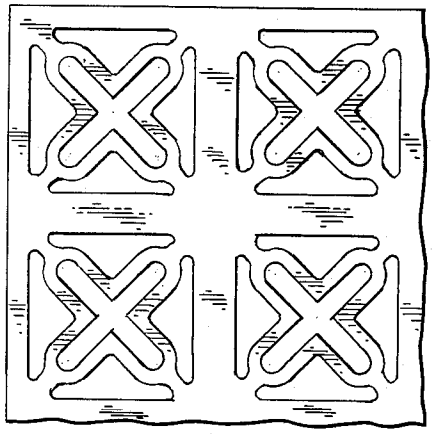


Fig. 7

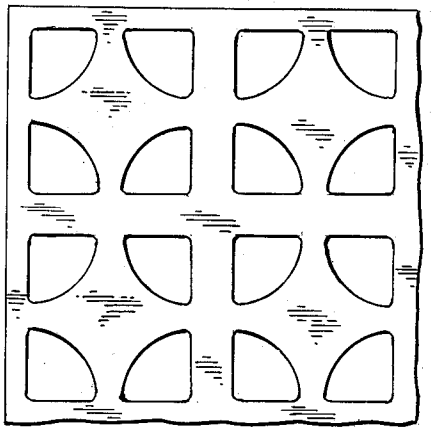


Fig. 8

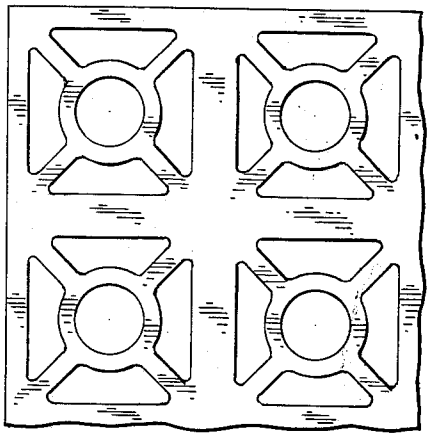
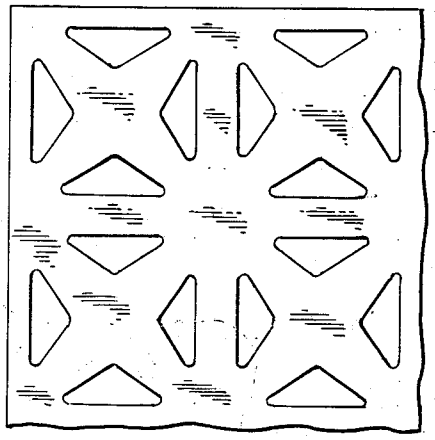


Fig. 9



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3,183,780

DECORATIVE DESIGN CARVING MACHINE

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Filed Sept. 23, 1963, Ser. No. 310,554
2 Claims. (Cl. 90—13.2)

This invention relates to apparatus for pierced wood carving to form a decorative building panel. More particularly, it relates to a machine for cutting multiply repeated silhouette or profile figures in a panel to form a decorative design useful as walls or screens in buildings with Moorish motif.

It is a particular object of this invention to provide a machine that in a continuous operation can carve a multiply repeated design in one or more sheets of building board, such as plywood, chipboard, or pressed wood, in a single, or at most two or three, tracings of a pattern.

In accordance with a preferred form of the invention, a pattern, containing the figure that forms the multiple modules of the design, is supported so that its outline can be traced by a stylus. When the stylus is moved to contact the pattern outline, hydraulic control signals are generated that represent the position of the stylus on the figure. These signals in turn control the position of a board support so that a board, or a plurality of boards, stacked one on top of the other, moves in a plane perpendicular to a plurality of cutters, such as routers or milling heads. These heads are spaced over the plane of the board and are at fixed locations. Each location is desirably one of the individual modules of the design, and these locations cover fixed, and preferably nonoverlapping, areas on the board. In a standard 8- by 4-foot building board, 32 areas are usually selected, so that squares of one foot by one foot form the modules of the design. If desired, more intricate designs can be cut by using multiples of these areas, such as 64, 128, etc With all cutting heads being driven simultaneously, and the board moved in direction and magnitude of motion to follow the outline of a single figure, the entire panel (or panels) is cut in a single operation.

In a preferred form, the stylus support unit is held stationary and the pattern is mounted for movement by and with the support means for the board, so that as the board is being cut the position of the multiple cutting heads in their respective modules is fed back to the pattern. In this way the stylus and cutters are at all times in registry at similar positions on the figures of the pattern and the modules.

Multiple boring machines for cutting dowel pin holes in boxes or to form hydraulic fluid passages in valves have been known before. These machines frequently include means for programming the boring operations. Likewise, machines for carving wood bodies to reproduce patterns in moldings, blocks, rods, and the like are known. Additionally, checkering or scoring machines are known for engraving, or marking, the surfaces of building boards with given curved or straight lines or relatively simple configurations. However, none have been capable of producing silhouette designs of the type made possible with my machine. In fact the only known way, heretofore, to produce decorative panels with multiply repeated modules of the same cut-out configuration in a building board has been to inscribe or mark each sheet with each of the multiple modules, and then cut each one by hand with a portable router.

It is accordingly a primary object of my invention to provide a machine that quickly and accurately reproduces the pierced wood modules in multiple positions on a board, to form outlined, or profiled, cut outs in a decorative panel. Such panels can thus be made available at cost not greatly

in excess of the cost of an unadorned panel. The major uses of such panels are as room dividers, partitions, walls, doors, windows, or as decorative backgrounds either indoors or outdoors.

Other objects and advantages of my invention will become apparent from the following detailed description when taken with the accompanying drawings, which form an integral part of this specification.

In the drawings:

FIGURE 1 is a top plan view of a preferred form of my machine, partially cut away to show a plurality of modules in a building board cut to form a decorative panel, of the type shown in the lower right-hand corner.

FIGURE 2 is a side elevation view taken in the direction of arrows 2—2 in FIGURE 1.

FIGURE 3 is a schematic representation of the hydraulic control system, including the tracer unit and the drive means for producing longitudinal and horizontal motion in the plane of the board as it is being cut.

FIGURE 4 is a schematic representation of the hydraulic control system for raising the board support to drive the multiple routers through the board and hold the desired elevation of the board.

FIGURE 5 is a cutaway top plan view of the machine at the elevation of upper box 100 of outer frame 98, showing the connection of the pattern support to the board support.

FIGURES 6, 7, 8, and 9 are indications of several of the infinite varieties of modules that can be cut in a building board to form decorative panels.

Reference is now made to the drawings and in particular to FIGURE 1, wherein a preferred form of my decorative panel carving machine 10 is shown. Machine 10 supports one, or several, building panels 11 in a horizontal plane to permit a plurality of identical modules 17′ to be reproduced in outline, or silhouette, form by routers 20 in response to signals generated by tracing means 12 and pattern 15.

Although the modules need not be carved completely through the panel, this operation is generally preferred and permits simultaneous cutting of several panels stacked, or clamped, on top of each other. The total number of panels that can be cut at one time is of course limited by the thickness of boards 11, the length of router tools 21 (FIGURE 2), and the power of drive motors 25. As indicated, each of the four motors 25 drive tools 21 through a belt 24 that engages eight pulleys 23 and chucks 22. In the present embodiment, it is thus possible to cut 32 identical modules 17′ in a single sheet of building board 11 in one continuous operation.

While it is possible to move the entire support for the drive motors 25 and tools 21 in a horizontal plane to form modules 17′, in this embodiment the board support, designated generally as 75, includes means for moving or positioning the board in the proper horizontal plane.

Before describing the various elements that produce three-dimensional movement of the board to cut the silhouette, or outlines, that create modules 17′, it will first be useful to explain the way that pattern 15 is used to generate the necessary control signals that are then used to move support 75 and board 11.

As mentioned above, tracing means 12 produces these control signals. In FIGURES 1, 2, and 5, it will be seen that the body of tracer unit 13 is mounted by bracket 18 on frame 110, the motor and router support, so that it is held stationary. A suitable form of such a stylus unit is described in U.S. Patent 2,753,145 and is known commercially as a "True-Trace" unit. Stylus 14 of this unit is free to move through 360° of freedom and resolves all such motion into rectangular coordinates that can be termed longitudinal (lengthwise to board 11) and

transverse (across board 11). The lower end of stylus 14 engages the cut-off portions 17 of pattern 15 when the latter is supported in holder 16. To provide "feedback" between the position of board support 75 and pattern 15, holder 16 is secured by bracket 19 to the side of inner box frame 80.

Pattern 15 will generally, although not necessarily, be an outline of the figures that are to be cut as modules 17' in board 11. While it can be of any size in the present unit, it is useful to make it a one-foot square.

In this way, only a single set-up of pattern 15 and cutters 20 is required to complete the panel. To generate control signals to move board 11, the lower end of stylus 14 enters the outline 17 of pattern 15 when support 75 is raised by four hydraulic units 34 positioned at each corner of machine 10. FIGURE 4 illustrates schematically a hydraulic circuit to produce elevation of support 75, which in turn lifts support 16 and pattern 15.

With stylus 14 and pattern 15 in registry, a slight pressure on stylus 14 moves table, or support, 75, board 11, and pattern 15 until stylus 14 contacts an edge of cut-out 17. FIGURE 3 shows schematically a detailed portion of the part of unit 13 that produces longitudinal movement of the work support table through hydraulic motor 32. If, say, stylus 14 moves left to touch the side 17A of cut-out 17, the upper end 14A moves right and pulls piston 13A to the right against spring 13B. This action connects supply line 60 to line 43 and opens line 42 to a return circuit (not shown) that returns fluid to line 64. As indicated, fluid under pressure, by pump 61, driven by motor 63, thus moves piston 32A to the right. This moves edge 17A into contact with stylus end 14A until a balance is achieved in unit 13. Such movement of course results in table 75 moving, and routers 20 carve the corresponding motion into board 11. Similar action by trace unit 13 in the transverse direction (into the plane of the drawing) creates motion in hydraulic motor 30. Motor 30 is supplied by lines 40 and 41, through the movement of piston 13D.

As indicated in FIGURE 3, the control lines 42, 43 for motor 32 and control lines 40, 41 for motor 30, respectively, include throttling valves 36, 37. These valves regulate the rate of response of piston 32A and piston 30A of motors 32 and 30 to the motions of stylus 14 and piston 13A of trace unit 13. Pressure relief valves 38, 39 assist in maintaining hydraulic balance of the system when the trace unit is at rest.

Referring now to FIGURE 4, it will be understood that the four motors 34 located at the corners of machine 10 are to be operated in unison so that all of the router tools 21 pierce the work simultaneously when support 75 is raised. For this reason, all of the motors 34 are connected in common to the supply lines 44 and 45. These are respectively connected to supply line 68 and return line 73 through directional control valve 69. This may be operated selectively by a selector switch designated at 59 which can be turned to either the "raise" or "lower" position. Hydraulic fluid is supplied from reservoir 72 by pump 70 driven by motor 71. Heat exchanger 60 maintains the temperature of the oil in reservoir 72 of the hydraulic system at a desired value. If desired, filter 61 can also be used to maintain cleanliness of oil in the hydraulic system.

To position board 11 in three dimensions, it is essential that support 75 be mounted for such movement and that it provide a firm base for the entire area of board 11.

The following detailed description of the board support means can best be seen in FIGURE 5. As there indicated, an inner box frame 80 is formed to the general outline of conventional building boards, namely, 4 feet by 8 feet. This frame is best formed of box girders welded together, and the long sides supported by lugs or bosses 84 that include bearing openings 85 that permit inner frame 80 to slide longitudinally on support rods 87. In turn, rods 87 are supported on inner bosses 89

that are mounted along the length of the external box frame 90. For rigidity, frame 90 is also formed of box girders. It is this frame which provides the transverse motion for support 75 through the mounting of frame 90 on bosses 92 at the ends of frame 90. Bosses 92 also include bearing holes designated as 93, so that the frame can be supported upon rods 94, which in turn are carried on the outer frame 98 through bosses 95.

Since external box frame 90 has only 1° of freedom relative to outer frame 90, motor 30 is mounted directly on frame 98. Piston rod 30B is the connection between motor 30 and frame 90. Motor 32 is mounted on external frame 90 and operates the power connection between frame 90 and inner frame 80.

For the purpose of clamping the work panel to the top of box frame 80, a plurality of transverse clamps 82 are positioned to ride directly on top of board 11. End clamp 83, at the same time, engages one end of board 11, and a transverse stop 81 engages the long edge of board 11. Stop 81, clamp 83, and transverse clamps 82 thus permit the work to be positioned accurately with respect to the pattern support 16.

It is of course necessary that all of the box frames be supported at proper work height, and for this reason outer frame 98 is supported at a height of about 30 inches off the floor. It is then supported on the lower box 101 and mounted thereon by corner posts 102 and bracing 99. Feet or pads 103 are positioned at the corners of posts 102.

As best seen in FIGURE 2, motors 25 and routers 20 are supported on an upper box frame support 110 that is supported at its four corners by posts 102 and brackets 112 that form the connecting link to elevating motors 34. These supports include bearing units 113 and brackets 114, which form the connection between motors 34 and bearing units 113. Rods 115 supported by brackets 117 form the guides for bearings 113.

Because it is desirable that the routers 20 be positioned at any desired location over the area of board 11, units 20 are mounted on a pair of slide bearings 118 that are movable transversely on a pair of rods 116. Each pair of rods 116 in turn are supported on bearing slides 120 that are adjustable lengthwise on rods 122. These rods 122 of course are supported by frame support 110. The locking means for the various bearings 118 and 120 are not shown. These are set screws or other clamps.

From the foregoing description, it will now be apparent that my pierced-wood carving machine permits the reproduction of a decorative design at multiple locations on a sheet of building board in a single set-up, each milling head cutting one of the modules of the pattern to correspond precisely to the configuration of any pattern that can be represented by cut-out portions.

Various modifications and changes will become apparent from the foregoing description. Among such changes are the possibilities of holding the routers stationary and creating all three degrees of freedom relative to the tools by movement of support 75. Alternatively, the individual groups of routers can be moved by obvious reversal of the support for the work and tools. Additionally, each individual router can be driven by separate motors and in any desired numbers or sequence. Further, the feedback of the position of support 75 relative to pattern support 16 can be by remote control rather than through the direct mounting of support 16 on support 75.

Other modifications coming within the scope of the appended claims are intended to be included therein.

I claim:

1. Apparatus for carving a pierced work design of a multiply repeated silhouette figure in a building material sheet to form a decorative panel which comprises,

(*a*) a stationary support frame,

(*b*) a support bed movably positioned in said frame, said bed being formed by an open, rectangular box

member to support only the edges of a sheet of building material,

(*c*) means for the clamping the edges of a building sheet to said box member for integral movement therewith,

(*d*) a multiplicity of cutter elements equally spaced from each other in a plurality of rows and held by said frame above said support bed, to permit pierced work carving of said sheet coextensive with the opening in said box and without interference by said support bed,

(*e*) a pattern support member affixed to one side of said support bed and extending outwardly in a plane parallel with said box member for integral movement with said support bed,

(*f*) means for integrally moving said support bed and said pattern support member vertically, longitudinally and transversely relative to said stationary support frame,

(*g*) a position sensing unit mounted on said frame above said pattern support member,

(*h*) said sensing unit including a stylus member movable from a null position both longitudinally and transversely relative to a pattern mounted on said pattern support member,

(*i*) fluid drive means between said support bed and said frame, said drive means including (1) means operable to drive said cutters vertically through said sheet, and (2) means to drive said bed transversely and longitudinally in response to the position of said stylus relative to a pattern on said pattern support, the motion of said bed transversely and longitudinally being in a direction opposite to the movement of said stylus relative to said pattern, said cutters being simultaneously driven to cut in unison multiple replicas in silhouette of said pattern in said sheet and thereby to permit movement of said bed in response to the deflection of said stylus, said movement of said bed in response to said stylus movement being continuous until said pattern is driven to a position where it returns said stylus to null position in said positioning sensing element, thereby terminating the cutting of said sheet by said cutters to duplicate in said sheet under each of said cutters the design in said pattern.

2. Apparatus for cutting simultaneously a plurality of multiply repeated identical modules in silhouette in a building material sheet to form a decorative panel which comprises,

(*a*) a stationary support frame,

(*b*) an open, rectangular box forming a support bed movably positioned in said frame to support only the edges of a sheet of building material,

(*c*) means for clamping the edges of a building sheet to said box for integral movement therewith, to permit pierced work carving of said sheet coextensive with the opening in said box and without interference by said support bed,

(*d*) a multiplicity of cutter elements equally spaced from each other in a plurality of rows and held by said frame above said support box,

(*e*) a pattern support member affixed to one side of said support box and extending outwardly in a plane parallel to said box for integral movement therewith,

(*f*) means for integrally moving said support box and said pattern support member vertically, longitudinally and transversely within said stationary support frame,

(*g*) a position sensing unit mounted on said frame above said pattern support member,

(*h*) said sensing unit including a stylus member movable from a null position both longitudinally and transversely relative to a pattern mounted on said pattern support member,

(*i*) hydraulic drive means between said support box and said frame for operating said moving means, said drive means including a first hydraulic unit operable to drive said box vertically so that said cutters pierce said sheet to a predetermined depth, and second and third hydraulic units operable in response to longitudinal and transverse deflections of said stylus relative to a pattern on said pattern support, to move said box longitudinally and transversely in directions opposite to the deflections of said stylus relative to said pattern, said cutters being simultaneously driven in unison to cut said sheet and permit movement of said box in response to said deflections of said stylus until movement of said box, sheet and pattern reverse the deflection of said stylus to its null position in said positioning sensing element and thereby terminating the cutting of said sheet in the direction of the deflection of said stylus so that said cutters may multiply reproduce the cut-out portions of the design in said pattern in said sheet.

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